Middle management and instructional leadership: a case study of Natural Sciences' Heads of Department in the Gauteng Province

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DECLARATION

I hereby declare that the work which is submitted here is the result of my own investigations and that all sources I have used or quoted have been acknowledged by means of complete references. I further declare that the work is submitted for the first time at this university towards a PhD in Education degree and it has never been submitted to any other university for the purpose of obtaining a degree.

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CBB MALINGA DATE

DEDICATION

To my loving husband Sicelo: for support and being there for our children-closing the gap.

To our children Phumelela and Nonjabulo: for staying up late to provide me moral support. I know that this achievement has motivated you to study further.

To our parents: you have always valued education and have encouraged us all to study further.

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SUMMARY OF THE STUDY

Natural Sciences (NS) Heads of Department (HODs) in schools often find themselves in the middle, shuttling between a role in the management of the school and another as ordinary classroom teachers. This is in addition to their role as subject leaders, a role which is made even more complex by the fact that NS is a conglomerate subject which brings together at least four science disciplines, each with its own disciplinary culture and expectations. Leading such a multidisciplinary subject department requires, among others, competence in each of the sub-disciplines and how to teach them effectively together with the ability to provide support and guidance to other members of the department by setting and monitoring standards of performance in the classrooms. This is a tall order for many HODs under the best of circumstances. The history of under-privilege in many South African schools and the relatively weak subject matter competence among many of the science teachers and HODs makes this even more complicated. How do NS HODs in South Africa negotiate their roles as middle managers to provide effective instructional leadership in their subject departments? Furthermore, what is their capacity to provide such subject leadership and how can it be enhanced?

The study uses a mixed methods research approach with questionnaires, semi-structured interviews and observation of subject department meetings as data sources to understand the realities of providing subject leadership for NS in selected schools within the Gauteng province of South Africa. The findings are reported in five articles that address different research questions. The first article explores the ways in which HODs in South Africa provide instructional leadership for NS specifically. The second article examines the nature and quality of support and guidance that the HODs receive from their principals and the subject advisors in respect of the multidimensional roles as subject leaders and middle managers. The third article provides a comparative perspective of instructional leadership for NS among six formerly segregated schools in the Gauteng province. The fourth article examines the perceptions of the NS teachers on the quality of instructional leadership provided by the science HODs. The final article discusses the issue of "capacity to lead" and examines the possibilities and opportunities for enhancing the capacities of the NS HODs.

The first set of findings suggests that most science HODs do not teach NS and/or do not have the instructional experience needed for all the sub-disciplines under their leadership. Some

are not adequately qualified to teach NS at all and/or do not have the subject matter competency, the Pedagogical Content Knowledge (PCK), or the professional credibility to lead NS instruction. As a result, they often resort to monitoring instruction through desk-top reviews of teachers' and students' work rather than conduct any meaningful classroom observations or spend time discussing curriculum issues with the teachers. This limits their capacity to provide effective instructional leadership.

The second set of findings have to do with the conglomerate arrangement of the science departments in the schools, which makes it difficult for science HODs to focus attention on NS relative to the other subjects in the mix. As a result, the NS teachers feel marginalised and are overshadowed by the senior secondary subject teachers, whose subjects receive more attention because of their prominence in the Grade 12 national examinations.

The third set of findings uncovered the rather weak position of the science HODs as middle managers within the overall leadership hierarchy of the school. By virtue of their position within the school leadership hierarchy, the science HODs do not have much of a say on who gets allocated to teach NS, how the subjects are grouped within the science departments and how time is allocated and/or protected for subject meetings and professional development of teachers.

The fourth set of findings unpack the observation that subject advisors and other district support officials often choose to work directly with the NS teachers in providing professional development and/or curriculum support on the new Curriculum and Assessment Policy Statement (CAPS) with no similar support for the HODs specifically. While the HODs benefit from such support by the district, the benefits relate more to their roles as teachers rather than as subject leaders.

The final set of findings show that neither the school leadership teams nor the district offices engage in any periodic reviews of the school-based subject leadership structures and practices to determine their effectiveness, thereby limiting the possibilities and opportunities for enhancement of subject leadership at the school level.

The study concludes with a discussion of the complexities of leading NS departments within the current school contexts and configurations. Firstly, the requirements for multi-disciplinary

expertise and competency in all of them represent a tall order for many HODs. Secondly, the current allocation of NS teachers by school leaders does not carefully consider their specialisation and that of the HODs who are expected to provide support for improved instruction. Thirdly, the success of the science HODs in supporting instruction depends on how the school arranges its systems and infrastructure to support instruction and its improvement in each subject. Lastly, the capacity of science HODs to provide effective instruction leadership is compromised by their middle management position, which provides neither the time and resources nor the required authority for such subject leadership.

The study recommends a review of the structures and practices for subject leadership in schools in order to provide the time, resources and authority for HODs to improve their capacity to lead. School leaders and district officers need to re-examine their criteria and processes for allocation of both the NS teachers and the HODs in order to foster subject competence and better leadership. Furthermore, subject specific training and support in the NS sub-disciplines, especially the physical sciences strands, is required for science teachers and their HODs. Finally, the relationship between HODs and subject advisors needs to be strengthened by forming a professional learning community (PLC) for these subject leaders in order to enhance the capacity to lead NS in schools.

Key Words: natural sciences; heads of department; subject departments; instructional leadership; middle management; science teaching; school leadership.

OPSOMMING VAN DIE STUDIE

Die departementshoofde (DH's) van Natuurwetenskappe (NW) in skole word dikwels in die middel vasgevang en moet wissel tussen hul rol in die bestuur van die skool en hul rol as 'n gewone klasonderwyser. Dit is bykomend tot hul rol as vakleiers, 'n rol wat nog meer ingewikkeld gemaak word weens die feit dat NW 'n saamgestelde vak is wat ten minste vier wetenskaplike dissiplines saamvoeg, elk met sy eie dissiplinêre kultuur en verwagtinge. Om so 'n multi-dissiplinêre vak te lei, vereis onder meer vaardigheid in elk van die sub-dissiplines en in hoe om hulle effektief aan te bied, tesame met die vermoë om ondersteuning en begeleiding aan ander departementslede te verskaf deur standaarde van prestasie in die klaskamer op te stel en te monitor. Dit is 'n strawwe opdrag vir baie DH's, selfs onder ideale omstandighede. Die geskiedenis van onder-bevoorregting in baie Suid-Afrikaanse skole en die relatief swak vaardigheid in die vakinhoud onder talle wetenskaponderwysers en DH's, maak dit selfs nog meer ingewikkeld. Hoe kan DH's in NW in Suid-Afrika hul rolle as middelbestuurders uitvoer om effektiewe onderrigleierskap in hul vakdepartemente te verskaf? Wat is hul kapasiteit om sulke vakleierskap te verskaf en hoe kan dit verbeter word?

Die studie gebruik 'n navorsingsbenadering van gemengde metodes, met vraelyste, semi-gestruktureerde onderhoude en observasie van vakdepartementsvergaderings as databronne, om sodoende die realiteite van die verskaffing van vakleierskap vir NW in geselekteerde skole binne die provinsie van Gauteng in Suid-Afrika te verstaan. Die bevindings word weergegee in vyf artikels wat verskillende navorsingsvrae aanspreek. Die eerste artikel verken die maniere waarop DH's in Suid-Afrika onderrigleierskap vir spesifiek NW verskaf. Die tweede artikel ondersoek die aard en gehalte van ondersteuning en begeleiding wat die DH's van hul skoolhoofde en die vakadviseurs ontvang ten opsigte van die multidimensionele rolle as vakleiers en middelbestuurders. Die derde artikel verskaf 'n vergelykende perspektief van onderrigleierskap vir NW onder ses voormalig afgeskeide skole in die provinsie van Gauteng. Die vierde artikel ondersoek die persepsies van die NW-onderwysers oor die gehalte van onderrigleierskap wat deur die wetenskap-DH's verskaf word. Die laaste artikel bespreek die kwessie van "kapasiteit om te lei" en ondersoek die moontlikhede en geleenthede vir versterking van die DH's in NW se kapasiteite.

Die eerste stel bevindings suggereer dat die meeste wetenskap-DH's nie NW aanbied nie en/of nie oor die onderrigervaring wat vir al die sub-dissiplines onder hul leierskap nodig is,

beskik nie. Sommige is nie gekwalifiseerd om NW aan te bied nie en/of het nie vaardigheid in die vak, die Pedagogiese Inhoudkennis (PIK) of die professionele geloofwaardigheid om NW-onderrig te lei nie. As gevolg hiervan maak hulle dikwels staat op lessenaaroorsigte van onderwysers en studente se werk om onderrig te monitor, eerder as sinvolle klaskamerobservasie en bespreking van kurrikulumkwessies met die onderwysers. Dit beperk hul kapasiteit om effektiewe onderrigleierskap te verskaf.

Die tweede stel bevindings het te make met die saamgestelde rangskikking van die wetenskapdepartemente in die skole, wat dit moeilik maak vir wetenskap-DH's om aandag op NW relatief tot die ander betrokke vakke te fokus. As gevolg hiervan voel NW-onderwysers gemarginaliseerd en oorskadu deur die senior vakonderwysers, wie se vakke meer aandag kry vanweë hul prominensie in die nasionale eksamens in graad 12.

Die derde stel bevindings werp lig op die ietwat swak posisie van die wetenskap-DH's as middelbestuurders binne die algehele leierskapshierargie van die skool. Weens hul posisie binne die skoolleierskapshierargie het die wetenskap-DH's nie veel insette oor wie aangewys word om NW aan te bied, hoe die vakke binne die wetenskapdepartemente gegroepeer word en hoe tyd toegewys en/of beskerm word vir vakvergaderings en professionele ontwikkeling van onderwysers nie.

Die vierde stel bevindings gee 'n uiteensetting van die waarneming dat vakadviseurs en ander distriksbeamptes dikwels verkies om direk met die NW-onderwysers te werk wat betref die verskaffing van professionele ontwikkeling- en/of kurrikulumondersteuning ten opsigte van die nuwe Kurrikulum- en assesseringsbeleidsverklaring (KABV), met geen soortgelyke ondersteuning vir spesifiek die DH's nie. Terwyl die DH's voordeel trek uit sulke ondersteuning deur die distrik, hou die voordele groter verband met hul rolle as onderwysers eerder as vakleiers.

Die laaste stel bevindings wys dat gereelde hersiening van die skoolgebaseerde vakleierskapstrukture en praktykte om hul doeltreffendheid vas te stel, nie deur die skoolleierskap of die distrikskantore gedoen word nie, wat die moontlikhede en geleenthede vir die verbetering van vakleierskap op die skoolvlak beperk.

Die studie sluit af met ’n bespreking van die kompleksiteite van leierskap binne NW-departemente binne die huidige skoolkontekste en -groeperings. Eerstens is dit ’n strawwe opdrag vir talle DH’s om aan die vereistes vir multi-dissiplinêre kundigheid en vaardigheid te voldoen. Tweedens toon die huidige aanwysing van NW-onderwysers deur skoolleiers nie versigtige oorweging van hul spesialisasie nie en ook nie van die spesialisasie van die DH’s waarvan verwag word om ondersteuning vir verbeterde onderrig te verskaf nie. Derdens hang die sukses van die wetenskap-DH’s wat onderrigondersteuning betref af van hoe die skool sy stelsels en infrastruktuur rangskik om onderrig en die verbetering daarvan in elke vak te ondersteun. Laastens word die vermoë van wetenskap-DH’s om effektiewe leierskap te verskaf in die wiele gery deur hul posisie as middelbestuur, wat nie voorsiening maak vir die tyd en hulpbronne of die nodige gesag vir sulke vakleierskap nie.

Die studie beveel ’n hersiening aan van die strukture en praktyke vir vakleierskap in skole om sodoende die tyd, hulpbronne en gesag wat DH’s benodig om hul leierskapkapasiteit te verbeter, te verskaf. Skoolleiers en distriksbeamptes moet hul kriteria en prosesse vir die aanwysing van NW-onderwysers en die DH’s weer bekyk om sodoende vakvaardigheid en beter leierskap te bevorder. Verder is vakspesifieke opleiding en ondersteuning in die NW-dissiplines, veral in fisiese wetenskappe, nodig vir wetenskaponderwysers en hul DH’s. Laastens moet die verhouding tussen DH’s en vakadviseurs versterk word deur ’n professionele leergemeenskap (PLG) vir hierdie vakleiers te vorm, om sodoende die kapasiteit om NW in skole te begelei, te versterk.

Sleutewoorde: natuurwetenskappe; departementshoofde; vakdepartemente; onderrigleierskap; middelbestuur; wetenskaponderrig; skoolleierskap.

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ACRONYMS

CAPS	**CURRICULUM ASSESSMENT POLICY STATEMENTS**
FET	**FURTHER EDUCATION AND TRAINING**
GET	**GENERAL EDUCATION AND TRAINING**
HOD	**HEAD OF DEPARTMENT**
LS	**LIFE SCIENCES**
NS	**NATURAL SCIENCES**
OECD	**ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT**
PCK	**PEDAGOGICAL CONTENT KNOWLEDGE**
PLC	**PROFESSIONAL LEARNING COMMUNITIES**
PS	**PHYSICAL SCIENCES**
SBAT	**SCHOOL BASED ASSESSMENT TASK**
SGB	**SCHOOL GOVERNING BODIES**
SMT	**SCHOOL MANAGEMENT TEAMS**

SECTION 1: ORIENTATION AND INTRODUCTION TO THE STUDY

1.1 INTRODUCTION

Many learners, even those who excelled in natural sciences (NS) during their junior secondary school grades, struggle with physical sciences (PS) as a subject at senior secondary school level. Senior phase[1] (grades 7 to 9) in the South African (SA) schooling system marks the transition between primary and secondary school. The transition from junior secondary school NS to senior secondary school PS is problematic for a number of reasons, most of which may be inherent to the transition process itself (Peloagae, 2010). Some of the reasons, however, have to do with the quality of teaching and learning in the primary and junior secondary school phase, which creates the more complex challenge of learning the subject in the higher schooling grades (grades 10-12). Ensuring high-quality teaching and learning of the subject, particularly at the transitional phase (grades 7 to 9), can itself be challenging because it requires sufficient familiarity and competence with the curricula on both sides of the transition (in primary school and in senior secondary school). If heads of departments (HODs) in schools are tasked with ensuring support and quality instruction in their subjects (DoE, 1999) then it is important to ask how they do this and what challenges and opportunities exist for them to alleviate the challenges of transition for the teachers and learners. I am interested in understanding how science HODs provide the required leadership for instructional improvement in the support of teaching and learning of NS, especially for the transitional phases. How is this middle management leadership for instructional improvement exercised and what are the consequences or outcomes of this leadership?

1.2 BACKGROUND AND RATIONALE

Most literature on the role of HODs traces this changing role over years and through curriculum reforms of various countries (Brown & Rutherford, 1998; Zepeda & Kruskamp, 2007). In SA, there is very limited research on how HODs perceive their roles, what is expected of them by

[1] The South African Basic Education schooling system is divided into two bands: 1) the General Education and Training (GET) Band comprising Foundation Phase (grades R-3); Intermediate Phase (grades 4-6) and Senior Phase (grades 7-9) and 2) the Further Education and Training (FET) Band comprising grades 10-12.

their principals, local education districts or the departments they lead, what they actually do and whether their activities correspond with what the policy documents prescribe.

1.2.1 Limited research on middle management

There is limited research on instructional leadership in SA. This is an emerging area of research, where studies mostly focus on the needs, training and development of principals (Mestry & Grobler, 2002; Van der Westhuizen, Mosogo & Van Vuuren, 2004) and on the management of schools. Not many studies focus on curriculum leadership[2] in schools. Where leadership in schools is addressed, the studies tend to focus on the roles and responsibilities of principals as leaders of all school activities including teaching and learning but not necessarily as instructional leaders (Hoadley, Christie & Ward, 2009), where the focus on teaching and learning is central to the work of leadership. There is limited focus, if any, on middle management globally or in SA (Koh, Gurr, Drysdale & Ang, 2011). A comprehensive study by Hoadley *et al*. (2009) investigated the management of curriculum at different secondary schools in SA. This study focused on high schools and the principal as the instructional leader and was not subject specific. However, research suggests that principals are not in a position to influence classroom teaching directly (Leithwood, Louis, Anderson & Wahlstrom 2004) because they spend less time with teachers than is the case with HODs (Highfield, 2010). HODs thus seem to be in a better position to influence instruction.

The present study puts HODs at the centre of instructional leadership. It investigates the way in which science HODs provide instructional leadership, if at all, how NS teachers perceive this leadership and the kinds of support that science HODs themselves receive. The study by Hoadley *et al.* (2009) is amongst a few in SA that focuses on the role of the HOD in the school. There are frameworks and studies from other countries on what HODs should do (York-Barr & Duke, 2004; Lai & Cheung, 2013) but there is very limited empirical research on HOD practices and their actual work.

[2] Curriculum management focuses on how the curriculum is designed, implemented and monitored while instructional leadership focuses on the interaction of people (management team or any other person that acts as a leader in the school, teachers as followers and learners as beneficiaries) involved in the instructional practice in order to improve learner outcomes.

1.2.2 Middle school or junior secondary school phase (grades 8-9)

There may be a bias towards research on primary (Foundation Phase) and high schools (FET[3] band) in SA. There are very few research studies that focus on the junior secondary school phase (grades 7-9), especially tracing the transition between primary and high school (Peloagae, 2010). Even where research has been done, most studies tend to focus on mathematics and language because these are the two subject areas that are regularly assessed in SA and internationally. The lack of research on the junior secondary phase is further confirmed by the fact that there is no national assessment data to analyse and report on except for languages and mathematics (DBE, 2011). An important assessment artefact such as an examination at the end of the phase would provide the much-needed information for this important phase of schooling.

Research studies have shown that challenges exist regarding the transition from primary to secondary school and these challenges need to be addressed as a joint effort by all stakeholders (Peloagae, 2010; Yeboah, 2002). This problem is not unique to SA. It exists in countries such as the United Kingdom (Millar, 2011), Nigeria (Olorundare, 1990), Ghana, Kenya and Zambia as well (Umalusi, 2008). Furthermore, there is some research to show that teachers often struggle to systematically decide on what to teach and when to teach it in the South African education system (Brodie, Shalem, Sapire & Manson, 2008). The junior secondary phase requires a science teacher who is well grounded in the content knowledge, who is creative and can adapt the teaching activities to achieve the desired outcomes. There is thus a need to conduct more research on teaching in this crucial transitional phase of schooling.

1.2.3 Subject-specific instructional leadership

The current allocation of teachers in most SA schools assumes that junior secondary school science teachers, by being generalists, can teach all the science disciplines in NS[4] and still adequately prepare learners to transition to PS and/or life sciences (LS) in high school. Teachers

[3] FET is the Further Education and Training band that includes the curriculum for grades 10-12. The curriculum consists of core and elective subjects.

[4] The natural sciences curriculum is only offered in grades 7-9 in secondary or high schools and is divided into 4 subject strands: 1) Life and Living (life sciences); 2) Earth and Beyond (earth sciences and physics; 3) Energy and change (physics); 4) Matter and Materials (chemistry).

are more likely to teach what they are comfortable with and are knowledgeable about. One of Woolnough's recommendations for preserving good science teaching is that teachers should teach what they feel comfortable with, as teachers in his study were happiest and most enthusiastic teaching in their specialist areas – a finding that clearly has implications for the organisation of the curriculum in separate versus integrated disciplines (Woolnough, 1994). SA does not often have the luxury of this choice because of the shortage of science teachers (CDE, 2011).

Careful monitoring of the implemented curriculum is done by the HOD and providing subject-specific instructional leadership is important given that teachers would be more likely to focus only on what they know and are comfortable teaching (Appleton & Kindt, 1999). Unless the allocation of less qualified science teachers to primary and junior secondary classes and the support given to them by school leaders is addressed, the learning gap and discontinuity will continue to persist between the junior secondary phase and high school. The recognition of this gap calls for subject-specific instructional leadership in the junior secondary phase to accommodate all the nuances of the subject. Such subject-specific leadership will include focus on the philosophy, practices, norms and the principles and beliefs held by teachers, learners and parents.

Middle management in schools comprises managers who are usually experts in their subject fields. Although research has been conducted on curriculum implementation, little has been done on subject-specific instructional leadership, especially in NS. We know less about what NS teachers perceive as important support to shape their classroom instructional practices.

1.2.4 Communities of practice or professional learning communities for HODs

This study has the potential to assist science HODs understand their roles better. While principals and teachers have associations, communities of practice or professional learning communities (PLCs), where they have opportunities to share their views and experiences on matters pertaining to their practice, HODs do not. HODs are supposedly accommodated in the teacher associations because they are, after all, teachers. According to the Personnel Administrative Measures (PAM) document HODs, in SA, spend 85% of their time teaching

(DOE, 1999). The teacher professional communities, however, do not accommodate the leadership needs of HODs. The present study sought to assist in identifying the needs of HODs in performing their instructional leadership tasks and to make recommendations on how their capacity might be enhanced through establishing PLCs for HODs.

By adopting a contingency theory[5] lens for my study, I was able to answer questions concerning the instructional leadership practices of the science HODs: Why do they act the way they do; and how NS teachers perceive the leadership of their HODs? As a subject advisor for 7 years and a manager of intervention projects for 10 years, in various schools, I have seen how the analysis of results tends to focus on the average performance of the school rather than the specific subjects. Usually performance in two or three subjects is enough to bring down the schools' overall pass rates. Among the major culprits in this regard are mathematics and PS. For some reason, many schools seem to accept that performance in these subjects will always be poor and they learnt to live with that fact. This is a belief that needs to be challenged and addressed if any reform in the teaching and learning of sciences is to have an effect. Proper action research and monitoring of learners and teachers' performances at school levels are the key dimensions of the instructional leadership that is necessary to achieve such a reform.

In summary, the present study could be significant at the systemic level, where recommendations will be made regarding the qualities of those who are expected to lead the science department, how instructional leadership is and should be provided in schools and how subject departments are currently structured and/or can be reorganised. The knowledge gained from this research has the potential to provide deeper understandings of the impact of organisation or structure in the junior secondary science departments versus the senior secondary. The study recommends a restructuring of the science departments to address the multidisciplinary nature of NS.

[5] Contingency theory is a behavioural theory that claims that there is no best way to design organisational structures. Its characteristics are that 1) there is no universal method/structure for organising management; 2) the best course of action is contingent on the work environment/task of the specific situation and 3) different methods of organisation should be used in different situations. The best way of organising a school is thus contingent upon the internal and external situation of the school (Laflamme, Harvie & Brock, 2012).

1.3 CONTEXT

The study was conducted within the context of a changing curriculum from the Revised National Curriculum Statements (RNCS) to the Curriculum and Assessment Policy Statements (CAPS). The latter has introduced school-based assessment tasks (SBATs) that are largely practical experiments for each of the NS strands at the junior secondary level. The district officials spend much of their time monitoring especially the implementation of these SBATs. My study investigated the instructional leadership practices of science HODs in the context of NS in junior secondary schools. NS is a multidisciplinary subject comprising four or five science disciplines (namely earth, environmental, life, physical and chemical sciences) and is a foundational subject for physical and life sciences in senior secondary school. The science HODs are expected to lead NS instruction and support NS teachers in teaching this subject broadly enough to expose learners to the whole field of science but also deeply enough for them to develop a keen interest, love and basic understanding of each one of the science disciplines.

The decentralisation of leadership to subject departments in secondary schools further complicates the role of the HODs because they tend to lead departments whose members teach grades 8-12. The status of the different grades and subjects varies and teachers may sometimes feel marginalised (Spillane *et al.*, 2001). For example, grade 12 is often given special attention because it is the exit grade and is subjected to a national examination. Grades 8-9 belong to the senior phase of the General Education and Training (GET[6]) band and are located in secondary schools in SA.

1.4 PROBLEM STATEMENT

In my experience as a teacher, HOD and subject advisor, I often noticed that good and suitably qualified physical sciences (PS) or life sciences (LS) teachers tend to be allocated to the last two grades of high school (i.e. grades 11-12), with the less qualified teachers being allocated to the lower grades (e.g. grades 8-10). This could weaken the foundations for the NS learners. Three other factors may contribute to the weak foundations in PS and LS. Firstly, there is no formal

[6] GET is the General Education and Training band which includes the curriculum provision for learners from Grade R to Grade 9. This encompasses the Foundation Phase (Grades R-3), the Intermediate Phase (Grade 4-6) and the Senior Phase (Grades 7-9).The curriculum at this band is not specialised and all learners do core subjects

exit examination or standardised test at grade 9. Each teacher sets his/her own examination and assesses and promotes learners accordingly. This lack of standardised tests creates uncertainty about what learners exiting the junior secondary phase are able to do and what content knowledge they have covered and acquired. An artefact such as an externally standardised examination question paper could be useful at this level (Brodie *et al.*, 2008).

Secondly, learners at this level are assessed mostly on what teachers have managed to teach and not always on what should have been taught (Spillane & Hunt, 2010). There are no common assessment standards to track the quality across the entire education system. In a study by Olorundare (1990), in Nigeria, it was discovered that the general science paper examined only 5% of PS. This makes it easy for a learner to ignore PS in preparing for the final examination and still perform well overall. Similarly in SA, NS teachers could teach only the "life and living" strand, which comprises a quarter of the NS syllabus and only examine this fraction of the syllabus if content coverage is not monitored and/or assessed.

The third factor that contributes to poor performance is that a subject like NS encompasses five science disciplines, the majority of which contribute directly to PS. This is compounded by the fact that NS is usually taught by either generalists or specialists in one of the science disciplines. Specialists are more likely to omit the sections they are not specialists in (Appleton & Kindt, 1999) and generalists may not provide the depth required in the different science disciplines. All these facts are interrelated and point to the need for strong instructional leaders who can supervise, evaluate and provide support and development to teachers accordingly. These challenges demand a science HOD who has the professional credibility (Angelle & DeHart, 2011) in the subject.

1.5 PURPOSE

In this study, I focused on the instructional leadership practices of science HODs as middle managers in selected secondary schools within Gauteng, SA. I wanted to find out how science HODs provided subject-specific instructional leadership and what kinds of support and resources they receive from the principals and the district office, with a view to understand how this leadership contributes to quality learning of NS in schools. I was also interested to learn how this

subject-specific leadership enables the smooth transition of learners from NS to PS. The study limited itself to the issue of the capacity of the HOD to provide instructional leadership with reference to the three strands (energy and change; life and living and matter and materials) of the NS curriculum because these are the topics that have a bearing to LS and PS in high school. The study sought to determine and examine ways in which the capacity of science HODs could be enhanced for more effective subject leadership. Improved subject-specific leadership, I argue, is one vehicle for increasing opportunities for effective teaching of this multidisciplinary subject such as NS.

1.6 FRAMEWORK OF THE STUDY

A study of more than 3000 Australian teachers concerning the effects of structural and process features on instructional efficacy, found significant direct effects across four components namely, contextual factors, structural features, process features of the programmes and professional communities. In addition, knowledge, practice, student learning and efficacy were found to be the four outcome measures for successful instructional leadership (Mulford, 2007). Using this background, the present study discusses the interaction of six components (of the conceptual framework) for the improvement of NS instruction (see figure 1). Contingent variables such as the school size, learner background, school community type and organisational culture and labour feature as components of the conceptual framework, while the HOD's competence and experience in the subject forms another component (Angelle & DeHart, 2011). The framework shows how personal factors associated with the instructional leader can influence the specific school context to produce desired results.

Certain stimulus for the school context necessitates a particular leadership style and behaviours (Hallinger & Heck, 2011). These styles and behaviours are referred to as the "means of influencing instruction" and "leadership work" and they constitute the third and fourth components of the conceptual framework respectively.

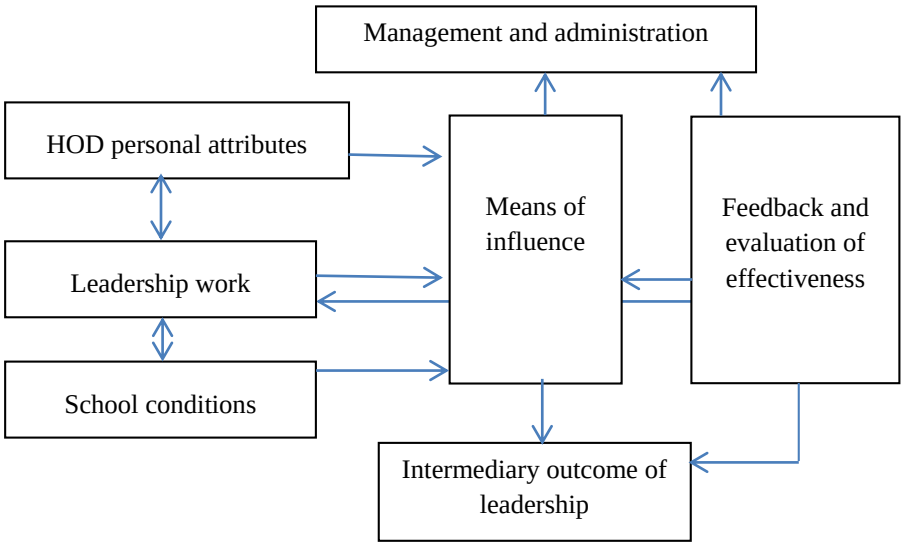

Fig 1: Abridged version of the conceptual framework for leading instruction–
(Adapted from Turner & Bolam, 1998; York-Barr & Duke, 2004).

The school context is the source of constraints, opportunities and resources (Hallinger & Heck, 2011). It shapes the type of leadership that will be displayed, determines which resources the HOD would use and defines the limitations and opportunities that the leader needs to understand and respond to in order to address these and be in a position to lead successfully. The fifth component is the routines and artefacts clustered in school administrative systems that the school and the subject leadership use to manage the school's organisational rhythms and sense of order. The last component refers to the feedback and evaluation of the leadership effectiveness. This component provides feedback loops that give a sense of the effectiveness of all the other components of the framework. The focus of the framework is on describing the context for achieving improved and effective teaching and learning practices within a department and school.

1.7 RESEARCH QUESTIONS

In light of the multidisciplinary nature of NS and non-standardised assessment techniques and methods in the junior secondary school phase, it is quite possible to avoid teaching and learning any NS strands that are considered to be difficult (as a teacher or as a learner) and still pass the subject. Could it be that one of the reasons for our poor outcomes in PS at grade 12 is the fact

that learners are only taught PS for the first time in the senior grades (grade 10-12)? Is it possible to pursue a successful secondary school science stream without the necessary background and foundation that NS seeks to provide? If so, is it worth overloading the NS curriculum with physics and chemistry strands if learners only start it at grade 10 level? Is the progression and cohesion that the present curriculum is trying to enforce necessary or even achievable at all? Monitoring the implementation of the curriculum and instruction is crucial if these challenges and the kinds of outcomes they yield are to be understood. This study focused on the roles and practices of HODs as instructional leaders in monitoring the implementation of the curriculum. The study asked the following broad question and sub-questions:

What is the nature and practice of instructional leadership in junior secondary science departments at schools and why is instructional leadership constructed in the way that it is? Specifically, I wished to understand,

- In what ways, if at all, do science HODs provide instructional leadership in NS or science departments?
- What support, if any, is provided to science HODs by the principals and subject advisors in providing NS instructional leadership in secondary schools?
- What are the NS teachers' perceptions of the quality of the instructional leadership that they receive from HODs?
- How can the capacity of the science HODs be enhanced to provide effective leadership?

1.8 AIMS AND OBJECTIVES

This study sought to examine the nature and practice of NS instructional leadership in junior secondary schools and looked for evidence of the understanding and enactment thereof in the schools. In examining how subject instructional leadership is practiced (however unsatisfactory it may be), supported and perceived, I sought to contribute to our understanding of the support provided by science HODs for the teaching of NS at the junior secondary phases (grades 8-9) in particular. In SA, there is currently a skewed focus in research towards mathematics and language, while little attention has been paid to NS. This is largely due to political and socio-economic reasons: mathematics and languages are required subjects for entry into most careers and university programmes (CDE, 2010). Science, however, is just as important a subject in the

school curriculum and for addressing the country's skills shortage. It therefore deserves some attention.

The main objectives of the study were:

- To explore the possibility and modes of providing instructional leadership in NS or departments led by the science HODs;
- To establish the extent of the support provided by the principals and subject advisors to science HODs in providing NS instructional leadership in secondary schools;
- To explore the perceptions of NS teachers on the quality of instructional leadership that they receive;
- To recommend capacity building for science HODs in order to provide NS instructional leadership in an effective manner.

1.9 RESEARCH METHODOLOGY

The instructional leadership role of the HOD is a dual role because HODs are teachers and administrators; administrators and managers; managers and leaders (Busher, 1988). However, experience and literature confirms that HODs are in fact fulltime teachers and the administrative management and leadership roles are extracurricular in most schools (DoE, 1999; Brown & Rutherford, 1998). Owing to the complexity of the role, this study employed a mixed methods investigation into how science HODs, as middle managers, provided instructional leadership for NS teaching and learning in seven secondary schools across four districts in Gauteng, SA.

1.9.1 Research approach

The mixed methods research approach is the methodology for conducting research that integrates qualitative and quantitative data collection and analysis in a single study (Creswell, 2014). The purpose of this mixed methods study was to explore from science HODs and NS teachers' perspectives instructional leadership practices for NS using self-reported data (quantitative and qualitative), observational data and artefacts. The mixed methods approach was useful in this study because it allowed for variations in the data collection that would lead to greater validity and allowed the researcher to explore the complexity of the practice of leadership in general and

instructional leadership in particular from a number of perspectives. It also ensured that there were no 'gaps' in the collected data (Tashakkori & Teddlie, 2010).

The fact that the study was premised around understanding middle management in the context of distributed leadership provided sufficient complexity. Since providing instructional leadership involved providing guidance and development to teachers, which might be prescribed in the school policies, a quantitative strategy was necessary to understand the nature and extent of the practice. However, in order to gain a better understanding of why certain practices were preferred or not practiced, narrative and observational methods were also employed.

The mixed methods approach enabled probing for trends that emerged from responses to the questionnaires and validation of the HODs' self-reports in interviews, using the analysis of artefacts and meeting observations (Tashakkori & Teddlie, 2010). I first collected and analysed quantitative data from questionnaires as the first phase. The second phase built on the first phase. Next, the qualitative data was collected and analysed, which helped to elaborate on the quantitative phase's results (Creswell & Plano-Clark, 2011).

1.9.2 Research design: Explanatory sequential design

This design consisted of two sequential strands (Cresswell & Plano-Clark 2011): a quantitative questionnaire strand, which was followed by a qualitative strand comprising individual semi-structured interviews, observations and documentary analysis. The aim of this design was to explore the problem quantitatively and qualitatively in order to attain a better understanding of the research topic while ensuring that meta-inferences that would be made were valid and justified (Tashakkori & Teddlie, 2010).

Phase 1: -Science HODs and NS teachers from four districts responded to questionnaires.

Phase 2: -Purposive, stratified sample of seven science HODs and 10 NS teachers from seven schools were interviewed;

-School subject meetings and district cluster observations were conducted; and

-Document analysis of subject meeting minutes, science HODs and NS teachers' files.

The study was undertaken in four school districts in Gauteng, SA. Data collection involved 243 schools, each with a science HOD and at least 500 NS teachers. Involving schools from a limited number of districts made it easier for the researcher to obtain permission to conduct the study, as well as administer the questionnaires in common venues where teachers gathered, for example, during the district cluster meetings. Some schools were junior secondary schools, some were combined schools and some were secondary schools. The researcher used different approaches to collect data on science HOD instructional practices. In the first phase 30 science HODs and 112 NS teachers from 77 schools completed the questionnaires. We supplemented this data with observations and interviews with a sub-sample of the science HODs and NS teachers in the second phase. We discuss each method below.

a. Science HOD and NS teacher questionnaire

The first data set contained responses from HODs collected using the questionnaire. It explored among other items, the HODs' teaching experience, the instructional activities of the science department, the profiles of the department's members and focused on the ways in which the science HODs attempted to influence and improve the department's members' NS teaching. The researcher also employed data collected using a similar questionnaire that was administered to NS teachers in the form of a multi-rater (360°) assessment instrument (Conger & Toegel, 2002) measuring HODs' instructional leadership practices. It enabled informal cross validation of information. For a full description of the questions and items that comprise the variables in the questionnaires, see appendix 5 and 6. The data from the questionnaires were analysed for trends and from the data, schools were identified for qualitative data collection.

b. Observations and interviews

A follow-up with a subset of this quantitative sample (Teddlie & Yu, 2007) was selected for in-depth semi-structured interviews, participant observations and document analysis. The interviews were designed to explain the trends and expand on some unexpected results (McMillan & Schumacher, 2010). Ten NS teachers and seven HODs from seven schools (the same schools) in two districts were engaged in in-depth, semi-structured, face-to-face interviews

where field notes were also taken. Meeting observation data was obtained from five cluster meetings held by subject advisors and two subject department meetings at the schools.

1.9.3 Mixed methods analysis

Mixed methods data analysis involved analysis techniques from the quantitative and the qualitative approach as well as a mixture of the two forms of sequential data in this study. In order to understand the practices of science HODs, I used descriptive statistics to analyse both the science HODs and NS teachers' questionnaires and I conducted content analysis of the interview transcripts and field notes. I identified leadership practices of the science HODs, systems that they put in place according to their context and I coded them accordingly. I also conducted a discourse analysis of the school subject meetings and the subject advisors' cluster meetings. A contingency theory approach was employed to identify trends and patterns. Documentary analysis of science HODs, NS teachers and learner files were used to triangulate data obtained from the questionnaires and interviews to search for data that might prove to be invalid. Qualitative and quantitative findings were integrated at the final stages to create meta-inferences that provided more insightful and complete answers to the research questions (Creswell & Plano-Clark, 2011).

1.10 SIGNIFICANCE OF THE STUDY

I investigated the instructional leadership practices of science HODs as middle managers because I wanted to find out how science HODs provided subject-specific instructional leadership. I wanted to know what type of support and resources they receive from the principals and the district office in order to understand how this leadership contributes to the quality learning of NS and ensured the smooth transition to the learning of PS. There is little understanding of what HODs actually do in departments, their reasons for doing it and perspectives of their roles. This study sought to contribute to the understanding of the challenging work of science HODs as middle managers in a school context and how they could be better supported in their quest to improve the quality of NS teaching and learning. This study also contributes to research in subject-specific instructional leadership and junior secondary science education research.

1.11 ETHICAL CONSIDERATIONS

The Ethics Committee of the Faculty of Education at the University of the Free State granted permission to conduct the research of this proposal. Permission to conduct the research in Gauteng schools was also received from the Gauteng Department of Education (Appendix 2). The participant schools were contacted to make appointments. All the principles of research ethics were applied and observed.

1.11.1 Confidentiality and voluntary participation

The confidentiality of the participants, the privacy of their information, their voluntary consent that was free from any coercion (McMillan & Schumacher, 2010) and the right to withdraw from the study were discussed with participants before data was collected (Cohen, Manion & Morrison, 2011).

1.11.2 Informed consent

An informed consent form (Appendix 3) that provided information to participants regarding the purpose of the research, how their responses would be used and any possible consequences of their participation, displaying their right to freedom as far as the research study was concerned, was explained (Cohen *et al.,* 2011). The participants signed the consent form that allowed them to state that they had understood the nature, the benefits and risks of the project and were giving permission to participate.

1.11.3 Anonymity

Necessary measures were taken to ensure the anonymity of participating schools and teachers and the protection of their contact information. All the identifying features of the schools were removed prior to their inclusion in the appendices (Babbie & Mouton, 2010). All harm to participants was avoided as far as possible. Deceiving subjects in terms of their identity or the identity of the researcher was avoided at all costs. Electronic data were secured with a password and hard copy data were stored in lockable cupboards with limited access. Pseudonyms were used as codes for each instrument.

1.12 LIMITATIONS

Firstly, the study worked with a small but representative sample of schools and the limitations existing as a characteristic of the small sample size mean that the results could not be generalised but only be interpreted for the findings in the schools and districts that were part of the study.
Secondly, this study only provided one or two teachers' perspectives per school of the support they received from each HOD. Future research might systematically do case studies of the different school types to examine instructional leadership differences.

Thirdly, the study used self-reports in the form of surveys and interviews, which might not be very accurate. Cook and Campbell (1979) have cautioned that subjects tend to report what they believe the researcher wants to hear and see, or report positively on their own opinions, knowledge and abilities. Care was taken to triangulate the data with observations and document analysis to address the possibility of the researchers' biases and subjectivities that could influence the research process in a positive or negative manner.

1.13 CLARIFICATION OF TERMS

Head of department: is an appointed post-holder who has the responsibility for the effective functioning of the department and organises relevant/related extra-curricular activities to ensure that the subject, learning area or phase and the education of the learners is promoted in a proper manner. The post-holder must be well grounded in the knowledge, skills, values, principles, methods and procedures relevant to the discipline, subject, learning area, phase of study or professional or occupational practice (ELRC, 2003).

Subject department: is a specialised division of a school that is responsible for a given subject or a particular discipline chaired by a member of the department who may be appointed by the school. Some disciplines are found in different departments at different institutions.

Natural sciences: can be broken into two main branches: life sciences (or biological sciences) and physical sciences. Physical sciences is further broken down into branches, including physics, astronomy, chemistry and earth science. All of these branches of natural sciences are divided into

many further specialised branches (also known as fields). These fields, which scientists study, have been grouped into four main content areas in junior secondary school, namely, life and living, earth and beyond, matter and materials and energy and change (DOE, 2002). NS is a subject offered only in grades 7-9 in secondary or high schools.

1.14 TITLES OF ARTICLES

The study is presented in five articles outlined below.

a. Stepchildren of the science department? Subject leadership for natural sciences and the neglect of the grade 8 and 9 teachers in South African high schools

b. Middle management and instructional leadership: The case of the natural sciences HODs in South Africa

c. Different schools, different practices: Comparing the organisational infrastructure and instructional leadership for natural sciences teaching among formerly segregated schools in Gauteng

d. Teachers' views on the quality of natural sciences instructional leadership in six Gauteng schools

e. Science HODs and their capacity to lead instruction: An exploratory survey across four districts in Gauteng, South Africa

Notes:

1. Each article is presented in a format that is required by the specific journal for publication purposes. The first author is primarily responsible for developing the articles, as part of the requirements for her PhD, under the guidance and direction of her promoter who is the second author on the articles.
2. The titles and sequence of the articles as captured in the CTR were modified slightly, after data collection and analysis, as stated above.

SECTION 2: SUMMARY OF KEY FINDINGS

This section shows how each of the research questions was answered in the study. The findings in this study are reported in five articles that addressed the different research questions.

- The first article explored the ways in which science HODs provided instructional leadership in their subjects or departments with specific reference to NS;
- The second article explored the support that science HODs received from the principals and the subject advisors when they provided leadership to NS teachers. It also discusses a number of challenges that HODs encountered as middle managers in secondary schools;
- The third paper compared the schools' organisational infrastructure and science HODs' instructional leadership for NS teaching among formerly segregated schools in the Gauteng province;
- The fourth article examined the teachers' perceptions on the quality of NS instructional leadership that they received from the science HODs; and
- The fifth and last article explored the science HODs' capacity to provide this leadership. A discussion of the findings related to each research question is discussed in the following section.

Based on the analysis of the data the researcher attempted to describe science HODs instructional leadership practices, NS teachers' views of these practices and the support that science HODs received in order to enact effective leadership. The five articles are presented below.

ARTICLE 1

STEP CHILDREN OF THE SCIENCE DEPARTMENT? SUBJECT LEADERSHIP FOR NATURAL SCIENCES AND THE NEGLECT OF THE GRADE 8 AND 9 TEACHERS IN SOUTH AFRICAN SECONDARY SCHOOLS

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School of Mathematics, Natural Sciences and Technology Education, University of the Free State, SA

Abstract

To date little research has been conducted on subject leadership by primary and/or junior secondary school Heads of Department (HoDs). Unlike their senior secondary school counterparts, primary and junior secondary science HODs (in South Africa for example) have the more complex task of leading in the multidisciplinary context of natural sciences (NS[7]), which usually includes physics, chemistry, geography, life and environmental sciences. Such leadership of a multidisciplinary subject comes in addition to the complications of role ambiguity, limited time, and limited authority that are inherent in the HOD position. Using interviews and observations, the present study reports on the instructional leadership practices of three NS HODs in South Africa. The paper suggests that providing leadership for NS teaching is more complex in practice than has been reported to date. In the context of increasing focus on accountability and national testing, the unintended consequence has been the neglect of the junior secondary NS teachers by the HoDs who tend to focus more on the senior high school, especially the Grade 12 level where learners write the national matriculation examination. Furthermore, the data suggests that the HoDs tend to limit their attention to their areas of specialisation. The paper concludes with a conceptual framework that provides guidance for

[7] In the South African context, natural sciences (NS) is the name of the subject that is offered at primary and junior secondary levels (Grades 3-9), while the more specialised offerings of life sciences, physical sciences, geography and agricultural sciences are offered at the senior secondary levels (Grades 10-12).

improving instructional leadership by the HODs in such multidisciplinary contexts, especially for the junior secondary school levels.

Keywords

Natural sciences, head of department, instructional leadership, subject leadership, junior secondary science

Introduction

School leadership, including instructional leadership, has historically been seen as the purview of the school principal. As schools become more complex in terms of their subject offerings and organisational arrangements, the principals have come to depend on the specialised knowledge of HODs to provide instructional leadership in the various subjects (Ng, Nguyen, Wong & Choy, 2015). Heads of departments (HODs) are subject specialists who are responsible for establishing and ensuring high standards of teaching and learning in their subjects. Unlike their senior secondary school counterparts, primary and junior secondary natural sciences (NS) HODs have a more complex task, that of leading in a multidisciplinary context, where the offerings are less specialised and often include physics, chemistry, life sciences, earth sciences, environmental and agricultural sciences. In the context of South Africa (RSA), NS lays the foundation for at least four high school subjects, viz., physical sciences, life sciences, geography and agricultural sciences.

Making the transition from NS at the primary and junior secondary levels to physical sciences in high school is problematic for both teachers and learners. The challenge is ensuring that junior and senior secondary school science is aligned and that there is continuity of teachers and key instructional goals (Lai & Cheung, 2013). Due to increased focus on accountability policies across the world, and on the Grade 12 exit examinations in South Africa specifically, NS teaching has tended to be marginalised and overshadowed by efforts to improve the subject results in the tested grades (viz. Grade 12 in RSA). Anecdotal evidence suggests that many schools sometimes allocate less qualified teachers to NS in Grades 8-9 (junior secondary) relative to Grades 10-12. These teachers are either generalists or specialists in only one or occasionally two of the five NS domains and are therefore more inclined to teach only what they know to the exclusion of what they are unfamiliar and uncomfortable with (Ng *et al.*, 2015). The

role of the NS HODs therefore becomes vital to ensure that all the prescribed topics are covered adequately.

HODs are specialist school leaders who have been tasked to manage teaching and learning of specific subjects. Instructional leadership for the HODs tends to be context dependent because subjects have histories, philosophies, cultures and values that differ from one subject to the next (Hallinger & Heck, 2011). Furthermore, the relevance, perceptions, and status of a subject and its department often shape decisions about resources and professional development of teachers. NS is one federal subject, with its own status and philosophy regarding how it should be taught, and the pedagogy is sometimes complicated by the attitudes (especially gender-related issues) of teachers and learners towards the subject. The complexity of NS has led to the present investigation on the nature and practice of instructional leadership for science at junior secondary school levels in South Africa.

The study is an attempt to understand the leadership and development experienced by NS teachers in Gauteng province secondary schools in South Africa. The purpose of the study is two-fold: firstly, to understand the HOD role, and challenges faced by science HODs as they engage in instructional leadership and, secondly, to compare the realities of this leadership to the experiences of NS teachers. The article begins with a review of relevant literature and the conceptual framework that guided the study. We then describe the research questions and the methods that were adopted to answer the questions. The paper concludes with a discussion of findings and makes recommendations for further research on the leadership practices and better ways to support NS teachers as they implement the multidisciplinary NS curriculum.

Literature and conceptual framework

The South African Department of Basic Education (DBE) recently introduced a new curriculum, the Curriculum and Assessment Policy Statements (CAPS), with the aim of raising standards of educational outcomes in the country (DBE, 2011). In addition to the CAPS, school-based assessment tasks (SBATs) have been introduced for each subject. In this way schools enjoy some level of decentralisation in assessment and teachers are empowered to create their own assessment tasks. Although SBATs are important for development of teacher professionalism

(DBE, 2011), Umalusi[8] evaluators suggest that teachers lack 1) resources to prepare for practical work, 2) subject expertise, 3) knowledge and skills to develop SBAT, and 4) time to plan and reflect on the curriculum (Umalusi, 2008). This curriculum demand on teachers has been marked by an increasing shift of responsibility to HODs, in particular, as curriculum leaders, to support teachers in the development of SBATs and the implementation of the new curriculum. However, the ability of the HODs themselves to engage with this demand is rather limited.

In this article, we explore some of the practices of HODs as they enact their leadership responsibilities. Wanzare (2013) refers to the HOD role as that of instructional supervision, which is more than just a position in a structure, but one that has interpersonal, technical, information, administrative, change management and conceptual skills and behaviours associated with it. Teachers' expectations of the HOD; the expectations of the principal, as well as the views of the HODs themselves all add to the complexity of the role.

In the South African context, education policies often present the position of the HOD as one of managerial control instead of instructional leadership (DoE, 1999). At the same time, HODs work 'within a team and for the team they lead' (Stephenson, 2010, p. 19). Siskin (1994) considers the role to be hermaphroditic, because the HOD is neither fully a teacher nor fully an administrator. HODs are therefore caught up between serving senior management and their subject departments. The duality of their role creates confusion (Stephenson, 2010) because they have dual accountability, to the school leadership and to the teachers they lead. HODs therefore find themselves shifting between the roles of being a class teacher and a subject leader, while prioritising urgent administrative tasks. They also have to manage the tension between quality assurance and threats to collegiality within their departments (Wanzare, 2013).

HOD role and responsibility

There is a gap between the way HODs as middle managers perceive their role and what they hope these responsibilities to be (Mercer & Ri, 2006). Kruskamp and Zepeda (2007) suggest that HODs tend to create their own roles, in the absence of clear policy guidelines. Most conceptions of what HODs should be doing refer to ambiguity, lack of clarity of focus, role conflict

[8] UMalusi is the Quality Assurance and Examinations Council responsible for the schooling sector in South Africa.

(Kruskamp & Zepeda, 2007) and lack of direction from principals and/or deputy principals (Collier, Dinham, Brennan, Deece & Mulford, 2002). An HOD is a teacher who has been promoted and assigned the additional responsibility of managing the work of others within a department. In many schools the position of the HOD is an underutilised resource (Weller, 2001), that could be harnessed to improve teaching and learning. HODs often lack the release time from their teaching duties in order to focus on the roles and responsibilities of the leadership position (Ng *et al*., 2015). Some of them feel that the role is overloaded (Barnett, Shoho & Oleszewski, 2012) and there is very little time to support junior secondary (Grades 8-9) colleagues (Bush, Joubert, Kiggundu & Van Rooyen, 2010). Bush (2013) emphasises the urgency for school leaders to prioritise 'managing teaching and learning and not retreating into their offices to do routine administrative work' (p. S18).

As suggested earlier, NS HODs are mostly specialists in one or two fields – they are unlikely to be experts in all five science domains. There is thus an incentive for HODs to adopt a distributed leadership paradigm in their own leadership roles. Melville, Jones and Campbell (2014) argue that leadership is not limited to formal positions and formal titles are not sufficient to achieve true distributed leadership. Lai and Cheung (2013) emphasise the importance of the practice of experienced teachers, who are not formally appointed leaders, guiding those who are inexperienced in order to improve teaching and learning, irrespective of their position in the organisational structure. In cases where other teachers would lead based on their expertise, the HODs became part of the followers.

However, the role of an HOD is complex, influenced by contextual factors, and compounded by conflicting expectations of principals and teachers. Melville *et al*. (2014) suggest that the legitimation of the HOD's role emanates from acknowledgement by members of the subject department that the HOD is generally knowledgeable about the subject (and the development of SBATs). Furthermore, teachers expect HODs to conduct class visits, present demonstration lessons, provide templates and guidelines and use information gathered from monitoring to improve teaching and learning effectiveness and organisational efficiency (Robinson & Timperley, 2007). The school and district leaders also expect HODs to set academic goals and standards for achievement, monitor achievement levels, evaluate practices and learning, and

maximise the effort of instructional organisation, appraisal and staff recruitment. Very little is known about the way HODs go about doing their work and their perspectives on what the role should entail (Stephenson, 2010).

Subject departments

The secondary school curriculum is organised according to subjects, and teachers are supposedly trained and prepared to be subject specialists. These subjects are further organised into departments that manage structure, content and instructional practices of the subject or subject groupings in their classrooms (Lai & Cheung, 2013). The subject departments provide a 'necessary unit of analysis for within school variation' (Highfield, 2010, p.173), and Harris (2001, p.480) calls them a crucial working unit and 'a unit of change'. Departments are platforms from which teachers can engage with curriculum matters, and reflect critically on and share their own practices (Vercio, Ross & Adams, 2008). This study explores the extent to which these platforms are used, if at all, to influence teaching practice.

In a study of Canadian HODs, Schmidt (2000) observed that departments were characterised by qualified teachers who were committed and capable of employing flexible approaches to teaching and learning. This is, however, not always the case; in South Africa, for instance, not all NS teachers are even qualified to teach the subject. This paper explores empirical data on the qualifications of a sample of teachers who teach NS in South African junior secondary schools, and investigates the contribution they make to the kind of leadership support that the HOD is expected to provide. The composition of the department, which comprises teachers from diverse sub-disciplines, has an effect on the department's cohesiveness as well as the instructional leadership practices of science HODs (Melville *et al.,* 2014). The HOD has the task of building this cohesiveness and collegiality so that the department is able to function as a unit. Higher performing schools in the OECD (2011) report tended to focus on effective mechanisms for the selection and quality of teachers and HODs who had the strong leadership capacity to ensure professional development of teachers as effective instructors within departments.

Instructional leadership

Instructional leadership involves sharing a vision with followers, monitoring the instruction and assessment standards, allocating resources and reflecting on the outcome of the instruction (Lai & Cheung 2013). It is not enough to merely monitor that teaching is taking place; a leader must determine whether learning is taking place by using classroom data to make decisions about professional development needs, interventions and grouping of learners where needed. The HOD as a member of the school management team is expected to create a safe and conducive climate for teaching and learning to take place. The HOD as an instructional leader influences many of the activities listed above; the type of leadership is also influenced by the followers. Instructional leadership embraces all activities that are directed to ensuring the quality, maintenance and improvement of teaching and learning (Wanzare, 2013). In the section below we describe our conceptual framework for the paper.

Theoretical and Conceptual framework

The role of subject leadership is context dependent and there is no single hymn sheet for leading a science department in different schools (Hallinger & Heck, 2011). Turner and Bolam (1998) argue that contingency theory is sometimes useful to explain how and why HODs practice (their role of) instructional leadership in the ways they do. The actions of the HODs often depend on the leader him/herself, the task that needs to be performed, the departmental staff or followers and the situation (Timperley, 2005). Spillane, Halverson and Diamonds (2004) concur that leadership is often distributed based on the leader, the task and the context.

To understand the work of the HODs fully, this paper proposes a conceptual framework that marries the provisional model developed by Turner and Bolam (1998) with the teacher leadership framework proposed by York-Barr and Duke (2004). The framework shows how the personal attributes of the instructional leader and his/her knowledge of the context and its problems can be integrated to provide leadership through effective interactions with department members with the aim of influencing teaching choices (Robinson, 2010). The framework is based on research into the effects of the roles and characteristics of HODs as instructional leaders. Six major components of instructional leadership by HODs have been identified in the literature and are discussed below.

The first component focuses on the HODs' personal attributes, which include the profiles of HODs, subject proficiency, experience in the subject (Wanzare, 2013), professional credibility

and trustworthiness, as well as agency in resourcing the department. The attributes influence how the department members view the HOD. The second component looks at the extent to which the HOD practises leadership through setting a vision, building relationships and collegiality, developing teachers, as well as the manner in which leadership is distributed among members of the department (Koh, Gurr, Drysdale & Ang, 2011). The agency of the teachers to take up leadership responsibilities (Lai & Cheung, 2013) as well as the supporting climate for them to take up such responsibility becomes important components of our framework.

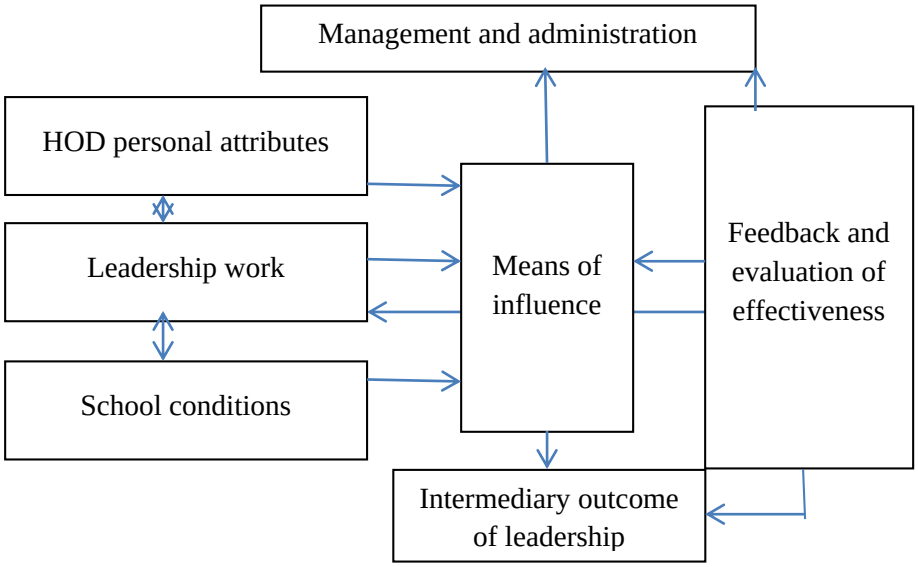

Fig. 1: Abridged version of the conceptual framework (adapted from Turner & Bolam, 1998; York-Barr & Duke, 2004)

The third component includes the way in which the HOD negotiates his/her influence through the school conditions, including social, political, economic, cultural and other contextual problems (Louis & Robinson, 2012) to create an environment that supports effective teaching and learning. It is important for the HOD to buffer teachers from the administrative tasks that take time and protect instructional time (Ng *et al.*, 2015). This requires the HOD to be creative with his/her time and to possess the ability to balance his/her own administrative and instructional leadership duties. The relationship with other school management team members

and the school governing body is crucial for the health of the department (York-Barr & Duke, 2004). In some schools, principals assist in fostering instructional leadership practices (Klar, 2012).

The fourth component focuses on how the HOD influences teaching choices through setting objectives, planning instruction, and developing reflective practice using interpersonal skills to establish trusting and collaborative relationships, not only from formal activities but also through informal collegial activities (York-Barr & Duke, 2004). The fifth component of administration and management involves the overarching role of managing people and resources (see Figure 1). The subject department co-creates and uses routines and artefacts as means of influencing the followers. The HOD is then expected to monitor the interaction of departmental staff through the artefacts and routines. This is the component where many HODs tend to spend most of their time.

The sixth and last component introduces the feedback and evaluation of the effectiveness of leadership. It involves critical reflection by individuals, teams and the organisation, as well as follow-up, mentorship and dialogues about effectiveness of instructional practices and learners' work (Koh *et al.,* 2011). The effectiveness of an HOD depends on the valued leader's work that is visible in the school and it is based on feedback and evaluation of effectiveness (York-Barr & Duke, 2004). The HOD consistently monitors the alignment of curriculum, instruction and assessment standards using data and technology to ensure accountability for performance in the classroom (Nguyen & Ng, 2014). Purposeful classroom observation (Kruskamp & Zepeda, 2007), especially that initiated by the teachers and which is followed by proper feedback, is key. This component evaluates and provides feedback to other components of the framework for their enhancement and modification, to achieve departmental and organisational goals.

The main focus of the framework is to achieve improved and effective teaching and learning practices within a department and school. Using the conceptual framework developed above, we then ask the key questions of our study, viz., how do science HODs practice instructional leadership for the improvement of teaching and learning of NS in the South African school context? And how do teachers perceive this leadership by their HODs?

Methodology

The instructional leadership role of the HOD encompasses several functions, including being the teacher, the leader, the manager and administrator. As a result of this role complexity, we adopted a qualitative research approach involving individual semi-structured interviews and meeting observations as data-collection strategies. Interviews were useful because they enabled the interviewees to interpret their worlds and express how they regarded their situations from their own perspectives (Cohen, Manion & Morrison, 2011). A 360º evaluation approach was used to gather holistic evidence of the way HODs provided leadership; we also asked teachers about their views on the leadership that the HODs claimed to provide. The meeting observations were also used to validate the interview data. In order to gain a better understanding of the reason why certain practices were preferred to others, a narrative and observational method was used (Yin, 2011). The necessary ethical measures were observed, including seeking informed consent and providing for confidentiality of the participating schools and teachers, by using pseudonyms (McMillan & Schumacher, 2010).

Sample

A purposeful sample was used, and we selected three township schools from two educational districts: Fhutura, Alpha and Sheba Secondary Schools. All three schools were public secondary schools whose science departments were led by male HODs who have extensive teaching experience ranging from 10 to 21 years (their experience as HODs ranged from 5 to 16 years).

The first school, Alpha Secondary School, is located close to an informal settlement. The school is over 20 years old and comprises a temporary prefabricated structure without an electricity supply. When the school was established, it was used as a hosting structure while a better and more permanent school structure was being built. The new school then relocated to the new building and this building was left to be used by learners who could not be accommodated in either the new school or other neighbouring schools. The HOD teaches Grades 10-12 mathematics. There are two NS teachers at this school.

The second school, Sheba Secondary School, is a township school that is about 60 years old. It has a relatively good infrastructure. The science HOD teaches Grades 10 and 11 physical sciences. There are three NS teachers at this school.

The third school, Fhutura Secondary School, is a fairly new school, about 12 years old, with good infrastructure. It is located in a new township on the eastern side of Johannesburg. The science HOD teaches Grades 10-12 physical sciences. There are three NS teachers at this school.

All HODs were fairly experienced teachers even though two had less than 10 years' experience as HODs.

Data collection

Two sets of semi-structured interview protocols (Appendix 7) were designed for the different groups (science HODs and NS teachers). Three HODs and four NS teachers from the three schools in the two districts were interviewed using semi-structured protocols with the aim of prompting their views on the role of the science HODs in supporting NS teaching and learning. Each interview started with questions that clarified personal details and qualifications in science. Teachers were asked about their views on the instructional support received from the HODs. Interviews lasted about 45 minutes each. All interviews were transcribed and the transcripts were sent back to participants for verification. Pseudonyms are used throughout for confidentiality. In addition to the interviews, we also observed six subject cluster meetings that were facilitated by the district subject advisors,[9] Thandeka and Zonke. During the observations, attention was given to the content of the meetings, the attendance and participation of the NS teachers and HODs, as well as the quality of the engagement with the NS content by the teachers and subject advisors.

Data analysis

Following interviews, data were transcribed, coded and categorised into emergent themes that represented topics that were mentioned frequently. To focus the comments of HODs and teachers

[9] Subject advisors are district-based subject specialists who are charged with the task of providing subject-related curriculum and assessment support to teachers at the schools.

about the instructional support, the questions were categorised into themes based on the conceptual framework presented earlier.

Findings

In secondary schools, NS is a compulsory subject that is offered only to Grade 8 and 9 learners. It comprises 25% life sciences, 50% physical sciences and 25% geography or earth sciences. This means that teachers who teach this subject must either be generalists or specialists in all three science disciplines: life, physical and earth sciences.

Capacity of teachers to teach NS

Anecdotal evidence indicates that most NS teachers are qualified to teach life sciences, which makes up 25% of NS. Very few of the teachers would therefore be qualified to teach the other 75% of the syllabus. When teachers are unfamiliar with certain sections of the syllabus, they resort to teaching what they know and avoid the other sections (Ng *et al*., 2015). In this study we investigated the qualifications of the teachers who taught NS in the three schools.

Table 1. Specialisation of natural science teachers in the three schools

Teacher	Specialisation
Teacher 1, Alpha	Computer Systems Diploma and an Advanced Certificate (ACE) in Educational Management
Teacher 1, Sheba	STD[10] (Afrikaans and Biology)
Teacher 2, Sheba	STD (Biology)
Teacher 1, Fhutura	STD (Geography)

None of the four teachers had physical sciences qualifications. At least three of the teachers had some qualification to teach 25% of the syllabus, either earth or life sciences. The teacher from Alpha had qualifications that are not relevant to the teaching of NS.

Teaching the physical sciences sub-discipline

NS teachers in these three schools needed development and support in the physical science domain in order to teach NS effectively. They constantly needed guidance and assurance to teach the sections that they were not confident to teach. Teachers' uncertainty about the content could also be the result of the introduction of new sections and changes in the curriculum since these

[10] STD is a 3-year Secondary Teacher's Diploma that Teachers' Colleges of Education used to offer before 2000, and which enabled teachers to specialise in at least two secondary school subjects.

teachers had qualified. Some of the teachers had been teaching NS for some time and one would expect them to have grasped the content. The fact that they hadn't, suggests that they had been avoiding these sections, confirming Ng *et al*.'s argument (2015) that teachers are not comfortable to teach unfamiliar content. The teachers in this study still needed help in the physical science section of the syllabus despite having taught the subject for several years. One of the teachers from Sheba Secondary School responded in the following way when asked about her qualifications in the subject:

> *I was teaching life and living and now it is matter and materials and I need to refer again. The HOD assists me when I approach him … I have to revisit compounds, reactions and the periodic table. I have to restudy that … I feel like I am learning with the children (Teacher 2, Sheba).*

Matter and materials is a component of the physical sciences sub-discipline of NS. The teacher from Sheba Secondary School had to study each section of the work and required daily assistance during the term in which she taught this section. The same teacher was later asked whether she was happy with the support she received from the HOD, and this was her response:

> *I am not happy at the moment as a new teacher. Much of the time is used preparing the physical science. I have to start afresh to prepare for natural sciences (Teacher 2, Sheba).*

Teacher 2 from Sheba was teaching NS for the first time since the revision of the curriculum. She had last taught the subject when it was general sciences prior to 1997. The other teacher from this school expressed the same sentiments.

> *The HOD supports me when I have problems. I am good in life sciences but I struggle with physical sciences, I need help with the PS (Teacher 1, Sheba).*

None of the teachers indicated that they needed help with the life and living section, which comprises 25% of the NS syllabus. Three of the teachers were already qualified to teach this section. The teacher from Alpha needed help in a sub-discipline that the Sheba secondary school teachers were more comfortable with.

Last year I was struggling with earth and beyond because I do not know geography myself. I told the HOD and he said he does not have a geography qualification only maths. I asked the geography teacher to help me (Teacher 1, Alpha).

In some cases teachers felt they did not know how to engage learners in the physical sciences discipline. The teacher from Alpha shared her experiences:

Learners do not like the balancing of equations in matter and material. They participate more when we discuss topics like reproduction (Teacher 1, Alpha).

The complexity of the challenge of teaching NS is exacerbated by the fact that the Department of Education has revised the curriculum and introduced CAPS and SBAT for natural sciences. SBATs require that a practical experiment be conducted and assessed every term. Teachers have to design these practical assessment tasks, and prepare and execute them with their learners.

We expect him to delegate to see if assessments are standardised and measuring certain things. By the time he checks we have not done. He checks but he is not satisfied ... This year we tried to check our own SBA but he was not happy (Teacher 1, Fhutura).

The SBATs have to meet certain assessment standards and teachers sometimes struggle to develop them to the required standard. The HODs are positioned to assist the teachers with the development of these tasks to the appropriate standard. A teacher who was very frustrated about SBATs commented:

We set the tests and the HOD calls us because he is not happy with our questions for the SBAT. We did not understand those things like interpret the graphs or do things in the form of the graph. Learners do not know how to do this; it is not in the syllabus. Learners do not understand those questions. When he intervenes he comes with big words (Teacher 1, Fhutura).

The only professional development session offered by the Department of Education was a once-off training workshop organised by the local district offices during the introduction of the new CAPS curriculum the previous year. It was up to the schools to plan subsequent professional development sessions. This kind of curriculum training happens every five years or so, when the curriculum is reviewed, and this could suggest that teachers only receive professional development every five years.

Capacity of HODs to support NS teaching

The schools have subject departments, which are supposed to provide teachers with ongoing professional support under the leadership of the HOD. This help could be offered in various forms, both formal and informal. Departments are headed by HODs who are supposed to also teach the same subject (NS, in this case) or other subjects. None of the HODs taught NS in the schools in this study.

Table 2. Qualifications and experience of science HODs in the three schools

School	Qualifications	Years of experience as HOD	Subjects taught
Alpha	STD (Maths); ACE (Maths and Technology Education)	5 years	Mathematics
Fhutura	STD (Biology and Physical Sciences); BSc (Physics 2)	5 years	Physical Sciences
Sheba	BSc Ed (Chemistry); ACE (Physical Sciences)	16 years	Physical Sciences

All HODs were teachers of Grade 10-12 subjects. The HODs found the pressure (time and workload) exerted by teaching Further Education and Training (FET or Grades 10-12) subjects like mathematics and physical sciences to be overwhelming; this was also experienced by the NS teachers. The teacher from Fhutura understood how much work the HOD had to do, and recommended that the HOD delegated some tasks to people who had time available to do it (NS teachers).

> *The HOD is focusing on FET. He has too much work. He is supposed to delegate, he is doing everything (Teacher 1, Fhutura).*

A teacher who teaches Grade 12 at another school also referred to the workload involved in teaching Grade 12 learners.

> *There's a lot of work and challenges in teaching Grade 12 … I prioritise Grade 12 because they will be leaving at the end of the year, although not all of them will win (Teacher 2, Sheba).*

The teacher from Fhutura envied FET learners, she believed they received more attention than the NS learners or teachers. The data displays a conflicted HOD who needs a balance between being a teacher and subject leader. She said:

He doesn't call our learners. He always has FET learners around him. He should be attending to the GET [General Education and Training or Grades 3-9] learners as well. Maybe he can ask them what the challenge is, whether we are too fast or what (Teacher 1, Fhutura).

Fhutura's HOD was aware of the teachers' concerns, and he commented:

The NS teachers are happy but they feel they don't get the kind of support that they need. They need more projects, and I am always in class, teaching, but I also try to prioritise NS and Tech education.

Despite this acknowledgement of the teachers' need the HOD decided to be reactive, and waited for the teachers to ask for help. This is how he responded:

Teachers have not asked for help in matter and materials, they think it is easy (HOD, Fhutura).

Even discussions during departmental meetings tended to be dominated by FET subjects; little attention was paid to NS. The teacher from Sheba commented:

Not much for Grade 8 and 9 NS is discussed because much work needs physical sciences [teachers]. There is a gap. There is not much natural sciences because the majority of the teachers are [teach] physical science (Teacher 2, Sheba).

Lack of professional development

The fact that HODs do not teach NS could also render the HODs incapable of supporting teachers in the subject they are not conversant with themselves. The new curriculum has introduced some changes that someone who does not teach the subject might not know about. It seemed any professional development that the teachers received, other than the new curriculum orientation, was provided by subject advisors during subject cluster meetings. The HODs exhibited reliance on the district subject advisor and, in Alpha school; the HOD referred teachers to the subject advisor because he was not a science specialist himself. He indicated that he did classroom observations and,

When I see shortcomings I refer the teachers to the facilitator [subject advisor] … We do get material from the subject advisor but only on the FET side, not GET. I only saw the specialist once a year at the school. Otherwise we go to them when we need assistance (HOD, Alpha).

This school (Alpha) seemed to be benefitting a great deal from the subject advisory services. The fact that their HOD was a mathematics specialist could be a contributing factor to their reliance on the subject advisor. One teacher from Alpha affirmed.

> *We attend cluster meetings once a quarter. When we attend we can ask questions how to treat certain topics (Teacher 1, Alpha).*

HODs themselves did not attend the cluster meetings, except for the HOD from Sheba Secondary School. The fact that they did not attend meetings or sessions organised by the subject advisors could have contributed to their lack of awareness of the subject demands and subsequent inability to provide teachers with assistance in NS.

Subject or departmental meetings

One way of supporting teachers is to hold subject meetings with the teachers to address their concerns, to plan instruction, develop materials jointly, analyse learners' scores and plan interventions etc. Subject meetings are very important management tools that all HODs knew they had to use to help the teachers in their departments. This was confirmed by all the schools in this study. All schools had scheduled their subject meetings in their management plans. However, the conversations that we had with the teachers and the HODs proved that the meetings did not always take place as required. Even though the meetings were considered important, they were either rescheduled or did not take place at all. The teachers confirmed that there was a schedule or plan for these meetings, but it was never followed.

> *Subject or department meetings do not always materialise as planned. Because we have GET and FET teachers mixed when we discuss GET matters FET teachers tend to get bored (HOD, Fhutura).*

The teacher from Alpha Secondary School emphasised the flexibility of the year plan as far as departmental meetings were concerned, by saying,

> *There is a year plan, but things just occur, but they are flexible. The plan is changed for emergency issues.*

This lack of consistency and priority for departmental meetings compromised the importance and integrity of these meetings. The time of day when these meetings occurred varied from school to

school; no particular time was allocated in the school day for these meetings. The teachers had to find time outside the school day or use personal time for the meeting. When asked when or what time the meetings were held in the school week, teachers and HODs gave the responses like the following:

> *It is difficult to meet because teachers travel away from school (HOD, Alpha).*

Another teacher from this school indicated that they used the period allocated to extramural activities to meet.

> *The meetings are usually on Wednesday during the sports period (Teacher 1, Alpha).*

Still in Sheba Secondary School, teachers used their own lunch time to meet, even though the meetings were indicated in the management plan.

> *There is a meeting management plan. We meet about twice a term. The meetings are during lunch time or after school. There is a departmental office where we meet (HOD, Sheba).*

One of the researchers experienced the rescheduling of subject meetings at Sheba Secondary School. She was supposed to observe the meeting and it was rescheduled twice before she could observe it.

It was not only the meeting time and space that provided challenges, but also the content of the subject meetings. HODs used the subject meetings to address administrative and management concerns.

> *We discuss curriculum and management plans at these meetings. Not much for Grade 8 and 9 NS is discussed because much work needs physical sciences. … There is not much natural sciences because the majority of the teachers are [teach] physical science (Teacher 2, Sheba).*

> *There is no discussion on the subject, like natural sciences. There is no common planning (Teacher, 1 Alpha).*

The HOD of Alpha Secondary School confirmed that he only addresses administrative matters at meetings with teachers, saying:

> *I only address administration issues; there is a lot of administration for teachers. Teachers do not have difficulties. It is evident in the books (learners' books).*

The HODs used the meetings as management tools to monitor content coverage and the pacing of teaching in general. The attempt to monitor was compounded by the fact that the meetings involved every member of the department.

> *When we meet as a department it is not only NS teachers. We meet with maths teachers and we only discuss administrative issues, learner discipline and the files and records that we should keep (Teacher 1, Alpha).*

The same sentiment was shared by a teacher from Sheba:

> *There is not much natural sciences because the majority of the teachers are [teach] physical science (Teacher 2, Sheba).*

Structure and organisation of subject departments

The science departments in the schools comprised subjects from different phases (GET and FET bands). Table 3 sets out the composition of science departments headed by the HODs in the study. The symbol ✓ indicates a subject in the department and X indicates that the subject is not part of the department.

Table 3. Organisation of science departments

School	NS	LS	PS	Tech Ed	Maths	Number of teachers
Alpha	✓	X	X	X	✓	8
Sheba	✓	✓	✓	X	X	8
Fhutura	✓	✓	✓	✓	X	12

The findings reveal that the composition of (subject) departments meant it was a challenge for the HODs to discuss individual subject issues at these meetings. The NS teachers were in a minority in the meetings; at one school most members of the department taught physical sciences and therefore no NS matters were discussed at the meetings: "*There is not much natural sciences because the majority of the teachers are [teach] physical science" (Teacher 2, Sheba).* The departmental meetings did not work as forums for building collegiality among teachers who worked in the same department. When both GET and FET teachers were together they had no

patience for each other: "b*ecause we have GET and FET teachers mixed, when we discuss GET matters FET teachers tend to get bored",* said the HOD from Fhutura.

Classroom observation

Another way of providing teachers with support is by observing teachers in the classroom, allowing them to reflect on their practice and providing feedback. Unfortunately, our conversations with both teachers and HODs revealed that classroom observations rarely took place in the schools. Teachers indicated that their HODs only did classroom observation once a year, for Integrated Quality Management System purposes (IQMS[11]).

> *I do classroom observations under IQMS in the second and third quarter and provide feedback. I am very accommodative (HOD, Alpha).*

Because the IQMS classroom observations are planned and initiated by the teacher, the teachers are likely to choose their best lessons for observation. It might be difficult for the HOD to identify areas of need if the teacher decides to conceal them. On the positive side, teachers did receive feedback on classroom observations:

> *Yes, I do get feedback. He always tells me to fix the classroom management (Teacher 1, Fhutura).*

One of the HODs indicated that he had tried to schedule classroom observations outside IQMS but the unionisation of the teachers proved to be an obstacle:

> *Other indirect observations I do in order to provide help with experiments. CAPS involves practical. If classroom observation is unplanned union issues come to play (HOD, Sheba*).

This could be the reason why the other HODs did not even try to conduct additional observation, though time pressure could be another reason.

The HODs could, however, apply another form of professional development instead of classroom observation. They could present workshops for the teachers in or outside the school. The HOD or any other capable teacher could present at these workshops. They could also conduct lesson demonstrations or coaching sessions. These schools did not present other forms

[11] The IQMS evaluation is conducted to target three levels of the system: Developmental appraisal of the teacher to identify strengths and weaknesses; performance evaluation for pay progression and whole school evaluation to measure the overall effectiveness of a school, including teaching and learning (DBE, 2009).

of professional development – no professional development of teachers was ever done by the schools, except for the CAPS training that was organised by the district or the provincial office. HODs chose to be reactive and wait for the teachers to ask for help.

There was, however, evidence of subject advisors providing professional development sessions once a term, in the form of subject cluster meetings. We had an opportunity to observe six of these cluster meetings, three in each district. These meetings occurred in the afternoons and lasted about 90 minutes. Grades 7 to 9 teachers and their HODs were invited to these meetings.

Observation of subject cluster meetings

Teachers and HODs from 120 schools in both districts were expected to attend the meetings, but only nine science HODs attended the subject cluster meetings that we observed. These cluster meetings were held for Grades 7 to 9 NS teachers and their HODs combined. About half of the HODs who attended these meetings were Grade 7 HODs who taught at primary schools. One HOD confessed that he did not attend NS workshops, saying,

'I do not attend NS workshops, I request the subject teachers to attend' (HOD, Alpha).

The cluster meeting rooms were packed with teachers. Some teachers arrived late and left early because they were either reliant on lift clubs or they had other pressing engagements. In one district a subject advisor, Thandeka, welcomed teachers and shared the agenda with them. She then gave a lecture on NS work that was planned for the quarter for Grades 7 to 9. Though the outline of the planned content could have been useful, no clear strategies for classroom practice were explained or demonstrated. She did not interact with teachers or identify their needs. She had the chance to build collegiality among teachers from the same cluster but she didn't. She made announcements about upcoming competitions and exams and after 90 minutes she ended the meeting.

While Thandeka focused on subject-content matters, another subject advisor, Zonke, focused on the structure of the upcoming common examination and did not address any subject-specific matters at all. Zonke's meeting was initially quite disorganised, as she was hampered by the room's small size, and she could not print hand-out documents due to a power failure. She spoke generally about the question-paper structure and how examination questions should resemble the

matriculation examination questions. Teachers started leaving the meeting after about 45 minutes. She made announcements about Grade 7 competitions and tried to hand out competition booklets, of which she did not have enough. On all three occasions this led to chaos in the meeting rooms. The handing-out of documents marked the end of the meetings. Zonke did not present strategies for classroom practice or direction for the next steps either.

Discussion

This study of the practices of science HODs at three schools provides insight into the leadership practices of HODs in the different contexts and situations. Instructional leadership practices by HODs, as described in this paper, are characterised by the contributions made by the personal attributes of the HODs, the school conditions and the means that the HODs used to influence instruction, as described in the conceptual framework. This paper also discussed aspects of the HOD's administrative role and feedback evaluation as they manifested themselves in the schools that were studied. Below we discuss how the HODs used the six components of the framework to provide instructional leadership and we reflect on the effectiveness of that leadership.

Conditions at schools

The paper identified three effects caused by school conditions. Firstly, the composition of departments in the schools we studied was not subject-based. In other countries researchers report on subject departments, e.g. English, science or mathematics departments (Highfield, 2010), while in South Africa that is not the case. The three schools in this study showed a variety of arrangements and grouping of subjects to form a department. Because of this arrangement the HOD's role and time became incredibly challenged. The finding on the effect of subject department culture is consistent with the studies that reveal the fact that the subjects have their own distinctiveness, contexts, philosophies and pedagogical implications (Highfield, 2010; Hallinger & Heck, 2011). Schools that showed a culture of mentoring and professional development instilled confidence in teacher leadership.

Secondly, the school principals did not provide time and space for HODs to hold their meetings (Ng *et al.,* 2015). Meetings were held during lunch times, sports periods or even after school hours. This indicates that the principals were not as supportive and undervalued these meetings.

This practice, although similar to experiences reported by Ng *et al*. (2015) is contrary to findings by Klar (2012), who reports on principals that fostered the work of the HODs by providing time and space for meetings, and even attended some of the meetings. The fact that the department meetings at the schools we studied were scheduled in the year plan but some other unforeseen events took their place was of concern for the effective management of departments by HODs. Furthermore, the school management teams allocated teachers who were not adequately qualified to teach NS, and this contributed to an instructional climate that was not conducive for optimal teaching and learning. High performing schools are very particular about mechanisms for recruiting teachers with good qualities to teach effectively (OECD, 2011). This was not the case in our study schools.

Means of leadership influence

The HODs used various ways to influence NS instructional practices.

- *Professional development*

The HODs in the study did not initiate professional development at all, neither for the teachers in their departments nor for themselves. They did not seem to recognise the teachers' intellectual resources or attempt to develop and explore teachers' knowledge and skills. The schools seem to have adopted a deficit model of teacher development (Lai & Cheung, 2013), i.e. waiting for teachers to cry for 'help' before they took any action. The findings suggest a reactive role instead of a proactive one in support of NS teachers. They did not support teachers to attend cluster meetings, neither did they attend themselves; they did not proactively develop instructional material. Instead as the Fhutura teacher indicated, teachers developed the assessment tasks and then the HOD would only comment and rectify. The HOD of Fhutura School even concluded that the learners only started to learn science in grade 10, because they did not seem to understand or remember anything that they had been taught in grades 8 and 9. Nevertheless, the HOD did not intervene to assist the teachers or the learners in this regard.

There are four possible reasons why HODs did not initiate professional development. Firstly, the HODs did not teach NS and they were not conversant with the subject content, the pedagogical challenges or the implications of teaching this subject. Secondly, they did not know what was

going on in the NS classrooms because they did not teach the subject and did not conduct frequent classroom observations, except when they did IQMS observations (Kruskamp & Zepeda, 2007). Consequently HODs were not able to identify areas of teacher development. Thirdly, the HODs were so busy with FET teaching, administrative work and FET subject discussions that they did not have time for a junior secondary subject such as NS, which is not externally examined. Lack of time has been a key problem for everybody involved in trying to complete tasks during in-school time for many years now (Brown, Rutherford & Boyle, 2000). In this study the only HOD who seemed to be involved in intervention was the HOD at Sheba, because he had fewer teaching periods. This is consistent with the argument that HODs need time off from their teaching duties to be able to practice instructional leadership effectively (Kruskamp & Zepeda, 2007).

The fourth possible reason for HODs' failure to initiate professional development may be a lack of subject expertise and knowledge on the part of the HOD (Melville *et al.,* 2014). It is possible that HODs feel that they lack the ability to provide professional help to teachers, because the HODs only know how to teach learners and not how to develop teachers (Barnett *et al.,* 2012). Sometimes HODs felt that teachers knew more about the subject than themselves (Ng *et al*., 2015). When they were promoted to the HOD position their induction lasted only one day and focused mostly on administrative issues.

- *Subject meetings*

Subject meetings at the three schools did not present a fertile environment for developing collegiality among or professionalism in teachers, nor was there any other forum where this could be done. Meetings tended to focus on administrative matters, and created friction between NS and FET teachers instead of collegiality. The HODs did not seem to have a mitigation strategy to address this threat to collegiality (Wanzare, 2013). There was no evidence of forums where teachers planned instruction together, analysed learners' scores, planned interventions or where the HOD established a good working relationship with the teachers. The fact that unforeseen events were prioritised over the subject meetings may be an indication of the lack of support and devaluing of the importance of the meetings by school management. None of the teachers or HODs mentioned that the principal attended the departmental meetings, as was the

case in Klar's (2012) study, or invited external experts to conduct programmes, as in the study by Ng *et al*. (2015).

Feedback and evaluation

In this study, we did not find evidence of attempts by HODs or principals to implement systems and procedures to monitor the effectiveness of teaching or reflect on the quality of instructional leadership (Harris, 2001). This is the area that our conceptual framework had identified as absent in previous frameworks. None of the HODs from the three schools mentioned analysis of tests and learner achievement results, or monitoring the work of HODs by principals and deputy principals. Although the learners' test and examination scripts were moderated, the findings suggest that the moderation was done to check the accuracy of marking rather than the learners' level of understanding of concepts. There was no evidence of score analysis conducted to understand instructional challenges and to plan interventions or to group learners (Bennett, Woods, Wise & Newton, 2007). From the interview with the Fhutura teacher it was evident that the teacher wanted to provide feedback to the HOD about the need for demonstration lessons and help with the development of SBA tasks. The way leadership is practiced in the schools is such that there is no platform for such feedback. There was no evidence of feedback on existing leadership practices. The ability to hold one-on-one feedback was not entertained, possibly because of the negative attitude held by the teachers towards classroom observation (Wanzare, 2013). The outcome of the lack of feedback from both teachers and HODs was only visible in the types and quality of tasks that these teachers produced and the performance of learners.

The neglect of NS teachers

Implementing a new curriculum and pedagogy can be very difficult in the absence of an effective HOD who has the right expertise in the subject. The HODs in this study demonstrated neglect of NS teachers at crucial times during the implementation of the CAPS curriculum. The involvement of the HODs in FET teaching and learning to the exclusion of Grades 8 and 9 teaching might have been a function of role overload (Barnett *et al*., 2012). This finding, although consistent with the argument that HODs lack time (Kruskamp & Zepeda, 2007), highlights inequalities in the treatment of subjects within a department. The HODs were more concerned with FET subjects, to the extent that NS was marginalised and NS teachers felt like

stepchildren in the department and the school. NS was afforded a lower (stepchild) status compared to physical sciences, life sciences and mathematics, which are subjects in the FET band.

There are three possible reasons why NS teachers tended to feel neglected compared to teachers of other subjects in the department. Firstly, their feeling of neglect stems from the fact that the HODs in this study do not even teach the NS that they are supposed to be supporting, monitoring and improving. This made HODs to lose touch with the subject and understanding of its dynamics and challenges. Secondly, NS, a junior secondary subject, is grouped in the department with subjects that are in the FET band – subjects that are externally assessed by the National Department of Basic Education and which therefore have an elevated status at schools. NS thus has a lower status compared to these subjects although, ironically, NS lays the foundation for these very subjects. Thirdly, the allocation of less qualified teachers, possessing only 25% expertise in the subject, could be another reason for feelings of neglect among NS teachers. In the study, the NS teachers reported that they felt as if they had been dumped to teach NS and they were not given support for the other 75% of the subject. It is for this reason that teachers would then teach what they were qualified to teach and leave out the sections they were unfamiliar with (Ng *et al*., 2015).

This scenario suggests an urgent need for the HODs to provide opportunities for some kind of professional development, whether it is self-initiated by teachers, school based or is an external opportunity for teachers to acquire the appropriate expertise, knowledge and skills to teach the subject.

Conclusion

This study identified a number of challenges faced by HODs that relate to supporting the teaching of NS teachers in junior secondary schools. The findings affirm the challenging nature of the role of the HOD in general, as well as the challenges presented by the particular subject and its context. The paper suggests that, as long as the qualifications of HODs and NS teachers and the organisational structure of science departments continue to be unsatisfactory, then its impact on learners' performance in physical sciences will remain a cause for concern. The fact

that less qualified teachers or those not qualified to teach science at all are allocated to teach NS suggests that this subject is not accorded the respect it probably deserves. The less qualified teachers are not even provided with opportunities for professional development by the HODs or through the support of the school principals.

Significantly, the findings also show that NS is so marginalised that science HODs do not, for the most part, even teach it but tend to focus on FET subjects. The study has enriched our understanding on the importance of the personal attributes, particularly the knowledge and expertise of HODs, especially science HODs, in secondary schools. Urgent attention needs to be paid to the subject groupings in departments and the allocation of teachers who are expected to teach NS in schools. We recommend that the structure of departments could be reconfigured to include a junior secondary science HOD, who would provide the much-needed leadership in the junior secondary section of the school. This proposal even though it has staffing implications, can be factored into the existing arrangements of some schools without much difficulty.

The main aim of this article was to explore the practices of science HODs as they support the teaching of NS in secondary schools. We explored the practices of HODs and teachers' perspectives thereon. While we know much more about the practices of leadership for NS in schools from this study, there is however some room for improvement especially in terms of the design of the study. The qualitative research approach limits the generalisability of the findings and calls for caution in the interpretation of the results. Furthermore, the study interviewed a limited number of teachers about the support they receive from each HOD. To obtain a more comprehensive picture on this support, a more detailed case study could assist to examine the degree to which teachers' perceptions hold out in practice especially in different school contexts.

The article, however, begins to provide research-based insights for the principals and the districts on the utility and effectiveness of the current structures and practices for subject leadership of NS in schools. The article also provides a basis and recommendations for a possible restructuring of such conglomerate departments as the one for NS to make them more effective.

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ARTICLE 2

MIDDLE MANAGEMENT AND INSTRUCTIONAL LEADERSHIP: THE CASE OF THE NATURAL SCIENCES' HEADS OF DEPARTMENTS (HODS) IN SOUTH AFRICA

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ABSTRACT

In many schools, Heads of Department (HODs) often find themselves in the middle, shuttling between one role as part of the school management team, and another as an ordinary classroom teacher. For natural sciences (NS) HODs, their role as subject and instructional leaders is made even more complex by the fact that NS is a conglomerate subject which brings together at least four science disciplines, each with its own disciplinary culture and expectations. To date, we still know very little about how HODs negotiate such role complexities to provide effective instructional leadership in their subject departments. This paper reports on a mixed methods study that explored the practices of the natural sciences HODs as they sought to provide instructional leadership to the teachers in a multidisciplinary context of their subject. Data on the HOD's administrative, management and leadership activities and practices as well as on the support they receive from the principal and subject advisor in order to provide leadership were gathered through questionnaires. Data from semi-structured interviews and observations with a purposive sample of subject leaders across four districts in the Gauteng province of South Africa was also collected. The data reveal that science HODs devise creative ways of mitigating the challenges of 1) differently qualified NS teachers and, 2) managing department meetings and resourcing science departments with apparatus. They further reveal that HODs receive minimal support from subject advisors and selective support from the principals. These findings suggest that the effectiveness of the HODs as instructional leaders is influenced by the immense pressure from the dual roles of managing from the middle, which also appear to affect the optimal

implementation of the NS curriculum. As science HODs can play a key role in strengthening teaching practice, we recommend that schools consider carefully the specialisation of both the science HODs and NS teachers when they do the teacher workload/ subject allocations for each year. Furthermore, we recommend that subject advisors work more closely with HODs (instead of teachers only) to support and build their instructional leadership skills. As there is very little research and scholarship on the role of the HOD as an instructional leader in the school, this study contributes to our understanding of the practices of the science HODs in schools; some of the challenges they face as middle managers; and their importance as an integral part of the school management team to support and strengthen teaching and learning.

Key words: middle management, instructional leadership, head of department, natural sciences

INTRODUCTION

There is a growing scholarship in South Africa on the importance of instructional leadership in improving learner outcomes in schools. Much of the research in this area focuses on the role of the school principal in instructional improvement (Bush, Glover, Bischoff, Moloi, Heystek & Joubert, 2006; Hoadley, Christie & Ward, 2009). One of the gaps in the research has been on the role of the HOD as a key member of the school management team (SMT) responsible for instructional improvement in the school. Due to the lack of attention given to HODs in both research and policy, there is confusion about the exact placement of the HOD position on the organogram in schools (Wanzare, 2013; Barnett, Shoho & Olewszeski, 2012). The position of HOD is a formal position with concurrent powers and responsibilities. As middle managers, HODs operate somewhere between the SMT and only a professional level higher than teachers, but because of their teaching duties (which make up 85% of their time in South Africa), they often find themselves at the same levels as teachers (DoE, 1999). Teaching takes most of their time and they have limited time for providing leadership (Glickman, Gordon & Ross-Gordon, 2011). Historically, HODs mostly served as a communication link between teachers and the management, without any evaluative power (Ng, Nguyen, Wong & Choy, 2015). Their role has evolved over the years to include being both leaders and followers (Spillane, Halverson & Diamond, 2004). In a typical South African public school, a science HOD would lead a team of

science teachers but could also be teaching English and would have to comply with the demands and expectations from the English HOD, thus assuming the role of the follower.

Science HODs have a more complex task of leading in a multidisciplinary context, where the offerings are less specialised. Natural Sciences (NS) is a multidisciplinary subject comprising four science disciplines viz., chemistry, earth sciences, life and physical sciences. It is a junior secondary subject that belongs to a group of science subjects (Ng *et al.,* 2015) constituting the science department in secondary schools. Spillane and Hopkins (2013) call this structural arrangement of departments in schools- 'a system and organisational infrastructure' (p2). This arrangement in secondary schools brings together a group of subjects like mathematics, mathematical literacy, agricultural, life, natural and physical sciences in South Africa. In this context NS lays the foundation for at least four high school subjects, viz., physical sciences (PS), life sciences (LS), geography and agricultural sciences. On the other hand, being a junior secondary school subject, NS tends to compete with subjects like mathematics and physical sciences for time and resources, which might have a higher status within the structural arrangement of science departments in schools. It is not likely that the NS teachers would be specialist in all the subjects listed above, nor would the science HODs who lead the subject departments. If no one is monitoring and providing guidance and support in NS instructional practices of these teachers, it will lead to poor learner performance in the subject (Spillane *et al.,* 2003).

One of the key science HOD tasks is to monitor NS instruction. In order to do this, the sciences HODs are expected by policy and practitioners to have knowledge of the subject and expertise in teaching it. As instructional leaders, they are expected to have subject competence in the classroom and sufficient subject teaching experience (Angelle & DeHart, 2011; Ghamrawi, 2010). The subject expertise and skills in leadership displayed by the HOD as a specialist (Ghamrawi, 2010) builds the confidence that the teachers have in her/him and enhances her/his professional credibility. Teachers need to be convinced of the leadership capacity of those who lead. The HOD should also show self-esteem and have confidence in own expertise (Wanzare, 2013). The position therefore demands that the HODs have the ability to influence members of their own department through influential relationships and desired behaviours (Spillane, Hallett

& Diamond, 2003). All these competencies and attributes of the HOD are essential to effectively fulfil the role of an instructional leader in the school. To date, not much research has been undertaken to understand the crucial role that these middle managers play in the teaching and learning processes of the school, and to identify the areas where support and development can further enhance this role. This study and its findings aim to make a contribution to the scholarship and practice of instructional leadership in schools.

We used a mixed methods study of six schools from four Gauteng school districts to examine how HODs perceived their role as NS instructional leaders in their schools. We specifically examined what subjects HODs taught and whether they had release time to carry out their HOD duties; what practices they enacted in order to meet NS teachers' expectations of their role; what administrative and compliance activities they carried out; and the kinds of support that they received from the schools and the local district offices. In this paper we identified different means of influencing teaching and learning and explored ways in which HODs mitigate the challenges that they encountered to support instruction. The study confirms that leadership is enacted within the practical constraints of a local context (Hallinger & Heck, 2011).

We recorded responses of all science HODs in the sampled schools and focused on the biographical data of NS teachers in order to understand the profile of the teachers that science HODs had to lead. Secondly, we focused on the role demands on HODs' time. These included instructional, administrative, management and leadership activities (Brown, Rutherford & Boyle, 2000; Koh, Gurr, Drysdale & Ang, 2011) that science HODs spent most of their time in and got allocated to do. We also explored the decisions they made as middle managers regarding managing some of the departmental routines (Spillane & Hopkins, 2013). We explored these activities to understand how their impact would be felt by the calibre of the NS teachers as displayed by the biographical data. The third focus is on the support and professional development that HODs themselves needed in order to be able to carry out their leadership duties effectively and whether principals and subject advisors provided any support.

Our findings advance and support the main proposition on our conceptual framework that the science HODs' work needs to be closely monitored by the principals and subject advisors, who

must provide support and feedback that would be used to improve instruction. Secondly we argue that the appointment of unsuitably qualified HODs to the science department to lead NS and the partial specialisation of NS teachers if not properly managed could affect the quality of instruction. We discuss the different ways that science HODs have devised to try and work around this challenge. We also argue that the effect of the science HODs' instructional practices could manifest itself as neglect for the subject being led with implications that the leader is not adequately informed and abreast with the subject developments. That would compromise the professional credibility of the HOD. We further argue that the lack of release time for the HOD could also manifest itself as neglect for NS teachers.

We conclude with recommendations to review the organisation of departments and recognise and advance other structures within the school that could support teachers especially in schools where the HOD leads a group of subjects rather than one subject. We also recommend the means of support for HODs that would enhance their instructional capacity.

LITERATURE AND THEORETICAL FRAMEWORK

There is limited research on instructional leadership in South Africa. A number of studies focus on the effect of the quality of leadership of principals on teacher effectiveness and learner performance (Naicker, Chikoko & Mthiyane, 2013) and on management of schools, but few studies focus on curriculum and instructional leadership in schools (Bush *et al.*, 2010). Where leadership in schools is addressed, the studies tend to focus on principals as leaders in the schools, including being instructional leaders. There is limited, if any, focus on middle management in schools (Barnett *et al*., 2012; Koh *et al.,* 2011; OECD, 2011) globally and in South Africa. A comprehensive study by Hoadley *et al.* (2009) investigated the management of curriculum at different secondary schools. This study focused on high schools and the principal as the instructional leader, and it was not subject specific. However, research suggests that principals are not in a position to influence classroom teaching directly, because they spend less time with teachers than HODs (Highfield, 2010; Lai & Cheung, 2013) who in contrast, spend more time with teachers and are therefore in a better position to influence their instructional

practices. This makes the role of the HOD as part of the instructional leadership team essential to influencing the teaching processes and learning outcomes.

Middle management is described differently in the literature. Several scholars describe middle management in schools such as lead teachers or teacher leaders (Stephenson, 2010), senior teachers, department chairs (Skinner, 2007), master teachers and HODs (Brown *et al.,* 2000; Turner, 2003). HODs are expected to be change agents for all the school reform initiatives on one hand, yet on another to foster effective teaching and learning in the classrooms (Angelle & DeHart, 2011). There is therefore a shift to label HODs as middle leadership, which involves managing people, resources and processes. Working with people would include influencing their behaviours and attitudes about instructional practice.

HOD roles and responsibilities as middle managers

Angelle and DeHart (2011), Spillane and Hopkins (2013) and Wanzare (2013) all agree that the legitimisation of the HOD role emanates from the acceptance by members of the subject department that the HOD is generally knowledgeable about the subject, possesses cross-grade level curricular knowledge and can develop teaching and learning materials like SBATS. Furthermore, HODs are expected to conduct classroom visits, demonstrate lessons, provide guidelines and provide teachers with helpful feedback to improve their teaching (Wanzare, 2013). They are also expected to set academic goals, standards for achievement, monitor achievement levels, evaluate practices and learning, maximise the effort of instructional organisation, appraisal and staff recruitment (Ng *et al*., 2015). However, the role of an HOD is complex, influenced by contextual factors and assumes different forms of leadership (Hallinger & Heck, 2011). It is compounded by conflicting expectations from principals, teachers and HODs themselves. Very little is known about how HODs go about doing their work and their perspectives on what the role should entail (Stephenson, 2010).

In South Africa the Department of Basic Education (DBE) has realised that school leadership needs to be adequately prepared and developed (Bush, 2013) by introducing a certificate programme in school management and leadership for school principals (DOE, 2008). Numerous programmes have been instituted to achieve this goal; however the focus has still been mostly on

management and administration of schools and not on instructional leadership (Bush, Joubert, Kiggundu & van Rooyen, 2010). Furthermore, the focus is mostly on principals and not the school middle management. Even though principals may be specialists in some subject areas their role is whole school curriculum management rather than subject specific management. Curriculum in secondary schools is specialised and specialists like HODs contribute better in the development of subject instruction and improvement of subject performance.

What seems to be missing is the development of school instructional leaders and even more important, the recognition of HODs as middle leaders that can be entrusted with the role of leading teaching and learning in the schools. In my experience as a teacher and a subject advisor, in the majority of South African junior and senior secondary schools, HODs are appointed into formal positions. Teacher leaders, other than HODs, in South Africa are not formal and they are sometimes chosen by teachers themselves as opposed to HODs or departments chairs (Guthrie & Schuermann, 2010; Skinner, 2007) where the candidate him/herself would contest for the position. In other countries like New Zealand and Hong Kong teacher leaders are nominated by teachers based on their expertise (Lai & Cheung, 2013; Stephenson, 2010). Literature also reports that teacher leaders are sometimes brought in by a project in the school or district and when the project closes or exits the positions also cease (Stephenson, 2010). Teacher leaders tend to focus on the classroom, the teacher and learning. Some teacher leaders do not teach because they focus on assisting different teachers in the implementation of curriculum in the classrooms and not on managerial and administrative duties like HODs.

Subject-specific instructional leadership

Middle management in schools comprises managers who are experts in their fields, usually a subject. Although a large amount of research has been done on curriculum implementation in South Africa (Kriek & Basson, 2008), little has been done on instructional leadership in NS and how it shapes the teachers' instructional practices. Instructional leadership research is an emerging area that is currently poorly understood. The enhancement of this limited instructional leadership research in South Africa calls for subject-specific instructional leadership research to accommodate all the nuances of the subject, its philosophies, cultures, principles and beliefs, held by teachers, learners and parents about the subject.

Instructional leadership is a set of leadership practices involving planning, evaluation, coordination and improvement of teaching and learning (Robinson, 2010). It involves sharing a vision with followers, monitoring the instruction and assessment standards, allocating resources and reflecting on the outcome of the instruction (Lai & Cheung, 2013). Skinner (2007) describes it as an ongoing process of providing professional support for other teachers and facilitating the movement towards a more collaborative and effective teaching of learners for the purpose of overall improvement of schooling. All these descriptions vary in their focus and as researchers, we find instructional leadership to be about having a vision that influences the quality of instructional practices and teaching choices that teachers make which lead to improved learning achievement by learners and teachers themselves. Although subject-specific leadership would concern itself with one particular subject, ensuring that the subject instruction is advanced and the performance of learners in the subject is improved, the aggregate effect if all subjects improved would result in the whole school improvement.

The subject- natural sciences

Unlike their senior secondary school counterparts, the primary and junior secondary science HODs have a more complex task of having to lead in a multidisciplinary context of NS, which often includes physics, chemistry, life, earth, environmental and agricultural science disciplines for example. Though a foundational subject, NS is usually taught by teachers who are either generalists or specialists in only one or occasionally two of the five NS domains. Specialists are likely to occasionally leave out the sections they are not specialists in (Ng *et al*., 2015) while generalists seem not to adequately provide the depth of the different discipline. This shallow exposure to the subject results in learners who are poorly prepared to engage with the science content meaningfully.

The grouping of subject-disciplines under NS is likely to pose challenges to the HODs, who may be expected to provide leadership in areas some of which they have no expertise in, or where followers' (teachers) may have more expertise than the HODs. NS or integrated science is not unique to South Africa though, but is offered in other countries such as in USA (California and Colorado), BOLESWA (Botswana, Lesotho and Swaziland) countries and Malaysia. In Malaysia

for example the prominent challenges of integrated science involved delivering and managing science instruction, and administering science instructional facilities and equipment. Teachers of various educational backgrounds teaching science subjects were common in most schools. This resulted in teachers with various subject majors' background often required to teach science subjects which they were not trained for (Osman, Halim & Meerah, 2006). For South African schools the challenge is how the local department of education equips the schools to meet this demand for better qualified teachers and subject leaders.

Conceptual Framework

The role of subject leadership is context dependent and there is no one hymn sheet for leading the same department in different schools (Hallinger & Heck 2011). The actions of the HODs often depend on the leader him/herself, the task that needs to be performed, the departmental staff or followers and the situation (Timperley, 2005). To understand the work of the HODs fully, this paper proposes a conceptual framework that marries Turner and Bolam's provisional model (Turner & Bolam, 1998) with the teacher leadership framework proposed by York-Barr and Duke (2004). We introduce the component of reflection into the extent of the influence of the leadership on the teaching and the learning outcomes. The framework is based on the research into the effects of the roles and characteristics of HODs as instructional leaders. Six major components of instructional leadership by HODs have been identified in the literature and are discussed here under.

The first three components could be viewed as inputs into the subject leadership system. The first component focuses on the personal profile of the HOD like subject proficiency, experience in the subject (Smith *et al.,* 2013), professional credibility, trustworthiness, the agency of the HOD in resourcing the subject department. The second component is the role expectations which include vision setting, building relationships, collegiality, developing teachers and how leadership is distributed among members of the department (Koh *et al.,* 2011). The third component is contextual (social, political, economic and cultural) factors and school conditions which the HOD negotiates his/her influence through (Robinson, 2010; Bendikson, Robinson & Hattie, 2012). The fourth component is the process of influencing teaching choices through aligning instruction with assessment, planning instruction, developing reflective practice using interpersonal skills to establish trusting and collaborative relationships not only formally but also through informal collegial activities (Barnett & Aagaard, 2007). The fifth component of administration and management involves the overarching role of

managing people and resources (see figure 1). This component contributes to how the other components interact to achieve the goals of the department and the school.

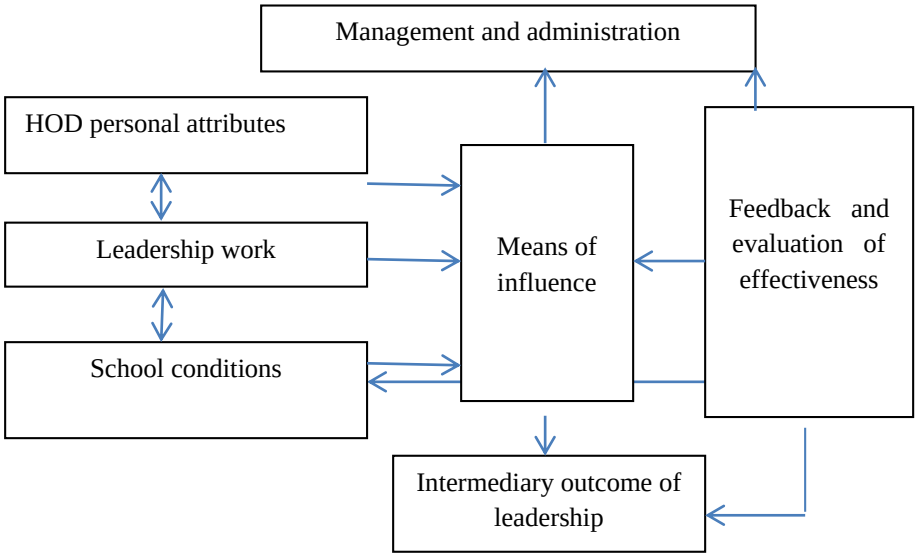

Fig 1: Abridged version of the conceptual framework for leading instruction. (Adapted from Turner & Bolam, 1998; York-Barr & Duke, 2004).

The sixth and last component introduces the feedback and evaluation of the effectiveness aspect of leadership. It involves critical reflection by individuals, teams, and the organisation, mentorship and dialogues about effectiveness of instructional practices and learners' work (Lashway, 2002). The HOD consistently monitors the alignment of curriculum, instruction and assessment standards using data and technology to ensure accountability for performance in the classroom (Nguyen & Ng, 2014). This component provides the feedback to other components of the framework (Bendikson *et al.*, 2012).

The findings from the evaluation form the basis on which the other components are modified and enhanced to achieve the set goals. The main outcome of schooling and focus of the framework is to achieve effective teaching practices and improved learning outcomes within the department and school. This outcome is affected by all six components and has feedback effects to all the other components. Using the conceptual framework developed above, we then ask the key questions of our study: What are the experiences of science HODs as they lead natural sciences

instruction? How can the capacity of science HODs be enhanced to provide effective instructional leadership?

METHODS

The purpose of this mixed methods study was to explore, from HODs' perspectives, how they provided instructional leadership for NS using self-reported data from two sequential strands (Cresswell & Plano-Clark, 2011). We employed a quantitative questionnaire strand, which was followed by a qualitative strand comprising individual semi-structured interviews, meeting observations and documentary analysis in order to attain a better understanding of the research topic while ensuring that meta-inferences that would be made were valid and justified. The mixed method approach enabled probing for trends that emerged from responses to the questionnaires and these were validated using purposefully selected HODs' interviews, the analysis of artefacts and meeting observations. The qualitative and quantitative findings were integrated at the final stages to create meta-inferences that provided more insightful and complete answers to research questions.

Mixed methods sampling

Questionnaires were sent to 243 schools and in total 112 schools from four Gauteng Provincial Districts were participated in the quantitative study. A subset of this sample (Teddlie & Yu, 2007) was selected for in-depth semi-structured interviews, participant observations of department/subject meetings and document analysis. The first phase collected data from science HODs and NS teachers from four districts using questionnaires. The second phase involved interviewing a purposive, stratified sample of science HODs and NS teachers, although this paper will only discuss the interviews with the HODs. Subject meetings observations were conducted and document analysis of meeting minutes, HODs and teacher files were also examined.

Mixed methods analysis

Mixed methods data analysis involved analysis techniques from the quantitative and the qualitative approach, as well as a mixture of the two forms of data sequentially in this study. We received questionnaire responses from 30 HODs out of a total of 112 schools that participated in

4 districts (26.7% return rate). The HODs' instructional leadership activities were rated on the basis of how frequently they did them (1 indicated 'never' while 5 indicated 'always'). Some descriptive statistical analysis was done on the quantitative data and these results could not be generalized outside this study setting. The semi-structured interviews with six HODs were audio-taped and transcribed and field notes of the meeting discussions were taken. We conducted content analysis of interview data, field notes, department files and educator files, learners' activity books and discourse analysis of minutes of department meetings. Several patterns were identified in Phase 1 (quantitative strand) which became the basis for Phase 2 (qualitative strand) data collection. In Phase 2, interview transcripts were coded for HODs' perspectives on leading and managing NS instruction using an open coding strategy (Strauss & Corbin, 1990). We then analysed coded data and identified patterns and checked their prevalence across schools.

FINDINGS

The findings from this study show some trends of practices that HODs engaged in to support the calibre of teachers described above. The findings provide actual experiences of HODs and how they got around some of the challenges they meet in providing NS instructional leadership. We look first at the profiles of HODs in the study and the sizes of science departments.

Profile of HODs

We followed up six HODs from two districts. Below is their profile.

Table 1: Profile of HODs that we followed up

Name	School/school type	Age range	Gender	Institution of professional qualification	Specialisation	Subjects in the department
Mr Sam	Alpha/ semirural	40-49	M	Teachers' College	maths	NS, Maths, Math Lite.
Mr Silumko	Fhutura/township	30-39	M	University	NS	Tech, PS, LS, NS
Mrs Hugo	Knowledge/ township	50-59	F	Teachers' College	LS	NS
Mrs Winfreda	Mooredale/urban	40-49	F	University	maths	Maths, PS, LS, NS & Math Lite.
Mr Themba	Promise/ township	30-39	M	Teachers' College	PS	NS, LS and PS
Mr Chester	Sheba/ township	40-49	M	University	PS	NS, PS, LS

Maths-mathematics; Math Lite-mathematical literacy, LS- life sciences, NS-natural sciences, PS –physical sciences, Tech-technology

These HODs were part of the bigger study of 30 HODs who had returned their questionnaires. There were more females in the study compared to males, with 17 (56%) of the participants being women compared to only 13 (44%) men. Most of the HODs were in the 40-49 and 50-59 age groups which accounted for 13 teachers (43.3%) respectively. Only four HODs (13.3%) were in the 30-39 age group.

Most of the HODs (11) had the Secondary Teachers Diploma (STD) as their highest educational qualification and they formed 37% of the whole study sample. Only 4 (13%) of the participants held a degree, whilst 5 (17%) held a post graduate diploma and the same frequency, 5 (17%), held Honours Degrees. The majority of the HODs, 10 HODs (33%) had majored either in life sciences or physical sciences. Only 7 HODs (23.3%) specialised in NS and the remaining 3 HODs (10%) had other specialisations.

Table 2: Demographic distribution of HODs

Variable	Level	Frequency	Total (n)
Overall		N(%)	30
Sex	Male	13 (43.38)	
	Female	17 (56.7)	30
Age	30-39	4 (13.33)	
	40-49	13 (43.33)	30
	50-59	13 (43.33)	
Subject of Specialisation	Life or Biological Sciences	10 (33.33)	
	Physical Sciences	10 (33.33)	
	Natural Sciences	7 (23.33)	
	Other	3 (10.0)	30
Type of Institution where qualification was obtained	Teachers' college	20 (66.7)	
	University	10 (33.3)	30
Highest Qualification	PTD/PTC	1 (3.3)	
	STD	11 (36.7)	
	ACE	3 (10.0)	
	Bachelor's Degree	4 (13.3)	
	Post Graduate Diploma	5 (16.7)	30
	Honours Degree	5 (16.7)	
	Other	1(3.3)	
Position held in school	HOD	26 (86.7)	
	Master/Lead Teacher	4 (13.3)	30

In order to understand the extent of the task that HODs were faced with we also distributed questionnaires to NS teachers. This questionnaire would assist to reveal the profiles of the NS teachers that these science HODs were expected to lead. The majority of the NS teachers in the

study were female (56.3%). A few teachers (12.5%) indicated that they were senior teachers in their schools. Although most teachers were qualified either with a secondary education diploma or degree, there was 8% of teachers who were not qualified to teach at the secondary school level at all.

Table 3: Qualifications of teachers

Qualification	number
Matric	3
PTC/D	5
STD	17
ACE	20
B DEG	24
Postgrad	32
Unqualified	2
No response	9

Table 4: Position and gender

Position	**number**	**gender**	**number**	**%**
Senior teacher	14	Male	41	36.6
Teacher	90	Female	63	56.3
No response	8	No response	8	7.1
Total	**112**		**112**	

Even those (28.5%) that had post graduate qualifications, 12.5% of them had qualifications which were not related to science teaching. Table 5 below displays the age and institution where teachers had qualified.

Table 5: Institution of professional qualification and age range of teachers

Institution	<25 yrs.	25-29 yrs.	30-39 yrs.	40-49yrs.	50-59yrs.	60+yrs.
College	0	0	8	31	8	1
University	8	4	18	14	4	0
Unqualified	0	0	0	1	0	1
Total (14 none response)	**8**	**4**	**26**	**46**	**12**	**2**

A majority of the teachers, 58%, were 40 years and older while two thirds of them had qualified from Colleges of Education and not from the universities. This meant that they had a 3-year qualification as opposed to those who qualified at universities with a 4-year qualification. About 11.6% of the teachers were younger than 30 years and they had all qualified from universities.

Table 6 shows that over a third of the teachers had less than five years of experience teaching grade 8 and/or 9 NS. Over a third (41%) taught PS grade 10, just over a quarter (26.75 %) taught grade 11 and 16% taught grade 12 PS.

Table 6: Teaching experience of teachers. NS- Natural Sciences; PS –Physical Sciences

Years of experience in subject	Grade 8 NS	Grade 9 NS	Grade 10 PS	Grade11 PS	Grade 12 PS
1-2	23	18	15	9	5
3-5	20	20	14	10	5
6-10	22	22	6	4	4
>10	17	17	12	7	4

The size of the departments

The science departments in various schools would differ in size and member subjects. The size of the department would indicate the magnitude of the management and support that the HOD needed to provide. Most schools of HODs who responded had science departments with less than ten teachers. The minimum number of teachers in the department was three in an independent school and the maximum number was 24 in a former model C school. There were a few schools (10%) that had more than ten teachers in the department.

Just over half of the teachers in the study had specialised in life sciences which covers a quarter of the NS syllabus (figure 2). About 45.5 % of the teachers had specialised in physical sciences which covers half the syllabus. There were 17% of the teachers who were not qualified to teach any of the sciences. Almost two thirds of the teachers were comfortable to teach all the NS disciplines.

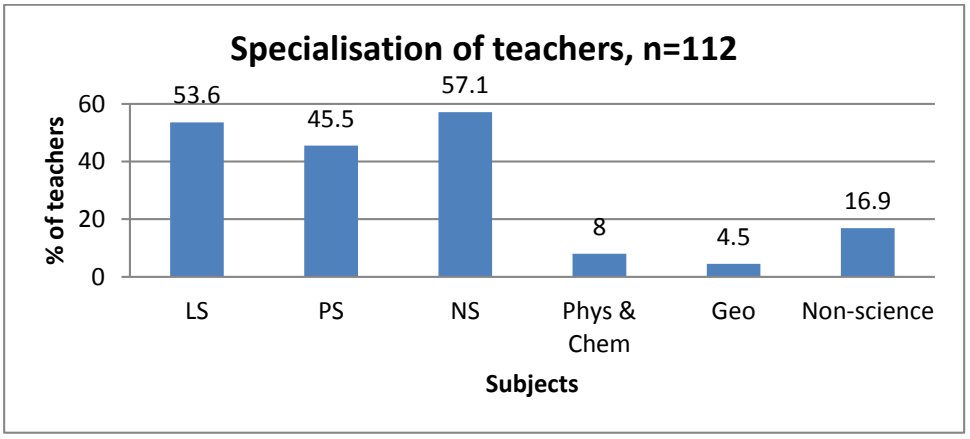

Figure 2: Teacher specialisation

Specialisation limitations

NS is a multidisciplinary subject comprising five science sub-disciplines. NS teachers were expected to have relevant specialisation to teach all NS sub-disciplines competently. This, however, was most unlikely because teachers could only specialise in one or two of the science disciplines. The partial specialisation or lack of science specialisation by NS teachers implied that the science HOD, as subject leader, had to develop that expertise. The data from the sampled schools showed that NS teachers in the schools had only specialised in some of the science disciplines and not all. The Sheba school HOD said, "*The other one is qualified in life science that is her major subject".* The Promise school HOD related his situation saying*, "*So it *means that for physical science we are only two with physical science, the rest they are life sciences".* He continued, "*...because first terms is more of life sciences so they don't have a problem with that part but second and third term is physics and chemistry so that's where they have a little bit of a problem".*

In Fhutura it was a similar case.

> *The other one is teaching NS and she specialised in life science and mathematics. That is why she is struggling when it comes to physics and chemistry (HOD).*

In some cases schools did not carefully consider who they allocated to teach NS. In this school an Afrikaans teacher was allocated NS.

> *The other one when Afrikaans was disbanded then he went into life sciences and now NS (HOD, Sheba).*

In Mooredale School a Life Orientation teacher had volunteered to teach NS.

> *Okay one volunteered to try something different this year [teach NS] and she has enjoyed it – that was the LO teacher (HOD, Mooredale).*

In Knowledge School the teacher was not even qualified to teach at a secondary school. The HOD confirmed saying; "*The one who is teaching grade 8 has PTC [Primary Teachers Certificate] but she is going for upgrading".*

HODs are aware of this challenge and have devised ways of mitigating the challenge posed by the specialisation of teachers in NS teaching. In Promise School the HOD delegates support to one of the teachers.

The other physical science qualified is working with the grade 8 teachers, supports them in terms of the physical science and I am dealing with grade 9s (HOD, Promise).

In the Sheba School for some time, before the new curriculum they allowed the teacher to teach what s/he specialised on. That meant that the learners would not cover the whole syllabus in that particular year.

This one teaching grade 8, he is more life sciences, so if he can like give these learners a good base on life sciences, then in grade 9 we don't give him so much of the classes; we give somebody who is part of physics and chemistry. That did work for some time but now this year they took away the lady who was more physical sciences, who could teach grade 9 now (HOD, Sheba).

Whereas schools could get away with is arrangement with the old syllabus, as described by Sheba School HOD, the HOD from Promise School also realised that not covering the whole syllabus to accommodate teachers' specialisation as in Sheba School would not work anymore with the new curriculum which specifies content for each term.

I thought that maybe this time the people who are good in life sciences they deal with the life science part and those who are good in physics deal with the physics part but it's not going to be very possible (HOD, Promise).

Due to the shortage of well-rounded NS teachers (in terms of specialisation) or the availability of teachers to share the teaching of the subject, this practice meant that learners in these schools were only taught life and living (25%) for the whole year in grade 8 and would be taught matter and materials; energy and change (50%) for the whole year in grade 9 depending on the availability of the PS teacher. If the PS teacher was moved this meant that the grade 8 group would not do PS in two years and only met it in grade 10. As described by the Sheba School HOD, HODs did not allocate teachers in their departments and that frustrated their plans.

The challenge with specialisation was not about teachers alone. HODs themselves had specialisation challenges. The graph below shows the specialisation of the 30 HODs that participated in the study. The graph shows that almost half the number of HODs (12) either did not have a physical or life science specialisation and almost a third had a mathematics specialisation. Those without a life sciences specialisation would not be comfortable to teach 25% of the NS syllabus and those without the physical sciences specialisation would not be confident to teach 50% of the syllabus. At the same time HODs could not be specialists in all 5

or 6 science disciplines themselves. They were likely to support teachers only in the areas of their expertise.

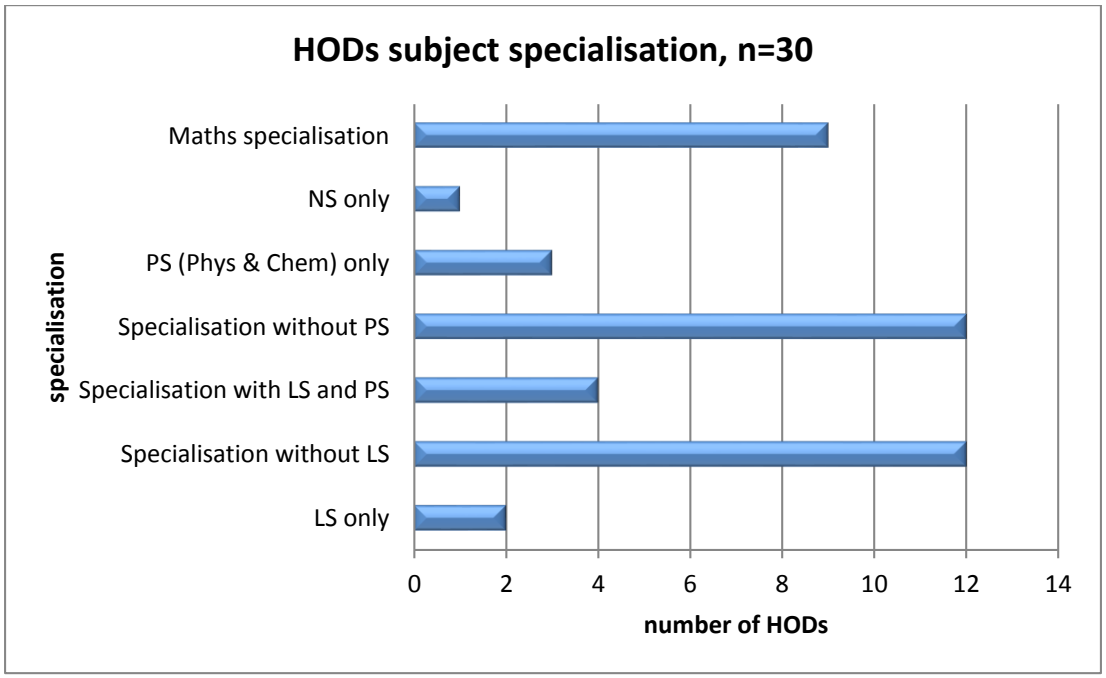

Figure 3: Subject specialisation of HODs; LS-life sciences; NS- natural sciences; PS –physical sciences

HODs that had not specialised in the sciences could request the senior teachers in the subject to assist them with monitoring the said subject. This provides an opportunity for shared or distributed leadership as advocated by Spillane *et al*. (2004) and Ng *et al*. (2015).

HOD as a teacher

HODs are both subject teachers and leaders. Subject teaching takes priority and the department policy specifies that they spend 85% of the time teaching. This leaves only 15% of the time to do other work. The HOD duties demand more time than can be allocated. Below we look at the extent to which HODs spend their time teaching and its effect on the NS instructional leadership.

Eighteen HODs (60%) were actually teaching the subject (figure 4). These HODs would understand the subject challenges, prove to have the needed subject expertise and be in a position to work with the teachers in the subject instead of working for them. The HODs did not only

teach NS but they also either taught physical or life sciences or mathematics. The number of HODs who taught physical sciences (12) was almost equal to the number of those who taught life sciences (13).

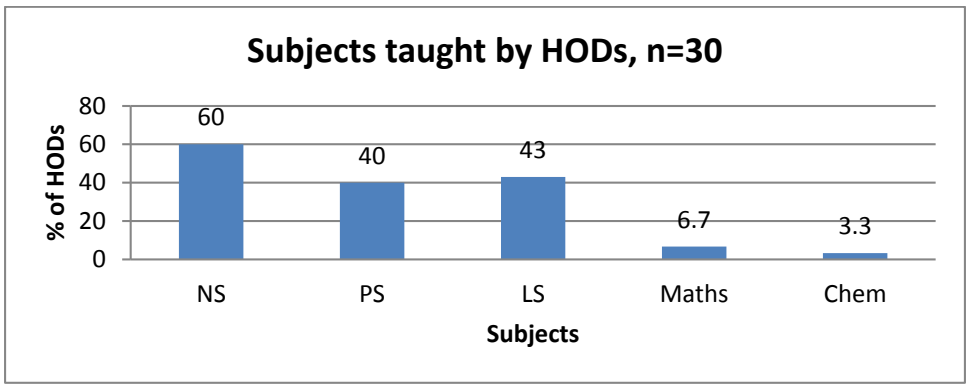

Figure 4: Subjects taught by HODs

Mooredale School HOD did not even teach any of the science disciplines and she said; "*My specialisation is Maths. I don't actually teach NS".*

The Sheba School HOD reported that he taught the subject on a relief basis and said: "*No, I taught it up to I think the end of the first term. Not this term. I taught it on and off sometimes, depending with the staffing."*

The HOD from another school used to teach the subject and was more conversant with the subject. This, however, was before the new curriculum.

> *I used to teach NS, so I knew where the problem was, the Bloom's taxonomy wasn't followed, so I knew. So most of the time what I do is we will do a management plan* (*HOD, Knowledge*).

During data collection she was only teaching LS which is only one science discipline. Even, then, she was only teaching the senior secondary learners.

> *No, I am not teaching NS. I am teaching grade 10, 11 and 12 life sciences (HOD, Knowledge).*

The Fhutura School HOD confirmed not teaching grades 8 and 9 and said; "*I am teaching 10, 11, and 12 only".*

These HODs had a sizeable workload of teaching and some of them had release time to do their HOD work. We discuss other HOD responsibilities later in this paper.

> *If you look at those periods, it is three classes. PL 1 teacher might have 6, so it gives me some free time to look at this admin work that you do. And sometimes you can have those four or five classes also, if the manpower is not balanced in the department, then you must find time after hours, leave this place around 4 or 5, so that you push your work (HOD, Sheba).*

The Promise School HOD was confident that he had some release time to do HOD work and said; "*I do have time to do my duty".*

HOD as a manager and administrator

HODs are expected to monitor subject instruction and quality against assessment standards and provide report to the school leadership (Wanzare, 2013). There were various ways that individuals at different levels adopted to monitor instruction. To do this the HOD needed to be aware of and up to date with subject curriculum developments. Sheba School HOD reported weekly monitoring of learner books.

> *You monitor on a weekly basis, where you send through the learners work and the educator completes a template to say they have done 1-2-3 for that week. So you compare what they say they have done with what is in the learner's book.*

Promise School HOD mentioned that they did monthly learner's workbook moderation.

> *Let's say once a month I moderate learners work. I sign and then sometimes I stamp them just to check and then look at the quality of the work, the number of activities they've been given.*

The Sheba School HOD also emphasised the stamping of learner books saying; "*You have to sign and stamp them to acknowledge that you have gone through their book and then make the relevant comments in the teacher's report to say' is the work okay, do you need support?".*

The Knowledge School HOD mentioned more areas that she monitored other than learners' books.

> *So from there I will write the monitoring tools, files must be in order, learners books must be in order, from there even the work schedule must be finished.*

Mooredale School HOD used subject meetings to monitor and said*; "Alright so basically what we do is have a meeting once every two weeks just to check that everybody is in the right place".*

Glickman *et al*. (2011) emphasise the possession of interpersonal and technical skills and knowledge in order to be sensitive to teachers who are supervised.

Subject meetings

Subject meetings were one of the organisational routines that schools used for teachers teaching the same subject to have instructional interaction. However, the attendance, frequency, content, management and outcome of these meetings vary from schools to school and are dependent on the organisational infrastructures of the school. Below we present findings on how subject meetings are managed in the sample schools. Although not all HODs mentioned meetings as means of monitoring all schools held subject meetings even as compliance activities. Sheba School HOD termed them (subject meetings) mandatory saying; "*Mandatory we must have a meeting every term or every month".* These meetings were planned for the year at Promise School.

> *My plan is to have a departmental meeting at least once a term and then at least one subject meeting per subject which means it's going to be 3 subject meetings* (HOD, Promise).

However, other priorities competed with the subject meetings.

> *No, this term we haven't had the meeting yet. We were busy doing all the submission and other stuff so that was the biggest problem; I don't have a meeting this term yet (HOD, Promise).*

Content of meetings

We asked the HODs what they discussed in the department meetings. The questionnaire results from 30 school showed that the most frequent item discussed at meetings were assessment issues and content coverage (table 7 below). This was confirmed by the semi structured interview data we collected from the six HODs. The Promise School HOD mentioned that his meeting aim was the curriculum report.

> *The main thing that I need is report in terms of syllabus covering, the number of SBAs per term and then I also give them a report on the quality of work that they give learners.*

The Sheba and the Mooredale School HODs had a similar meeting agenda.

> *Firstly is curriculum delivery, secondly is any interventions we need to put in place, and thirdly upcoming events, we are going towards exams or just beginning the term, what we expect on that term or that year. We also discussed circulars from the district, are we in line with that circular? (Sheba).*

…what we do is have a meeting once every two weeks just to check that everybody is in the right place (Mooredale).

Table 7: Frequency of items discussed in subject/department meetings

		Discussion frequency at meetings		
		Mean	**S.D**	**Rank**
A.	Policy reviews	3.267	1.596	13
B.	Clarification of the department's direction	3.8	1.127	11
C.	Textbook and course-material reviews	3.967	1.098	7
D.	School improvement plan	3.9	1.242	9
E.	Instructional evaluation	3.833	1.117	10
F.	Professional development	2.833	1.599	14
G.	Curriculum and learner outcomes	4.233	1.006	4
H.	Learner-assessment issues	4.533	0.860	2
I.	Question-paper monitoring	4.633	0.718	1
J.	Analysis of learner scores to inform instruction	3.533	1.456	12
K.	Start- and end-of-term issues	4.167	0.913	5
L.	Budget	2.6	1.379	16
M.	Development and sharing of lesson plans	2.667	1.539	15
N.	Account of the term's work or content coverage	4.4	0.969	3
O.	Distribution of leadership activities	3.933	0.944	8
P.	Plan of next remedial or enrichment steps	4.033	0.809	6

The teacher from Alpha School reported a different story. Her HOD was a mathematics specialist. She said, *"When we meet as a department it is not only NS teachers. We meet with maths teachers and we only discuss administrative issues, learner discipline and the files and records that we should keep (Teacher 1, Alpha).*

Sometimes meetings tended to focus on assessment requirements and deadlines.

> *Initially, at the beginning they were not up to standard, but after we had designed the tool for setting the question paper, they are coming alright. We look at the results, check problem areas, how do we do intervention programs, diagnostic analysis, and feedback from the subject advisor (HOD, Knowledge).*

The Mooredale School HOD concurred saying, *"we normally just follow up to see if there is assessment coming up that everybody knows what it is on."*

Schedule and duration of meetings

Almost all schools that we followed up with semi structured interviews held their meetings during the lunch hour. The meetings were very short as teachers took time to gather from the respective classrooms.

We try to meet about twice a term. The meetings are during lunch time or after school. There is a departmental office where we meet (HOD, Sheba).

The Mooredale School HOD also preferred lunch break meetings saying; "*I found that break was the most effective way to get them all at the same time".*

However, one school indicated that it had its department meeting during the sports period instead of during the lunch hour.

The meetings are usually on Wednesday during the sports period (Teacher 1, Alpha).

The HOD from Fhutura School also indicated that the lunch time was usually too short to discuss any detail and they sometimes used time after school hours to complete the meetings. He said, "*Nowadays we normally hold meetings during lunch time. If maybe you find that during lunch time we couldn't exhaust the agenda we normally adjourn to half past two, after school".*

Frequency of the meetings

Almost all schools held their department meetings once a term, although they tried to have them more frequently.

My plan is to have a departmental meeting at least once a term (HOD, Promise).

The HOD from another school confirmed saying: "*Mandatory we must have a meeting every term" (HOD, Sheba).* They sometimes did not even meet at all due to other pressing issues. The Knowledge School HOD mentioned that meetings were flexible.

Subject meetings we do as often as possible, maybe if Mr Lato comes with some issues that need to be discussed, then we do diagnostic analysis of the question paper, just to see.

The Fhutura School HOD concurred*, "Subject or department meetings do not always materialise as planned. Because we have GET*[12]*[General Education and Training] and FET*[13]*[Further Education and Training] teachers mixed when we discuss GET matters FET teachers tend to get bored (HOD, Fhutura).* The teacher from Alpha secondary school also emphasised the flexibility

[12] GET is the General Education and Training band which includes the curriculum provision for learners from Grade R to Grade 9. This encompasses the Foundation Phase (Grade R-3), the Intermediate Phase (Grade4-6) and the Senior Phase (Grade 7-9).The curriculum at this band is not specialised and all learners do core subjects.
[13] FET is the Further Education and Training band includes curriculum for grades 10-12. The curriculum consists of core and elective subjects.

of the year plan as far as department meetings were concerned saying, "There *is a year plan but things just occur but they are flexible. The plan is changed for emergency issues".*

Mooredale School HOD clearly distinguished between subject and departmental meetings

> *We normally have a department meeting once a term, the whole lot together, I just found that it is sometimes if you are only working with the NS then it is a bit much to sit through everybody else's issues, and certainly at the beginning of the year we have a big one, everybody altogether…Alright so basically what we do is have a meeting once every two weeks just to check that everybody is in the right place.*

Classroom observation

Classroom observations are powerful tools to gain understanding of what goes on during the interaction between the teacher and the learners about the subject. They can be time consuming because of the size of departments in schools. If not properly planned and their purpose is not well understood they could be deceiving because the teachers could mask their inadequacies during the observations. When working well they could be used to identify areas of strength or development. Not all sample schools did classroom observations and they were not uniformly welcome in all schools.

All schools indicated that they did classroom observations. The follow-up interviews revealed that these were done for Integrated Quality Measurement Systems (IQMS[14]) purposes.

> *We do classroom observations, sometimes primarily for purposes of IQMS (HOD, Sheba).*

The Promise School HOD confirmed saying, *"Normally the only class visits that we do is for IQMS because that one is basically a must".* Fhutura School HOD concurred*, "I normally do that in the name of IQMS".* Mooredale School used time as an excuse for only doing IQMs class visits saying*, "Normally we do them when we do the IQMS. It is difficult to fit that [other class observations] at the same time. Yes, because there are about 12 of them so to get through everybody takes a long time".* Alpha HOD also concurred*, "I do classroom observations under IQMS in the 2nd and 3rd quarter and provide feedback".*

[14] IQMS is integrated Quality Measurement Systems. The IQMS evaluation is done to target three levels of the system: Developmental Appraisal of the teacher to identify strengths and weaknesses; Performance evaluation for pay progression and Whole School Evaluation to measure the overall effectiveness of a school including teaching and learning.

The Promise School HOD also reported that some teachers were not comfortable to be observed, saying: *"No I haven't done the plan for class visits. I wanted to put it in my management plan but I decided to remove it because most teachers they don't want to be visited in class. We had another meeting where we discussed that, so I cannot visit the teachers who do not want to be visited".* The HOD from Sheba School concurred saying*, "If classroom observation is unplanned union issues come to play".*

Smith *et al.* (2013) warn that teachers might see observation as a demonstration of lack of trust in them which is replaced by surveillance (p S170). The responses from all teachers in the study showed that HODs did classroom observations and provided feedback even though it was ranked 6th (table 8) and the HODs occasionally allowed observations in their own classrooms (ranked 10th).

Table 8: Frequency of instructional leadership practices

N=112	**Frequency of IL practices**		
	Mean	S.D.	Rank
Discusses teaching of a particular concept with the staff	2.293	1.209	12
Works with my department to prepare teaching material	2.317	1.193	11
Visits other teachers' classrooms to observe their teaching	2.415	1.203	9
Allows informal observations in his/her own classroom	2.366	1.337	10
Does classroom observations	2.683	1.171	6
Provides regular and useful feedback/suggestions on my teaching	2.976	0.987	3
Monitors and controls learners' activity and assessment books	3.219	0.962	1
Monitors subject content coverage	2.707	1.229	5
Carefully tracks learners' academic progress	3	1.096	2
Knows what is going on in science classrooms	2.61	0.946	7
Actively monitors quality of science instruction	2.83	1.202	4
Works directly with teachers who are struggling to improve instruction	2.61	1.263	7
Leads professional development sessions in which you participate in	2.195	1.345	13

Response scale: 0=Never, 1=seldom, 2=occasionally, 3= frequently, 4= always

However, classroom observations were diagnostic and developmental in some schools. The HOD below described how she identified a need during classroom observation and then arranged help for the teacher that was observed.

> *It was an experiment about the acids and bases so I found the other teacher for Grade 8 was not that well equipped with the knowledge, so I said this other one must go and help her (HOD, Knowledge).*

Other HOD duties

HODs got allocated other management and administrative duties to perform over and above their teaching and monitoring the subject instruction. They found that IQMS was time consuming and did not justify the amount of time involved.

They belonged to a myriad of committees ranging from social, fundraising, sport, LTSM, timetable to being cluster leaders for the subject. The Sheba School HOD listed school committees he belonged to and other administrative work that he had to do over and above being a HOD.

> *You become part of the exam committee, the LTSM committee which procures the books and the materials, etc. You can also be the teacher component of the SGB, where I am the secretary of the SGB. And then I am also responsible for taking the school stats, from day 1 up to day Z of the year, you take your registers, (and tally attendance).*

The Mooredale School HOD explained the whole school leadership approach adopted by her school and said: "*I am head of grade 10 so I deal with grade 10 behavioural issues, phoning parents. I do extramural activities; I have got athletics, hockey and award ceremonies".*

Institutional support for HODs

HODs performed a lot of duties within and outside their specialisation. We investigated if they had received any leadership training on the work that they were doing. They responded that they had not received any formal training or professional development. The Sheba School HOD responded*, "Here I haven't received training but we do go for the HOD workshop, and we are taught these are the instruments that you use".* The Knowledge School HOD from a different district confirmed that they had a common workbook but they had not received any training.

> *We have got at the moment a common work book for them, so the work is kind of set out, and if somebody does an extra thing then they will share it with the others.*

HODs had not been trained to lead or manage departments except being trained as teachers. They reported that balancing available time with administrative work was difficult. They found that personnel issues, finding time for action research and dealing with school management and administration were the most difficult issues to handles. Managing subject finances was voted the least difficult and was never discussed in subject meetings either.

Table 9: Issues identified as difficult to handle

	Difficult issues to manage	Mean	S.D	Rank
A.	Staffing issues	3.2	1.540	1
B.	Bureaucracy/ Dealing with school management and administration	2.833	1.440	3
C.	Managing subject finances	2.3	1.236	7
D.	Finding time for action research	2.967	1.519	2
E.	Analysing learners' scores	2.4	1.453	6
F.	Managing with inadequate resources	2.7	1.489	5
G.	Time management	3.767	1.407	4

Subject advisor support

Subject advisors are stationed in the local district offices to provide specialist subject instructional support to a group of schools. Their services are available to schools but they are not mandatory. Below we display the responses from sampled schools on the support they received from subject advisors. We wanted to know where their source of support was. The principal was voted the most helpful person (40%). The deputy principal and the subject advisor were also equally voted as the next helpful persons. About a third of the HODs were modest about the helpfulness of the subject advisor though.

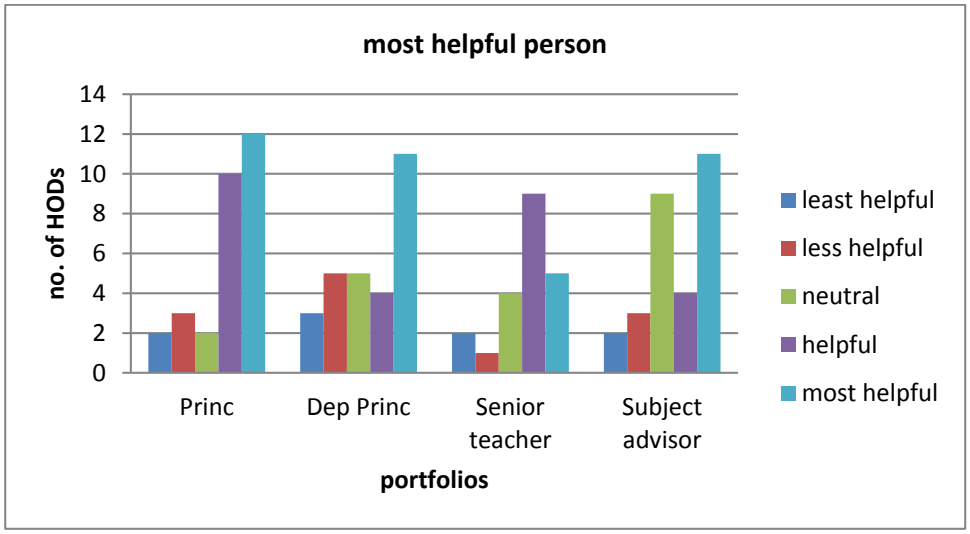

Figure 5: The most helpful person to the HOD

There was an association between the extent of helpfulness of the district subject advisor and the level of support that was received from the subject advisor (p=0.001). Subject advisors supported schools in many different ways. The local district subject advisor supported the schools by providing some common teaching and assessment material.

Table 10: Helpfulness of the district curriculum specialist and full support from subject advisor

Variables	I have the full support of my subject advisor				P-value of association
Extent of helpfulness of the district curriculum specialist	**Disagree**	**Neutral**	**Strongly Agree**	**Agree**	
Least helpful	0	0	1	1	
Less helpful	1	1	1	0	
Averagely helpful	1	4	2	2	
More helpful	1	0	1	2	
Most Helpful	0	0	0	11	
Total	3	5	5	16	**0.001**

This, the Promise School HOD acknowledged and said: "*Yeah, control tests normally come from the district".*

Another way in which subject advisors supported the schools was with different kinds of workshops varying from content knowledge to action research. Sheba School HOD confirmed and said: "S*he does visit us; we do hold workshops with her.* The other HOD also concurred.

> *Yes there are workshops wherein they (district) will be giving us feedback on the learner's performance and then they will be teaching those topics that we need attention (HOD, Knowledge).*

Content knowledge was also attended to at the district cluster meetings with subject advisors.

> *So they do that on a topic because when they visit they will ask 'do you need any help?' And if there are many people who need it then they will do it (HOD, Knowledge).*

The other means of support were reported by the Sheba School HOD when he said: *"Support from subject advisor is wonderful, I think we can communicate with them every minute that we want. We have a science WhatsApp group that takes care of our life sciences, PS, NS".*

The Promise School HOD, though, revealed that the subject advisors only paid attention to FET subjects saying, "…they *did come to visit but only for FET, they didn't come for NS".* He went on to mention that even the meetings that subject advisors arranged were only for FET teachers and he said*, " the cluster meetings for teachers we had one yesterday but it was for FET only". T*he Mooredale School HOD confirmed saying*, "No, they don't do it for NS, the FET has. We had a cluster meeting but it was for the FET section, not the NS, they do neglect the middle. At the beginning they are beating everybody into shape, but the middle doesn't matter."* The Alpha

School HOD concurred and said*, "We do get material from the subject advisor but only on the FET side, not GET".*

It was evident that subject advisors were somewhat supportive but more to the teachers (the teaching of the subject) than the HODs (the curriculum management). We then explored the extent to which HODs engaged with the HODs. The Sheba School HOD reported that he attended the workshops organised by subject advisors even though he did not teach NS at that time.

> *Even though I am not teaching the subject, I have to attend. I remember spending a day in NS, where we were doing the experiments, and by then I was not teaching.*

The Mooredale School HOD had a different view point about her engagement with the subject advisor.

> *Ja, I think so, I don't have as much contact with them because I don't attend those cluster meetings. But certainly if teachers wanted to know something they could get hold of him (subject advisor).*

The Alpha School HOD also reported that he did not attend workshops planned for NS teachers and said, *"I do not attend NS workshops, I request the subject teachers to attend".*

Principal's support

The HODs were also asked to rate the extent of the support that they received from the principal. The support was categorised into specific areas like provision of space, time and resources to do instructional work, buffering the school from outside influences and different forms of encouragement. Principals were rated helpful on average by HODs from all types of schools. However, some HODs found them to be either less helpful (10%) or were neutral (6.7%) about the kind of support that they received from the principal. When the HODs were interviewed the Mooredale School HOD said, "*She is very supportive. If you need to discuss something with her you can go and talk to her".* Below we look at specific areas where HODs found principals to be supportive or not.

Table 11: Helpfulness of the principal and the ability to deal effectively with pressure from outside the school that might interfere with teaching

Variables	**The principal deals effectively with pressure from outside the school that might interfere with teaching**					**P-value of association**
Extent of helpfulness of the principal	**Strongly Disagree**	**Disagree**	**Neutral**	**Strongly Agree**	**Agree**	
Least helpful	1	1	0	0	0	
Less helpful	0	1	1	0	1	
Averagely helpful	1	0	0	1	0	
More helpful	0	1	0	8	1	
Most Helpful	2	1	0	2	7	
Total	4	4	1	11	9	**0.002**

There was an association between the extent of helpfulness of the school principal and his/her ability to deal effectively with pressure from outside the school that might interfere with teaching (p=0.002). However, schools strongly disagreed that they received support from principals in terms of space and time to carry out their duties. This was evident in the HODs using their lunchtime for meetings.

There was an association between the extent of helpfulness of the school principal and the provision of space and time for departmental activities (p=0.033). All township and informal settlement schools that we followed up, except the former model C school, Mooredale, held their meetings in the HOD's offices. These were not proper offices but usually store rooms behind the laboratories. The HODs indicated that the principal could have been more helpful to provide space for the HODs to conduct their meetings (table 12) instead of using the cramped offices or classrooms. The Mooredale School team held their meeting in one of the classrooms.

Table 12: Extent of helpfulness of the principal and provision of space and time

Variables	**The principal provides space and time for departmental activities**					**P-value of association**
Extent of helpfulness of the principal	Strongly Disagree	Disagree	Neutral	Strongly Agree	Agree	
Least helpful	0	1	0	1	0	
Less helpful	0	1	2	0	0	
Averagely helpful	0	0	1	1	0	
More helpful	1	1	2	4	2	
Most Helpful	0	2	0	2	8	
Total	1	5	5	9	10	**0.033**

Arrangement of subject departments

One of the ways principals could support HODs was by arranging and resourcing the departments optimally to support instruction. The Knowledge HOD explained how the NS department was created in her school.

> *No, he wasn't giving us that full attention because he was not life sciences or NS. When it comes to problems for NS or PS you must go to other schools .So most of the time we didn't get answers direct from him, we will get admin answers, but curriculum related questions were not fully answered so I think that was the reason it was divided into two departments.*

Regarding resourcing the departments for optimal NS instruction the Fhutura School HOD said, *"Yes. I have an NS educator. She didn't specialise in Physical Science. She didn't specialise in any science subjects like Life or Physical Sciences. She was teaching Physical Science in Grade 12, hence the results were 9%. She qualified in Geography and she is teaching NS Grade 9. She is also teaching mathematics.* He continued saying*: "The other one is teaching NS and she specialised in Life Science and mathematics. That is why she is struggling when it comes to physics and chemistry".*

Sometimes the proper handover from one HOD to the next did not happen in the schools. This is supposed to be facilitated by the principal and his deputy. The Promise school HOD reported this challenge saying**, "***I did prepare one and then the person who was acting said that most of the things are his there and then I had to start from scratch for senior phase there was nothing ….I didn't even have a mark sheet, I didn't have a work schedule".*

From the data it is evident that science HODs looked to the principal for support especially with the school conditions and contextual factors in order for them to provide effective instructional leadership.

Apparatus and laboratory facilities

Facilities and science equipment are some of the most important resources for science instruction. The principals as school leaders had the duty to provide these as a demonstration of the capacity of the school to support learning. The challenge is that these facilities are expensive to purchase and maintain. Most sampled schools did not have laboratories and where they had they were poorly equipped and HODs had to borrow from other schools.

Our school is a little bit poor in terms of the apparatus required for practical investigation, sometimes we go out. I go out and borrow some practical from the neighbouring school and then from there I bring them here, demonstrate them how to perform them in front of learners before they go to class (HOD, Promise).

The Sheba School HOD concurred saying, *"Like now when you phoned I was supposed to go to one school there and just borrow a few burettes for our practicals for the grade 12s".*

The HODs reported that although it was important to take and control stock especially in science classrooms and laboratories, they found it extremely difficult to manage the department with inadequate resources, both financial, physical and human resources (table 13).

Table 13: Importance of taking and controlling stock and degree of difficulty of managing with inadequate resources

Variables	**Degree of difficulty of managing with inadequate resources**					**P-value of association**
Importance of taking and controlling stock	**Least difficult**	**Less difficult**	**Averagely difficult**	**More difficult**	**Most difficult**	
Least important	5(62.5)	2 (25)	0 (0)	0 (0)	1 (12.5)	
Less important	0 (0)	0 (0)	2 (66.7)	0 (0)	1 (33.3)	
Important	1 (12.5)	1 (12.5)	1 (12.5)	4 (50)	1 (12.5)	
More important	1 (50)	0 (0)	0 (0)	0 (0)	1 (50)	
Most Important	1 (14.3)	0 (0)	0 (0)	1 (14.3)	5 (71.4)	
Total	8	3	3	5	9	**0.01**

Science HODs perform a number of duties as expected by their school leadership ranging from compliance activities where they just tick the box to going out of their way to borrowing laboratory equipment from other schools. They had never been trained professionally or developed to perform their management duties. In some districts, their teachers receive support from subject advisors but there is no support for them. Some principals support the HODs while some principals do not even consider how they staffed the departments for optimal NS instruction.

DISCUSSION

Minimal influence over teaching and learning

Both the literature and education policy in South Africa view the HOD as a person who has strong professional, pedagogical, and subject matter knowledge that is underpinned by

experience in teaching the subject (Smith *et al*., 2013). Experience in the subject is gained by teaching it and understanding areas where learners are likely to meet challenges. With the changes in the curriculum, teaching the subject becomes crucial, as one gets to understand the areas of difficulty in the subject. In this study, just under half of the HODs actually taught NS or knew what was going on in the subject. The findings show that they are not familiar with the subject matter and do not understand the grade expectations. These HODs are mostly teachers of senior secondary subjects like PS, LS and mathematics. They have expertise in these subjects and would therefore dedicate most of their time to it. This presents the conundrum of managing in the middle (Koh *et al.,* 2011). While they have expertise in the subjects that they teach, they could not meet the NS teachers' subject specific needs or expectations of support because they themselves are not sure of the subject demands. The findings suggest that in general, the HODs' influence over instructional practice is very weak, even when the various contexts were taken into consideration.

The focus on compliance to meet role expectations

The conundrum of managing in the middle is further revealed in how the HODs understood and managed their roles. In order to meet role expectations as prescribed by policy, the HODs focused on compliance activities when monitoring the subject instruction. Compliance activities centred around the administrative work (Bush, 2013) related to their subjects and included conducting regular subject meetings; monitoring the coverage of syllabi; checking teachers' files; and moderating learner workbooks and test papers. There was very little evidence of how all these activities related to analysing and improving learner performance; and improving teaching practice. In other words, the work of the HODs in many instances involved 'ticking the boxes' to show completion of their tasks rather than any meaningful and substantive engagement with the core teaching and learning processes at the schools, and how these could be improved.

The HODs could not provide effective support and leadership as described by Lashway (2002) in the form of professional development, classroom observation, mentoring and coaching. Considering the profile of the teachers in their departments and the changes in the curriculum, the teachers needed very visible and available leadership. They required continuous professional development and support even in the classroom. It was revealed that classroom observations are

only done for IQMS purposes, and the HODs do not diagnose other challenges or identify examples of best practice. The findings reveal that teachers needed support particularly on the development of SBATs. This support involved not only developing the tasks, but tasks that were customised according to 1) the availability of apparatus in the school; 2) the ability of teachers to perform the various experiments; and 3) the ability to assess the tasks meaningfully.

The findings suggest that the focus on compliance was related to a number of factors: 1) Lack of release time (Brown *et al.,* 2000); 2) pressure from the top leadership to submit reports (Glickman *et al.,* 2011); and 3) their own teaching in the FET band. The HODs were fulltime teachers and did not get release time to focus on their instructional leadership duties. Yet, in order to fulfil their roles as HODs, they have to show evidence regarding their activities, which in most cases takes the form of reports to the school principal. The compliance focus also raises interesting questions about how far the schools have progressed in moving from a bureaucratic style of management to focusing on instruction as the core activity of the school. The findings of this study suggest a predominance of the bureaucratic impulse for compliance, and highlight some of the organizational, contextual, personal, and professional constraints to more effectively managing and leading the teaching and learning processes in the school.

Curriculum coverage

Another factor that has made managing in the middle a challenging task is the qualifications of HODs. Some science HODs did not have a science qualification or specialisation. This meant that besides lacking content and pedagogic knowledge, they could also not provide effective instructional guidance in specific science subjects. To save themselves from embarrassment they would allow teachers to do what they could and would not query any discrepancies in the syllabus coverage (Wanzare, 2013). From our research, it could be inferred that this is also the reason why they 1) did not do classroom observation (because they might find a teacher who knows more than them in that subject); and 2) did not do professional development, mentoring and coaching (because they did not have the necessary subject expertise). In at least two out of the six schools that we interviewed, the science departments were led by mathematics specialists.

Furthermore, in the old syllabus, teachers would be allowed to only teach what they specialised in. They could get away with it because the grade 8 and 9 instruction is not monitored and there

is no standardised assessment. If, say the grade 8 teacher is a LS specialist, learners would be taught only the "life and living" strand in grade 8 with the hope that they will get a PS specialist in grade 9. This was not a guarantee in the schools as the grade 9 teacher could be the same teacher or another teacher with only LS specialisation (as in Sheba School). This is partly because there is a shortage of PS teachers in the schools (Kriek & Basson, 2008). Curriculum coverage is thus a major challenge in certain science subjects. These learning gaps accumulate over time, leading to difficulties in the subjects in the higher grades, and could be one of the contributing factors to the high drop-out rate in grade 10.

Restrictive organizational arrangements in schools

Subject departments in most South African schools are for a group of subjects and not one subject. The arrangement of subject departments is often determined by the social contexts of schools and the availability of resources (Spillane & Hopkins, 2013). Schools with better finances would have more HODs or even senior teachers to assist with instructional support. However, the arrangement in most of South Africa's public schools is such that subjects like mathematics, mathematical literacy, technology education, natural, physical, life and agricultural sciences (where applicable), all belong to one department. It is highly impossible for one HOD, who also teaches, to be a specialist in all these subjects, have separate subject specific meetings, and address subject specific issues. The meetings as reported by the HODs were short (about an hour at most) and in some cases it happened during the lunch break. The HODs responded to these restrictive conditions by only discussing administrative issues and sharing information that was needed to produce the departmental report.

The organizational arrangements in schools thus appear to neglect the NS as a key foundational subject and the NS teachers as important in laying a good foundation for the four senior secondary school subjects. The school structures do not enhance the school's capacity to support learning or provide an enabling environment in which science teaching can be strengthened through effective instructional leadership that is exercised by the HOD.

Lack of school and district support for the HOD

The findings reveal that the principals do not support the HODs or make an effort to make their jobs easier (Klar, 2012). This is evident in the way they structure and resource the (subject) departments. Firstly poorly qualified teachers are allocated to teach NS. In Fhutura school we saw a geography teacher who was a failure in grade 12 PS (producing only 9% pass rate) being 'demoted' to teach NS. This suggests that the school leadership do not care about the foundation that this teacher would lay for the Grades 8 and 9 learners. This is not only the case in one school and seems to occur in other schools in the study. A reason for the allocation of poorly qualified could be because there has been no monitoring of the grade 8 and 9 curriculum and alignment of instruction with assessment standards.

Secondly, the principal's support is not evident in the appointment of HODs, especially those expected to lead NS. If the principals were mindful of the specialisation of the HOD and the teachers, they could have strengthened the senior teacher structure in the schools. The senior teacher would ensure subject specific support for the teachers in each subject strand (science discipline). The HOD would support the teachers in other areas that did not need subject expertise. As it is the case, the principals leave the HODs to swim or sink with whatever resources they have and they have to make a success of it.

Thirdly, the senior school leadership team in the study does not prioritise subject or department meetings and seem not to attach much importance to these meetings (Klar, 2012). Our interview data supported these findings. The HODs described cases where other activities in the school took priority and they could not find time to meet. This shows a lack of focus on the instructional mandate of the school. Subject meetings are not formalised and prioritised by the senior school leadership team, and are considered less important than extramural activities which at least are allocated time. Teachers have to sacrifice their own lunch time to attend these meetings. This is also evident in the number of times that these meetings were postponed in some schools during the data collection cycle.

Fourthly, the findings show that although the principals are supposedly supportive, they do not assist in the providing of safe and adequate space where the HODs can do their work (Naicker *et*

al., 2013). We witnessed the shortage of space for HODs in terms of meetings, professional development activities, storage and filing space. We conducted interviews in very crammed spaces which were originally laboratory store rooms. These rooms were packed with textbooks, some laboratory equipment, learners' books, and teacher files etc. In other schools we conducted interviews in the deputy principal's offices because the HODs did not have any space different from his/her classroom to hold such meetings. The only spaces to do any work with teachers were the classrooms, which they used with the learners.

The NS teachers also compete for laboratory space with the physical and life sciences teachers. The FET subjects are prioritised to use the laboratory (which is a scarce resource in the schools). The grades 8 and 9 classes are very big and to schedule their use of the laboratory is very cumbersome. This challenge is complicated by 1) the lack of apparatus to accommodate all learners (especially with regard to consumables); 2) the allocation of poorly qualified NS teachers who struggle to perform experiments to teach NS; and 3) non-specialist HODs who could not therefore support these teachers in subject specific matters.

A number of HODs mentioned that they had to go to other schools to borrow equipment. There is no evidence that the principals were actively supporting the HODs to ensure that there are adequate resources for teaching. These findings point to the lack of an instructional orientation in the schools, especially from the senior leadership team. It once again highlights the difficulties of shifting the paradigm of the school as an essentially bureaucratic institution to one that has a singular focus on teaching and learning and in which the organizational arrangements and resources are directed at supporting these two core activities.

Subject advisors are very rich resources that the department of education has to support subject instruction. The findings reveal that mostly FET subject advisors visited schools. This finding attests to the focus on FET subjects because of the pressure exerted by the need to improve performance in the grade 12 exit examination. Although some subject advisors did come to schools, they would monitor the implementation of SBATs, which was a compliance activity. When subject advisors come to the schools they require subject files and learner books from the

HOD where they check the records of the SBATs. That is about the only interaction that subject advisors had with the HODs.

Subject advisors also tend to work directly with teachers and not the HODs (unless the HOD was also a teacher of that particular subject). They invite teachers to workshops and cluster meetings but there is no evidence of the HOD specific workshop organised by the subject advisors. In this arrangement, the district system misses the very important link to subject instructional improvement - the HOD (Melville, Wallace & Bartley, 2007). Subject advisors are responsible for a group of at least 20 schools and it is not possible to be available every time the teachers need them. HODs are better placed to support the teachers because they spend more time with them (Highfield, 2010). Hence there is potential for building the instructional capacity of the HODs in order for them to effectively support and guide the work of many more teachers. By ignoring the professional development needs of the HODs, the district has missed out on an opportunity to expand and deepen the instructional focus in schools.

From the issues raised in the discussion above, we get a sense of the difficulties associated with the role of the NS HODs in schools. Very often these leaders find themselves caught between their roles as teachers and that of instructional leaders in the school that leads to tensions, conflict and frustration (Naicker *et al.*, 2013). The potential for science HODs to more effectively adopt an instructional mandate remains largely unfulfilled due to the organizational arrangements in the school; their lack of qualifications and expertise in certain subject areas; and the inadequate support provided by the senior school leadership team and the district office. All of these issues contribute to the conundrum of managing in the middle – where the HOD has to find a balance between teaching and leading, and where the latter is often made more difficult by the issues discussed above. The result of all of this is that the opportunity for the HOD to play a more effective role as instructional leader on the school's SMT and contribute to improving learning outcomes is lost. Given the current crisis of quality in our education system, the focus on supporting and strengthening the instructional role of the HOD in South Africa's public schools will require urgent attention.

CONCLUSION

This study is located within the emerging field of research on instructional leadership in South African schools. The focus on instruction has been made more prominent by the call from policy makers, academics, and the public in general to improve educational outcomes in the country. This study aims to contribute to the literature on instructional leadership in schools by considering the role that HODs play as part of the SMT and exploring the extent and nature of their work. To date, not much attention has been paid to the important role that HODs can and should be playing in supporting and strengthening teaching and learning in schools, and this study makes a contribution to deepening our understanding of their work.

The sciences HODs occupy the middle position between the senior school leadership team and the teachers. This makes their work both complex and challenging. NS is a multidisciplinary subject area. The HODs are expected to lead subject departments but they find themselves leading a group of subjects, some of which they have no specialisation in. They find themselves leading teachers who know more than them in some subjects. The NS and science HODs' experiences, understanding of the reality and expectations are mediated by the contextually constructed paths the schools created for them. These paths are influenced by the social context and resources available at the school; the organizational arrangements around instruction; and the support provided to the HODs by the senior leadership team at the school and the district office.

The findings of this study offer evidence that the senior school leadership does not hold NS in high regard and they do not support the HOD in working with poorly qualified teachers. NS competes with other subjects that are given a better status. The findings also reveal that science HODs do not receive subject specific support (in terms of time, space, apparatus, qualified teachers) from the school senior leadership nor the subject advisors. The HODs have devised ways of mitigating the challenges of poorly qualified or non-qualified teachers which results in learners being taught only one science discipline a year (e.g. only life sciences for the whole year and sometimes both years –grade 8 and 9). These findings further reveal that senior school leadership does not reflect on the instructional leadership provided by HODs for the purposes of development and providing feedback to the other components of the school system in order to improve instruction and learning outcomes.

The findings of the study sheds light on the role of the sciences HOD in the schools, and highlight both the importance and constraints of the role. As very little research has been conducted in this area to date, the study makes an important contribution in deepening our understanding of how the work of the HOD fits into the broader school effectiveness discourse and literature in South Africa. School principals and deputy principals, on their own, will not be able to transform their schools and successfully embark on improvement initiatives. What is required is "distributed" leadership that stretches across the school and is centred around common improvement goals. The HODs are central to this paradigm of instructional leadership in the country. In essence, the findings suggest that the schools were still operating within a bureaucratic paradigm that focused on management for the sake of compliance, without any explicit connection being made to how these management practices related to and supported teaching and learning in the schools. The findings of the study give rise to a few recommendations for how the work of HODs can be more effectively supported in schools.

Firstly, from a systemic perspective, the department of education and the senior leadership teams in schools should relook at the arrangement of the academic departments in schools. Junior secondary subjects should not be grouped with senior secondary subjects in one department. School principals should reconsider how teachers are allocated to NS and the suitability of HODs to lead the NS department. In addition, the department and senior school leadership teams should consider the appointment of senior teachers to provide instructional leadership in individual science disciplines that would complement the work of HOD and support the teachers with subject specific leadership.

Secondly, from a policy perspective, we recommend that the role of subject advisors be revised to include working with the HODs to build their capacity for more effective instructional support in schools. The HODs as middle managers have the most contact with teachers, and their potential to make a significant contribution to curriculum improvement remains untapped. This would also boost the capacity of school based support teams and turn the IQMS into an authentic school development tool.

Thirdly, we recommend that from a training perspective, much more attention be given to the role of the HOD as a key member of the SMT and the school's instructional leadership team. Currently, there is a focus on the training of principals and deputy principals that have not yet been extended to the HODs. The focus of such training should be on developing curriculum management and supervision skills; the monitoring of curriculum coverage; the assessment of learner work in order to improve instruction; and the soft skills of building personal and professional competencies around teamwork and dealing with conflict at the school. The curriculum for such a leadership training programme should take school contexts in account and focus on the importance of shifting the school leadership paradigm from bureaucratic management for compliance and control to instructional leadership for improved learning outcomes in the school.

Lastly, we recommend that as a supplement to this study, further research into the work of senior teachers should be conducted to develop a deeper understanding of the important role that they can play in supporting the work of the HOD in the sciences departments.

Limitations

We worked with a small but representative sample of schools and the findings could not be generalised to all schools across the country. The findings are thus limited to the schools and districts that we worked in. However, the study is important as it is located within the broader research focus on instructional leadership in schools – a focus that has become central to the school improvement discourse and practice in South Africa.

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ARTICLE 3

DIFFERENT SCHOOLS, DIFFERENT PRACTICES: COMPARING THE ORGANISATIONAL INFRASTRUCTURE AND INSTRUCTIONAL LEADERSHIP FOR NATURAL SCIENCES TEACHING AMONG FORMERLY SEGREGATED SCHOOLS IN GAUTENG

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Abstract

School organisational conditions have some influence on teaching and learning in general while the subject matter contexts and cultures shape the instructional practices in any particular school. Instructional leadership is context-based and the practices of the leader are contingent upon the school's organisational context. In this paper, we examine how different schools create the organisational infrastructure for teaching and learning of natural sciences and the adequacy thereof in providing a supportive environment for the teachers and students in the subject. Specifically, the paper focuses on how natural sciences (NS) subject departments are organised and led in schools with different organisational infrastructures. The leadership conditions and the specialisation of heads of departments (HODs) that lead these departments tend to affect the instructional practices in the different schools. We compare the extent to which the organisational infrastructures in different types of schools enable and/or constrain NS instruction and its leadership. Using a mixed methods approach, survey data on NS teachers and their HODs' attributes, school conditions and infrastructures, management and administrative processes and subject leadership practices were collected and analysed. In addition we gathered data from semi-structured interviews, observations and documentary analysis about organisational and departmental dimensions that impact NS instruction. The first major finding is that school context matters. Schools that shared the similar socio-economic contexts had similar organisational infrastructures and arrangements around which core work of teaching and learning

was organised. The next major finding is that science HODs from schools with better organisation for instruction are able to interact more productively with teachers about improvement of instructional practice. The study concludes that schools' organisational infrastructures (shaped by contexts) either promote or constrain effective NS instructional leadership. We recommend that schools review their organisational arrangements and infrastructures to more effectively support instructional leadership and enhance their capacity to strengthen NS instruction.

Key words: organisational infrastructure, head of department, instructional leadership, subject department, natural sciences instruction

INTRODUCTION

Junior secondary science is generally undervalued and side-lined when it comes to subject reform and innovation (Spillane, Diamond, Walker, Halverson, Jita, 2001). It is often grouped in one department with subjects like physical sciences and sometimes mathematics, which receive more attention from policy makers and education officials (Burch & Spillane, 2005). These subjects enjoy an elevated status and are allocated more resources from the education departments (Brown, Rutherford & Boyle, 2000). There is also evidence to show that the way school leaders and teachers organise their schools for instruction differs by school subject (Spillane, 2005). In South Africa, languages and mathematics are evaluated systematically (DBE, 2012), and the education sector is dominated by interventions to improve performance in these subjects.

Subjects like NS are not assessed systematically and therefore do not have standards against which they can be benchmarked. Spillane, Hallet and Diamond (2003) argue that standardised tests shape teachers' instructional practices. The lack of benchmarks for NS in South Africa creates a loophole that affects the quality of NS instruction in schools. This has the undesired outcome of learners encountering certain subject topics for the first time at senior secondary level, particularly grade 10. Research suggests that this could be one of the contributing factors to the high dropout rate in grade 10 (Reddy, Dlamini & Ntshingila-Khosa, 2004). Some of the

subject topics are supposed to be introduced earlier in the school years because each year's work builds on the previous years'. School leaders therefore have to monitor the teaching and learning of this particular subject (NS) if a solid foundation is to be laid for the teaching of senior secondary science.

Junior secondary science, NS in South Africa is a conglomerate subject comprising five science disciplines, and laying a foundation for at least two senior secondary subjects. It is often taught by teachers who are typically generalists and do not have well-defined subject matter specialisations (Spillane & Hopkins, 2013). These teachers tend to teach NS only when time allows (Spillane *et al*., 2001) and what they feel they are competent to teach. The NS curriculum is open to interpretation by the teachers, who decide what to teach in order to achieve the outcomes. NS teachers therefore do not use any systematic way of making decisions about what to teach and when to teach it (Brodie, Shalem, Sapire & Manson, 2008). An evaluation done by Umalusi[15] (2008) suggests that NS teachers lack: 1) resources to prepare for practical work; 2) subject expertise; and 3) knowledge and skills to teach NS.

The NS curriculum demands on teachers have been marked by an increasing shift of responsibility to HODs as curriculum leaders. The HODs have to play a key role in supporting teachers with the implementation of the new curriculum. However, the ability of the HODs to effectively provide this kind of support is sometimes constrained by organisational factors inside the school. In addition to NS teachers being generalists, school leaders allocate teachers who are poorly qualified in science or who do not have any science specialisation to teach the subject. A study by Malinga and Jita (2015) reveal that a language teacher was allocated to teach NS when that language was phased out as a subject in the school. At another school, a life orientation teacher volunteered and was allowed to teach NS.

There is also evidence that the capacity of the school to provide and support learning differs based on how the school is broadly resourced (Jita & Mokhele, 2008). This study employed a broader approach to resourcing to mean not only the material and human resources within and outside the school but also the school organisational infrastructures (Spillane & Hopkins, 2013)

[15] Umalusi is the Quality Assurance and Examinations Council responsible for the schooling sector in South Africa.

which includes processes, procedures, systems and routines that determine the school rhythms and sense of order. We focus on subject specific organisation for instruction because the school subject matters (Spillane & Hopkins, 2013). Among other school organisational groupings the study looked at how influential others as advocated by Spillane *et al.* (2003) interacted with teachers to construct leadership for instruction. The study specifically looks at the 'cultural capacity' of the principals and subject advisors to support NS instructional leadership and hence NS teaching and learning (Spillane *et al*, 2003: 1).

This study also seeks to understand the extent to which different schools organisational infrastructures were effective in promoting high quality NS instructional leadership. The provision of resources in public schools in other countries would be uniform at least within one local school district but in the South African context there are still some traces of the effect of the apartheid education system that causes inequality and resource differential in schools (Jita & Mokhele, 2008). This study further seeks to understand how schools that were formerly segregated have allocated their resources and structured their departments to improve the schools daily rhythms that support particularly NS instruction. We examine how schools have arranged their teaching staff for NS instruction, differences and similarities in departmental staff qualifications and how they impact on NS instruction and instructional leadership practices that are enacted because of the context of each school.

Contextual background

We first provide the background of how schools were segregated in South Africa as a good context for examining the effect of organisational infrastructure on instructional leadership and NS teaching and learning.

Before 1994, there were separate education departments. Black children schools belonged to the Department of Education and Training (DET), the House of Representatives (HOR) controlled coloured children's schools, the House of Delegates controlled Indian children's schools and white children's schools were known as Model C Schools (Branson & Lam, 2010). The former DET and former homeland (African) schools were all township, rural or farm schools which now include the informal settlement schools. The four departments had different funding allocations,

different resources at their disposal and held different examinations (Mncube, 2008). The South African Schools Act (SASA) of 1996 established and recognised two categories of schools: public and independent. Public schools were state controlled and funded while independent schools were privately governed and only received a subsidy from the state. In this way, the government managed to transfer more authority to the independent and former Model C schools and allocated most of the state funding to the poorest schools (Mncube, 2008). The government has recently categorised the schools further into no-fee schools and fee-paying schools. Most townships, rural and informal settlement schools are now no-fee paying schools while most ex-Model C schools are fee-paying schools. This arrangement impacts on the availability of funds to maintain the activities of the schools.

Former Model C schools are typically still well-resourced in terms of teaching staff and educational opportunities for children, inherited from the past. All public schools receive government funding, however former Model C schools, as fee-paying schools, are allowed to charge fees payable by the parents to top up their allocation. Because former Model C schools are able to top up their state allocation, they are able to recruit more teachers using school SGB funds and in this way reduce the teacher-learner ratio. They are also able to purchase more resources and improve facilities using the fees paid by parents. This segregation of schools resulted in disparities in the management of school resources and how schools organised themselves to improve teaching and learning based on their context and resource capacity.

One of the central and intermediate units in secondary schools' organisational structures (Busher & Harris, 1999) is the subject department led by HODs. In secondary schools, the curriculum is organised into subjects where teachers are trained and prepared to be subject specialists. These subjects are further organised into departments that manage all curriculum aspects of the subject or subject grouping (Brown *et al.*, 2000). Spillane and Hopkins (2013, p 2) call the structural arrangement of departments in schools 'a system and organisational infrastructure'. Subject departments are specialised with specialist facilities, staff and a packed day which creates mini empires (Mulford, 2007). They display the organisational and political context of the school and the district, and character of the subject area and its teachers. There is no uniform model on how departments should be organised but different school types organise their school systems and

organisational structures such as departments to attend to the challenges posed by the subject matter nature, culture and philosophies. These departments are led by heads of department (HODs) in South Africa or department chairs in America, to mention a few name variations of this position (Klar, 2012). Science Heads of Departments (HODs) have a complex role of ensuring that all science disciplines within NS as a multidisciplinary subject are properly taught to the required depth and breadth. There is little attention that has been paid to leadership dynamics within the science department which is multidisciplinary (Ritchie, Mckay & Rigano, 2005).

Partly as a result of the multidisciplinary nature of NS as a subject, there is likely to be a crisis of competence both among the teachers of the subject, but more importantly for this paper also among the subject leaders. Although departments are supposedly equipped with specialist staff and facilities, in reality it is not so. Teachers are trained to be specialist in two subjects at most and are unlikely to be specialist in all NS disciplines. NS teachers therefore might not be competent to teach all science disciplines. This is also true for HODs, because they are after all, teachers as well.

The legacies of apartheid organisation wherein some schools were more likely to be better prepared in terms of physical and intellectual resources and infrastructure than others remain. Schools with poor resource capacity would always face these resource challenges and need to come up with innovative ways to address the human capital challenge. This dilemma led us to investigate how formerly segregated schools in SA organise science departments to meet the organisational resource capital challenge and its impact on instructional leadership to ensure quality NS instruction.

We used a mixed methods study in seven schools from four Gauteng school districts to examine how formally segregated schools organised their subject departments for NS instruction. We specifically examined how different types of schools (independent[16], former Model C[17] and

[16] Independent schools are privately governed schools according to the South African Schools Act of 1996 while public schools are state controlled (www.isasa.org)

[17] Parents and alumni administrate and largely fund former Model C schools, which are government or state controlled schools. Some of the country's best schools fall into this category and fees are somewhere between

township and/or informal settlement schools) arranged their formal organisational routines and formal positions because they are two organisational infrastructural aspects that can enable or constrain leadership practice (Spillane & Coldren, 2015). Organisational routines included department meetings, SMT meetings, lesson plans and assessment data reviews, checking learner books and teacher files. These would tell us about how teachers did their work. It is when the school leaders monitor these routines that they would know if all components were working as intended and everyone was doing what they were supposed to be doing. Organisational routines enable efficient and coordinated action; reduce conflict about how organisational work is done (Spillane *et al*., 2011). At the same time, without careful monitoring by managers such as the HODs, these routines could contribute to mindless action, demotivation, mere compliance and inappropriate responses to problems.

In this paper, we identify patterns of organisational infrastructures in these schools that tended to impact instructional leadership. As leadership is enacted within practical constraints of a local context (Hallinger & Heck, 2011) we explore practices of HODs in relation to NS instruction in the schools. We begin by discussing the biographical details of each school to gain the understanding of the contexts within which schools operate and consider policies and procedures adopted for instructional growth by each school. Secondly we discuss the professional attributes of HODs such as qualifications, subject proficiency, experience in the subject, ability to build relationships and develop teachers, collegiality as well as the agency of HODs (Angelle & DeHart, 2011; Robinson, 2010; York-Barr & Duke, 2004).

Thirdly, we discuss the professional interactions between the science HODs as leaders and NS teachers as followers because it is through an interactive process that teachers value the HODs' human capital (skills, knowledge and expertise) and social capital (networks and relations of trust) (Spillane *et al*., 2003). Literature has shown that staff interactions about teaching (Jackson & Bruegmann, 2009) are influenced by how the school system has arranged its organisational structure and resources to support teaching and learning (Spillane, & Hopkins, 2013). The extent to which the HODs negotiated and shared leadership with members of the department would

private and regular government school fees. They were known as "Model C" schools during apartheid, this name has stuck and the best of these schools continue to offer exceptional facilities and high academic standards (www.expatarrivals.com).

reveal the kind of leader-follower and trust relations the HODs had with the teachers. It would also reveal the leadership style that the HODs adopted that was contingent to the organisational infrastructures in the particular school. Some of the means of influence include how the science HODs established trusting and constructive relationships (Barnett & Aagaard, 2007); interacted with departmental members through formal (e.g. subject meetings) and informal points of influence (Printy, 2008); co-created and used routines and artefacts (Spillane *et al.*, 2011). In this paper, we focus on only one of these formal interactions, i.e. subject meetings. In their research, Burch and Spillane (2003) caution that principals and deputies were reluctant to lead subject meetings in subjects such as science and mathematics and preferred that specialists such as HODs held these meetings.

The fourth focus of our discussion is on professional development of NS teachers. This was important, given the introduction of the new curriculum, where teachers required support in the development and scoring of practical assessment tasks. This could involve training, coaching, mentoring (Koh, Gurr, Drysdale & Ang, 2011; Naicker *et al*., 2011); collaborative development of material; and observations with constructive feedback (Lai & Cheung, 2013). The literature shows that some teachers prefer to learn from one another's classrooms rather than from formal programmes offered at universities or colleges. Such professional development support is based on teachers' own context, goals, knowledge; learner needs (Vercio, Ross & Adams, 2008) and comes in the form of reflective and collaborative work (Collier, Dinham, Brennan, Deece & Mulford, 2002).

Based on our analysis, we argue that the nature of NS as a multidisciplinary subject has a major impact on how schools choose to organise their academic departments that house the subjects. Different schools can thus be expected to create different organisational infrastructures for NS teaching, and can display varying degrees of effective the leadership. Our central argument is two-fold. Firstly, we argue that school organisational infrastructures influence NS teaching and instructional leadership depending on the school's context. Secondly, the school contexts remain the legacy of the apartheid schooling system, where, even two decades later, schools infrastructures and organisational capacities remain largely unchanged. In conclusion, we argue that despite the difficult conditions under which these schools operate, clearly focused and

competent leadership is required to create better organisational infrastructure for improvement in the subject. We suggest that school leaders take the multidisciplinary nature of NS as a subject into account when allocating NS teachers and appointing science HODs. This is because instruction is not generic but subject specific (Spillane & Hopkins, 2013).

LITERATURE AND CONCEPTUAL FRAMEWORK

Organisation infrastructure for instruction

School organisational infrastructures are designed to promote teaching and learning. They link goals, practices and people through planned processes and systems. Some organisational routines are crucial to the schools' core work of classroom instruction and they influence it (Spillane & Coldren, 2015). What matters, is how the school arranges its teachers and positions work together to allow for most effective amount of work to be done. Subject departments are organisational functions that group, break up work and coordinate it to make organisational goals.

The systems would include how the power to make decisions is distributed, how learners and teachers are grouped in a school, how instructional goals are discussed and managed, what behaviours are punished or rewarded and how data about the performance of the school are collected, analysed, evaluated and communicated (Bloussing, Nyen, Soderstrom & Hagen Tonder 2015). These infrastructures shape daily work.

School organisational conditions have been reported to affect teaching, learning and instructional change (Spillane *et al.,* 2011). Schools have designed formal organisational structures to include formally designated positions, departments, programmes and formal organisational routines (Spillane *et al.,* 2011). We focus on school leaders' efforts to design these routines and examine how these efforts shaped the administrative and leadership practices of HODs. Subject departments are an organism for facilitating teacher interaction, collaboration, learning and development. Whether teachers interacted with one another about instruction and how they interacted varied depending on the organisational infrastructure and somewhat the type of school. The results of the study on teacher collaboration by Goddard, Goddard and Tschannen-

Moran (2007) indicate that fourth-grade students achieved better in mathematics and reading when they attended schools with higher levels of teacher collaboration for school improvement. Jackson and Bruegmann (2009) also concur that teachers who learn from each other are more effective in raising test scores.

Where subject departments are set up as PLCs, teachers discuss useful teaching approaches and encourage each other to try new teaching approaches, share expertise and talk about new teaching and learning resources (Glickman *et al.*, 2011). PLCs develop trust and openness among departmental staff members. School leaders who foster joint learning (Angelle & DeHart, 2011; Klar, 2012) among staff and create an environment that promotes collaboration are viewed as effective. Burch and Spillane (2003) caution that it is not just interactions with one another but also the frequency and content that make a difference.

Subject departments

To understand the instructional leadership landscape of HODs we use the subject departments as a field for the HOD to develop the culture and habitus of the teachers (Melville, Wallace & Bartley, 2007). Most researchers have explored the practices of HODs or department chairs where a department was for one school subject (Brown *et al.,* 2000, Harris *et al.,* 2011) as opposed to a group of subjects. In other countries there seems to be a clear design for the department to be subject-based except for conglomerate subjects such as science (Harris *et al*., 2011; Ng *et al.,* 2015; Stephenson, 2010). Departments are administrative units within secondary schools and learning cultures, which powerfully influence 'what and how teachers teach' (Siskin, 1994, p. 5). Siskin views the subject department as the crucial part of the school teaching context 'which organises teachers spatially and administratively (Siskin, 1994 p. 12), while Highfield (2010, p. 173) sees them as a 'necessary unit of analysis for within- school variation'. They are the crucial building blocks for providing the site for social interaction, the teachers' professional identity and community (Ghamrawi, 2010) and for building the professional culture of that particular subject area. In subject departments teachers are able to identify how they fit with other colleagues and how they are perceived in the school (Chow, 2013). Ghamrawi (2010) also contends that departmental cultures build the sense of collegiality within its members. They influence decisions and shape the actions of those who are its members. The members of the

subject departments would agree on shared values and norms about learners' ability to learn and prioritise collectively, how to use time and space, how to involve parents, other teachers and the administration staff to improve learning.

Mulford (2007) argues that subject departments are important school structures that enhance curriculum implementation. The focus of the department is learners' learning and for all professionals to enhance this learning (Vercio *et al.*, 2008). By creating departments, principals 1) establish a forum for professional discourse where teachers can engage with teaching and learning issues under the leadership of the HOD, 2) construct new classroom roles and expectations and 3) provide instruction in a new way. Departments separate the school into manageable sections; create distinctive cultures and direct key decisions about resources and professional activities of both the leader and the followers (Chow, 2013). The establishment of subject departments as Professional Learning Communities (PLC) promotes the cultures that build a sense of common purpose (collaboration) and collectively prioritises learning (collegiality) of all staff members (Chow, 2013). Although two departmental chairs can express reformative visions for their departments, they would enact leadership differently based on their contexts and personal understanding of leadership. The formerly segregated schools might depict a picture with similarities or differences in department cultures, establishment of departments, how they utilise resources and lead instruction.

Subject influence on the activities of the department

In this paper we argue that the school subjects have an influence on how the school organises its systems and structures for instruction (Spillane & Hopkins, 2013) using a combination of surveys and semi-structured interviews. Turner (2003) found that the organisation and how themes were prioritised to affect teaching and learning in academic departments in the United Kingdom was unique to the subject area. For example, science was perceived as a practical subject which is reliant on the cumulative knowledge, the prescriptive nature of the science curriculum and the relevance of subject to everyday life. Furthermore, the status of science as a core subject within the National Curriculum and the different ways in which boys and girls respond to the teaching of science tends to influence the instructional decisions of science chairs

(Turner 2003). Bolam and Turner (2003) concur that the HODs' instructional leadership practice is affected by the structure of a subject but not the subject's cognitive structure.

Some of the instructional decisions are translated into how some subjects such as mathematics and languages are taught in the morning and more time is devoted to teaching test taking skills instead of the content being tested (DoE, 2002). Subjects such as English and mathematics get more attention from policy makers and National Education and Standards officials (Burch & Spillane, 2003). In South Africa, such subjects tend to have an elevated status compared to others such as NS, history and music. Most of the international benchmarking tests are on these two subjects, English and mathematics. There are Annual National Assessment (ANA) tests for mathematics and languages in grades 3, 6 and 9. These policy pressures marginalise low-stakes subjects and influence what teachers teach (Spillane *et al*., 2011). The teachers' perceptions and philosophies about the subject tend to shape their instruction and response to the subject changes (Siskin, 1994). These perceptions influence curricular practices, content coverage and coordination and assessment standards (Stodolsky & Grossmann, 1995). The way that different types of schools attach the status to NS will be manifested in how they organise their systems and structures like subject departments and meetings for NS instruction.

We further argue that a subject such as NS, which is a federal subject, partly demands a review of how the school's human and physical resources are deployed. Turner (2003) suggests that there are distinct instructional leadership implications for each subject based on the specific curriculum and the context of the subject and its nature. In the next section, we describe instructional leadership as the key role of the HOD.

Instructional leadership

Instructional leadership is seen as sets of leadership practices that involve the planning, coordination, evaluation and improvement of teaching and learning (Robinson, 2010, p. 2). It involves the ability to integrate educational knowledge into leadership practice, the ability to build relational trust with stakeholders and the ability to solve complex problems within the local school. Instructional leadership could include leading and managing curriculum development, planning and assessment, alignment of curriculum instruction and assessment standards

(Lashway, 2002), building a culture of continuous learning, institutional and educational evaluation (Melville, Jones & Campbell, 2014) and reflecting on the outcome of the instruction (Lai & Cheung, 2013). Instructional leadership also involves the teachers who are followers because followership determines the kind of leadership that will be provided. Glickman, Gordon and Ross-Gordon (2011) propose a collegial approach to leadership that focuses on teacher involvement and growth, collaboration, ongoing reflection as proposed by Lai & Cheung (2013) and peer coaching aimed at improving instruction. All these approaches to instructional leadership cannot be exclusive especially for instructional leaders. Effective instructional leadership is more important than traditional notions of classroom observations and direct coaching. It is not enough just to monitor that teaching is taking place but whether learning is taking place using classroom data to make decisions about professional development needs, interventions and grouping of learners where needed. The HOD as a member of the School Management Team (SMT) is expected to create a safe and climate conducive for teaching and learning to take place. The HOD as an instructional leader initiates and sustains many of the activities listed above and the type of leadership that s/he enacts is also influenced by the followers.

Conceptual framework

The conceptual framework used in this study shows how the instructional leader's attributes, his/her knowledge of the context and its problems can be integrated to provide leadership through effective interactions with the department's members and influence the teaching choices (Robinson, 2010). Certain stimulus for the school context necessitates a particular leadership style and behaviours (Hallinger & Heck, 2011) that would be exercised when realities are considered. The school context is the source of constraints, opportunities and resources (Hallinger & Heck, 2011). The interaction of contingent variables such as the school size, learner background, school and organisational culture, labour features, community type, teacher competence and experience (Angelle & DeHart, 2011), school size and financial resources make leading a department very complicated. It shapes the type of leadership that will be displayed, determines which resources the HOD would use, the limitations and opportunities that the leader needs to understand and respond to in order to address these and be in a position to lead successfully. A study of over 3000 Australian teachers about the effects of structural and process

features on instructional efficacy, found significant direct effects across four components (contextual factors, structural features and process features of the programmes and professional community) as well as the knowledge, practice, student learning, and efficacy as the four outcome measures for successful instructional leadership (Mulford, 2007). We discuss the framework that integrates all these component and measures for effective leadership below.

Six (6) major components of the framework for leading instruction have been identified in the literature and are briefly discussed. The first component of the framework is the leader's attributes such as subject proficiency, professional credibility (Angelle & DeHart, 2011) and agency in resourcing the department. The second component is the leadership practices such as vision setting, building collegiality, developing teachers and the manner in which leadership is distributed among the department's members (Koh *et al*., 2011).

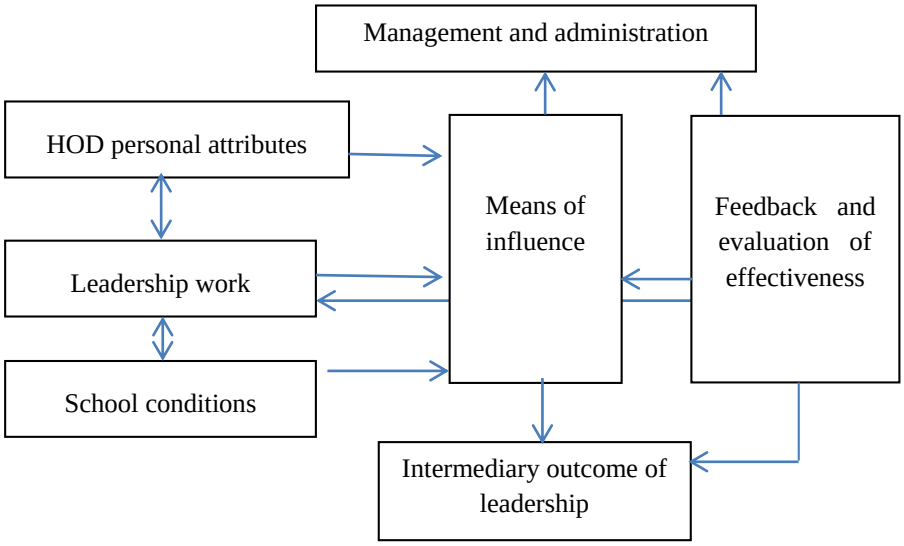

Fig 1: Abridged version of the conceptual framework for leading instruction (adapted from York-Barr & Duke, 2004)

The third component includes how the HOD negotiates his/her influence through the school's social, political, economic, cultural and other contextual problems (Robinson, 2010). This requires the HOD to be creative with his/her time and be able to balance his/her own administrative and instructional leadership duties. In some schools, as in Klar (2012), principals assist in fostering instructional leadership practices. These three components are somewhat linked to the schools' organisational infrastructure and might vary from school to school

depending on the type of school. How each school appoints the HOD, and provide a climate conducive for leading instruction will be the focus of this paper.

The fourth component explores how the HOD influences teaching choices through setting instructional objectives, planning instruction and developing reflective practice using classroom observational feedback sessions (Wanzare, 2013) and action research (York-Barr & Duke, 2004). The fifth component is where administration and management overarch the role of managing people and resources (see figure 1). This is where routines and different systems and processes for managing the curriculum are located (Spillane *et al.*, 2011). The sixth and last component introduces the feedback loop and evaluation of the effectiveness of leadership. This paper will focus on the integration of these components by different schools to improve NS instruction. Using the conceptual framework developed above, we then ask the key question of our study: How do instructional leadership practices of science HODs from different types of schools compare with regard to NS?

METHODS

The current study was a mixed-methods exploration of the HODs' instructional leadership practices from different school contexts which integrated numerical and qualitative information gathered in several ways (Creswell, 2014). The researchers considered the importance of matching the research methodology to the purpose and context of the research in order to generate an understanding of what science HODs do to fulfil their role and their reasons for acting that way. The mixed methods approach combined elements of quantitative (numerical) and qualitative (narrative) approaches in a single project and integrated the findings (Creswell & Plano-Clark, 2011), thereby achieving a deeper and broader understanding and corroboration of the research problem.

The purpose of this study was to explore different schools' organisational conditions regarding how they organised and equipped subject departments for NS instruction. Ways in which schools allocated their teaching staff for NS instruction, differences and similarities in department staff qualifications and instructional leadership practices that were enacted as a result of the context of each school were explored. The methods that were used involved the collection of self-reported

data (quantitative and qualitative), observational data and artefacts. The decision to use a mixed methods approach was based solely on the research purpose, the type of data we wanted to collect, answering questions from a number of perspectives and complementarity. A sequential explanatory research design was used where data collected quantitatively were analysed to inform the qualitative collection (Creswell & Plano- Clark, 2011).

Description of instruments

The HOD questionnaire explored among other items, the HODs' teaching experience, the instructional activities of the science department, the profiles of the department's members and focused on the ways in which the HODs attempted to influence the teaching of members of their departments in order to improve it. A similar questionnaire in the form of a multi-rater assessment instrument measuring HOD's instructional leadership practices was administered to NS teachers. It enabled informal cross validation of information. The qualitative data were collected from a purposeful sample of schools using semi-structured interviews, meeting observations and documentary analysis (Creswell, 2014). The interview schedule focused on the HOD's role on influencing the practices of NS teachers and explored both general and specific issues regarding HODs' attempt to influence teaching.

Sources of data

Data were collected using self-report techniques (the questionnaire and the interviews), observational methods (participant observation) and secondary data analysis from artefacts and school documents (Teddlie & Tashakkori, 2012). The quantitative study used full-group data for all 243 secondary and combined schools (all schools with grades 8 and 9) in four out of fifteen districts in Gauteng. The questionnaire targeted science HODs and NS teachers. Completed questionnaires were collected from 77 schools (31%) although thirty HODs returned the questionnaires. We received questionnaires from 44 schools where both the HOD and the NS teachers responded. The data from questionnaires were analysed for trends and from these data, the schools were identified for qualitative data collection. The HODs and NS teachers from seven schools were followed up with in-depth semi-structured face-to-face interviews. The researchers observed three departmental meetings chaired by the HODs at the schools and took field notes.

Sampling

The sampling strategy that would suit each respective research approach strand was adopted. The overall sequential mixed methods sampling strategy was used where information from the quantitative sample in phase 1 was used to draw the qualitative sample in phase 2 (Teddlie & Yu, 2007). The data reported in this paper were only from the schools where both the HOD and the NS teacher responded to the questionnaire. The seven schools were selected for in-depth interviews with their science HODs and teachers, participant observation of their subject/departmental meetings and document analysis.

Analysis

We received 142 (112 teachers and 30 HODs) questionnaires from 77 out of 243 schools in four districts (31.7% return rate). The HODs' involvement in instructional leadership activities were rated based on how frequently they did them (1 indicated 'never' while 5 indicated 'always'). Some descriptive statistical analyses were done on the quantitative data and these results could not be generalised outside this study setting. The semi-structured interviews were audiotaped and transcribed while field notes of the meeting discussions were taken. We analysed department files and educator files, learners' activity and test books and minutes of departmental meetings.

Several patterns were identified in phase 1 (quantitative strand) which became the basis for phase 2's (qualitative strand) data collection. This included the prominence of policy routines and compliance activities as prescribed by the PAM[18] document (DoE, 1999); the trend in the way in which subject meetings were conducted and science departments were constituted. In phase 2, interview transcripts were coded for HODs and teachers' perspectives on leading and managing NS instruction across different schools using an open coding strategy (Creswell, 2014). Five coding categories were used namely biography, arrangement and composition of departments, compliance to administrative routines, professional development, other instructional leadership practices and support provided by principal. We then analysed coded data, identified patterns and checked their prevalence across schools. We coded the field notes of meetings with five

[18] Personnel Administrative Measures (PAM) document is the document that provides norms and guidelines of employment of educators, the workload of educators (school based), duties and responsibilities of educators, and rank designations of educators.

categories: compliance activities, frequency and duration of meetings, discussion points of meetings, learning material and professional development. Our analysis focused on understanding whether and how formal structures and HODs' leadership practice connected with the type and context of school. Below are the demographics of the schools which we followed up with semi-structured that responded to the questionnaire.

Table 1: The spread of the schools across the districts

District	Number of HODs	Number of schools whose teachers responded
B	13	16
E	8	16
J	5	8
W	4	37
Total	**30**	**77**

Schools from four districts in the Gauteng province responded to the questionnaire survey. More than one NS teacher responded to the multi-rater questionnaire. District B had the highest number of HOD questionnaire returns while in District W although fewer HODs (4) had responded, had highest number of teacher responses (37).

Table 2: Schools demographics

Type of school	Race	Number of schools	Number of teacher responses	Number of HOD responses	Number of teachers from schools where both HOD and teachers responded
Township and informal settlement	Black	42	64	17	23
Former Model C	Mixed	30	44	10	21
Independent	Mixed	5	4	3	3
Total		77	112	30	47

The township and informal settlement schools recorded the highest number of responses and they are the majority in the province. Very few (5) independent schools responded.

FINDINGS

In this section we present the results of your study and we initially present profile of the schools that we followed up using the qualitative methods.

Biographical data

School A

Sheba Secondary School is a 60 years old township school with a relatively good infrastructure, an enrolment of approximately 1600 learners and 48 teachers. It is a no-fee paying school. There were three NS teachers at this school. We interviewed the HOD (Mr Chester) and two NS teachers (SF and SM) at this school.

School B

Promise Secondary School is a big township school in the east of Johannesburg that was formerly a technical training centre too. It has an enrolment of approximately 1500 learners, 39 teachers and it is a no-fee paying school. The school lacks adequate infrastructure required for a secondary school. Although there are properly built classroom there are other prefabricated structures that are used as SMT offices that had been sponsored by a local bank. The premises of the school were shared with an Adult Education and Training Centre (AETC). There were three NS teachers at this school including the HOD, Themba.

School C

Knowledge Secondary School is a relatively new township school located west of Johannesburg with an enrolment of approximately 1200 learners and 36 teachers. This school is located in an industrial area and it is a no-fee paying school. It is fairly new with good infrastructure and is located in a township that has developed from an informal settlement that housed the labour force from the nearby industries. The laboratory storeroom was converted into the science HOD's office. There were three NS teachers and the subject department is fairly new as it had just been split from a bigger department comprising mathematics and NS.

School D

Fhutura Secondary School is a 12 year old, big school in a new area on the eastern side of Johannesburg. It is located at the boarder of a new township and an informal settlement. This is a no-fee paying school and at the time of my visit, the school had no electricity. We interviewed

two teachers (FF and FM) and the HOD, Mr Silumko, at this school. The third teacher did not consent to being interviewed.

School E

Alpha Secondary School is a no-fee paying, medium sized school located close to an informal settlement with approximately 900 learners. The school is over 20 years old but uses prefabricated structures as classrooms and lacks electrical power. A large proportion of Alpha's learners are 'migrants' in the province who live in informal settlement houses.

School F

Harriotside School is a small, low-fee independent school, one of a few township-based independent schools. The school was about 6 years old and many classrooms were made of prefabricated structures. The enrolment of the school was approximately 450 learners and 17 teachers. Harriotside is a combined school that houses learners from grades R to 12. We only interviewed the HOD, Mr Bertus, at this school in his office. He was the only one who teaches NS in the school.

School G

Mooredale is a big, former Model C school situated in an industrial area on the outskirts of a small East Rand town of Johannesburg that boasts of good and well-kept facilities. The mixed race enrolment of the school was approximately 1500 learners and 63 teachers. This school utilised the services of a senior teacher for physical sciences (PS) to focus on the physical sciences strands of NS. There were four NS teachers in this school. We interviewed the HOD, Mrs Winfreda and two NS teachers (MW and MF). The interviews were conducted in the HOD's office. During the time of data collection a new HOD, Mr Mthende who is a life sciences (LS) specialist, was appointed. This HOD chaired the subject department meeting that we observed.

Most of the HODs and NS teachers in the study were in their middle ages (older than 40 years) from all different contexts. This age range depicts that they had experienced many changes in the curriculum and may have professionally qualified when the subject (NS) was still general

science and it comprised only two science disciplines. The table below shows the age ranges of teachers and HODs from the schools where both responded to the questionnaires.

Table 3: Age ranges of teachers and HODs

Type of school	**Age range (in years)**								
	Teachers		**30-39**		**40-49**		**50-59**		**HODs**
	<25	**25-29**	**T**	**HOD**	**T**	**HODs**	**T**	**HODs**	**>60**
Township/informal settlement	1	2	6	3	12	5	2	9	0
Former Model C	3	1	3	1	8	6	4	3	2
Independent	0	1	1	1	1	1	0	1	0
Total	**4**	**4**	**10**	**5**	**21**	**12**	**6**	**13**	**2**

More than half of the NS teachers in the sample from schools in different contexts were in their middle ages (older than 40 years), 60.9% in township and informal settlement schools and 62.5% in former Model C schools. The NS curriculum has been revised more than three times since these teachers qualified. The former Model C schools had at least 25% of the NS teachers who are younger than 30 years compared to only 13% in the township and informal settlement schools.

Institution of professional qualification

We then explored the institutions where these teachers and HODs had qualified. The teachers' colleges offered a 3-year diploma qualification while the universities offered a 4-year degree. A degree qualification was considered a higher qualification and hence better preparation to teach than one with a diploma qualification. Table 4 shows that a majority of teachers (17) from township and informal settlement schools qualified at teachers' colleges while a majority of former model C schools teachers (18) qualified at universities. A similar pattern was observed with township schools' HODs where more (13) had qualified from teachers' colleges whereas the number of university and teachers' colleges qualifications for former C schools HODs was more or less equal (5 and 6 respectively). This correlated with the age range of the HODs as well because most HODs and teachers in township schools were older than 40 years. These township and informal settlement teachers trained during the era of teachers' colleges. The number of teachers from independent schools was too small for comparison.

Table 4: Institutions where HODs professionally qualified

Type of school	Rank	University	Teachers' College
Township/informal settlement	HODs	4	13
	Teachers	6	17
Former model C	HODs	5	6
	Teachers	18	3
Independent	HODs	1	2
	Teachers	2	2

Specialisation of HODs with regard to NS

Because of the interdisciplinary nature of NS, the HODs were expected to have the ability, knowledge and expertise to support the teachers who might not have expertise in some science disciplines. Various subjects that HODs specialised in were grouped into categories according to the school science disciplines.

Table 5: HODs' specialisation according to school type

Subject	Former Model C schools N=10*	Township/informal settlement schools N=17*	Independent schools N=3*
LS Only	1(10%)	7 (41%)	2
NS	5(50%)	5(29%)	0
PS Only	3(30%)	4(24%)	1
Maths	3(30%)	3(18%)	3

**HODs specialised in more than one subject, therefore the total numbers of specialisations do not tally with the number of HODs per school type.*

Table 5 indicates the spread of subject specialisation by HODs in the different schools with regard to the key strands of the NS, LS and PS. The earth sciences strand was not the focus of this study. The HODs, as specialists themselves, could only specialise in certain science disciplines and not all the disciplines of NS. The majority of township school HODs (41%) had specialised in LS while an equal number (30%) of HODs in former model C school had either specialised in PS or mathematics. This was because some schools had mathematics as part of the sciences department. An equal number of HODs (5) from both township and former model C had specialised in NS. Half of the former Model C schools HODs and 29% of the township and informal settlement schools HODs had a qualification that allowed them to teach any sciences discipline. The rest of the HODs were qualified to teach either of the science disciplines. The big question was, with these kinds of subject specialisations, would the HODs be able to support the

teachers in their departments? It was therefore important that we examined the specialisations of the rest of the members of the science department. We started by looking at the size and subject composition of the science departments that HODs were responsible to lead.

The size of the departments

Most schools had science departments with less than ten teachers irrespective of the school type. The minimum number of teachers in the department was three in an independent school and the maximum number was 24 in a former Model C school. A few schools (10%) had more than ten teachers in the department.

Table 6: Number of teachers in the science department

	Township/IS	Former Model C	Independent
<10	8	12	3
11 to 20	1	2	0
>20	1	1	0

Most of the former Model C schools' science departments comprised NS, LS and PS but there were 27% of the schools that had mathematics and mathematical literacy as part of the department (table 7). Only 3% of township, informal settlement and former Model C schools had mathematical literacy, earth sciences and technology education as part of the sciences department. The former Model C and Independent schools did not have agricultural sciences as part of the science department while two township schools included it. Just over a quarter of the schools, from all types, also had mathematics as part of the science department.

Regardless of whether they were township, informal settlement, former Model C or independent schools, most schools (96.6%) had science departments comprising NS, PS and LS. This posed a challenge in that these are subjects in two different schooling bands (PS and LS are in the FET[19] band and NS is in the GET[20] band). The science departments in most schools comprised a group of subjects and not only one subject. There was only one township school, Knowledge, in the

[19] FET is the Further Education and Training band includes curriculum for grades 10-12. The curriculum consists of core and elective subjects.

[20] GET is the General Education and Training band which includes the curriculum provision for learners from grade R to grade 9. This encompasses the Foundation Phase (grade R-3), the Intermediate Phase (grade 4-6) and the Senior Phase (grade 7-9).The curriculum at this band is not specialised and all learners do core subjects.

follow-up schools where the subject, NS, constituted a department on its own. However, this department was relatively new. Having explored the composition of the departments we wanted to know how the different departments interacted with its members to improve instruction. One of the means of interaction was using subject meetings. We then looked at when and how these departments held their meetings and looked at patterns in different schools.

Table 7: Subjects comprising the science department according to school type

	former model C	township/IS	independent
NS	11	15	3
PS	10	13	2
LS	7	12	3
ES	1	1	0
Maths	3	4	1
ML	1	2	0
AS	0	2	0
Tech	1	3	0

NS-natural sciences, PS-physical sciences, LS-life sciences, ES-environmental sciences, ML-mathematical literacy, AS-agricultural sciences, Tech-technology

Departmental or subject meetings

The subject meetings are prescribed in the PAM document and therefore all school-based HODs were expected to have these meetings. We looked at the different patterns and styles of conducting these meetings.

Schedule and duration of meetings

Almost all the schools that we followed up with semi-structured interviews, whether public or independent, township or former Model C held their meetings during the lunch hour. The meetings were very short as teachers took time to gather from the respective classrooms.

> *We try to meet about twice a term. The meetings are during lunchtime or after school (HOD, Sheba).*

However, one township school indicated that it held its department meeting during the sports period instead of during the lunch hour.

> *The meetings are usually on Wednesday during the sports period (Teacher 1, Alpha).*

The HOD from Fhutura also indicated that lunchtime was usually too short to discuss any detail and they sometimes used time after school to complete the meetings.

> *Nowadays we normally hold meetings during lunchtime … If maybe you find that during lunchtime we couldn't exhaust the agenda we normally adjourn to half past two, after school … Lunchtime is not enough actually (HOD, Fhutura).*

Frequency of the meetings

Almost all township schools held their departmental meetings once a term, although they tried to have them more frequently.

> *We try to meet about twice a term (HOD, Sheba).*

And

> *My plan is to have a departmental meeting at least once a term and then at least one subject meeting per subject which means it's going to be 3 subject meetings (HOD, Promise).*

The HOD from another school confirmed saying:

> *Mandatory we must have a meeting every term (HOD, Sheba).*

The Knowledge School HOD mentioned that meetings were flexible.

> *Subject meetings we do as often as possible, maybe if Mr Lato comes with some issues that need to be discussed, then we do diagnostic analysis of the question paper, just to see.*

In the former Model C School that we followed up on, Mooredale, subject meetings were held at least once every two weeks and departmental meetings once a quarter. Mooredale School HOD clearly distinguished between subject and departmental meetings.

> *We normally have a department meeting once a term, the whole lot together, I just found that it is sometimes if you are only working with the NS then it is a bit much to sit through everybody else's issues,…Alright so basically what we do is have a meeting once every two weeks just to check that everybody is in the right place.*

Sometimes they did not even meet at all due to other pressing issues. The HOD from Alpha secondary school also emphasised the flexibility of the year plan as far as department meetings were concerned saying, "*There is a year plan but things just occur but they are flexible. The plan is changed for emergency issues".*

The HOD from another school reported that other priorities competed with the subject meetings.

> *No, this term we haven't had the meeting yet. We were busy doing all the submission and other stuff so that was the biggest problem; I don't have a meeting this term yet (HOD, Promise).*

This was the view from the new HOD who was only at the school for two months when we collected data.

Content of the discussions at meetings

The township schools had department meetings where every department member attended except for one school, Knowledge. The subject meeting at the former Model C School was only for NS teachers and only topics pertaining to the teaching and learning of NS were discussed at this meeting.

Table 8: Topics discussed at department meetings-teachers' views

	MEAN		
	Township N=17	**Independent N=3**	**Model C N=10**
Policies	4.25	1.5	3
Department direction	4.25	1	2.75
Material Reviews	5	3	2.75
Improvement plan	4.5	1.5	2.2
Evaluation	3.4	1	2.75
Prof Development	3.4	1.5	3.67
Learner outcomes	3.4	1	2.75
Assessment	5	1	5
Exam papers	3.4	1	3.67
Assessment scores	3.4	1.5	3.67
Start-End term issues	3.4	1.5	2.75
Budget	3.4	1.5	2.2
Lesson plans	3.4	2	3.67
Content coverage	3.4	1	3.67
Distribution of leadership	3.4	1.5	2.75
Remedial and enrichment	3.4	1.5	3.67

Table 8 shows the mean responses of teachers on the frequency with which topics were discussed in department meetings. In the township schools where meetings were held quarterly and the topics that were frequently discussed were pertaining to subjects' assessments, material reviews and improvement plans. The rest of the items were fairly equally discussed. The HOD from Sheba confirmed this:

> *We also discuss circulars from the district; remind each other there is a circular that 1-2-3, and whether we are in line with that circular.*

The teachers indicated that the budget was the least discussed item during subject meetings in township and informal settlement schools; instead, they discussed the direction of the department and policies more frequently. Model C schools discussed most items equally frequently but top of their list were professional development, assessment issues, lesson plans and differentiated teaching (remedial and enrichment). The improvement plan and the budget were the least discussed in their meetings.

Meeting place

All township and informal settlement schools that we followed up on, except the former Model C School, Mooredale, held their meetings in the HODs' office. This was observed during the interviews at the schools. These were not proper offices but usually storerooms behind the laboratories that were full of chemicals, broken equipment, stationery, and textbooks and learners books. The Mooredale school team held their meeting in one of the classrooms.

Instructional leadership practices

Thirty nine percent (39%) of the township and informal settlement schools HODs responded that they always did class visits (mean of 3.83) and knew what was going on in NS classrooms and provided professional development (mean of 3.73). Former Model C schools HODs reported frequent provision of professional development to the teachers (mean of 3.33) and calling meetings (mean of 3.33) while over a quarter (28.6%) of former Model C schools HODs responded that they never called meetings. Over a quarter of the township schools HODs also reported that they frequently discussed subject topics with staff and prepared lesson material jointly (mean of 3.69). It was later established during follow up face-to-face semi-structured interviews that these class visits were only compliance ones done for Integrated Quality Measurement Systems (IQMS[21]). Former Model C schools HODs reported that they occasionally discussed topics with staff, allowed teachers to discuss issues or knew what was going on in NS classrooms.

[21] IQMS is integrated Quality Measurement Systems. The IQMS evaluation is done to target three levels of the system: Developmental Appraisal of the teacher to identify strengths and weaknesses; Performance evaluation for pay progression and Whole School Evaluation to measure the overall effectiveness of a school including teaching and learning.

Table 9: HOD's instructional leadership practices (self-reported)

	MEAN	
	Township	**Model C**
calls meetings	3.44	3.33
allows staff to discuss issues	3.73	2.75
develops staff professionally	3.73	3.33
discusses topics with staff	3.69	2.50
preparing material together	3.69	2.00
class visits	3.83	2.50
knows what is going on	3.82	2.75

Model C schools' HODs seldom prepared material or jointly prepared instructional material. Below we explore the perspectives of the teachers on these instructional practices of HODs.

Teachers' views of these instructional practices

Figure 2 below shows that more than 61% of the NS teachers from former Model C schools responded that their HODs always allowed teachers to meet with them, monitored learners' progress and content coverage.

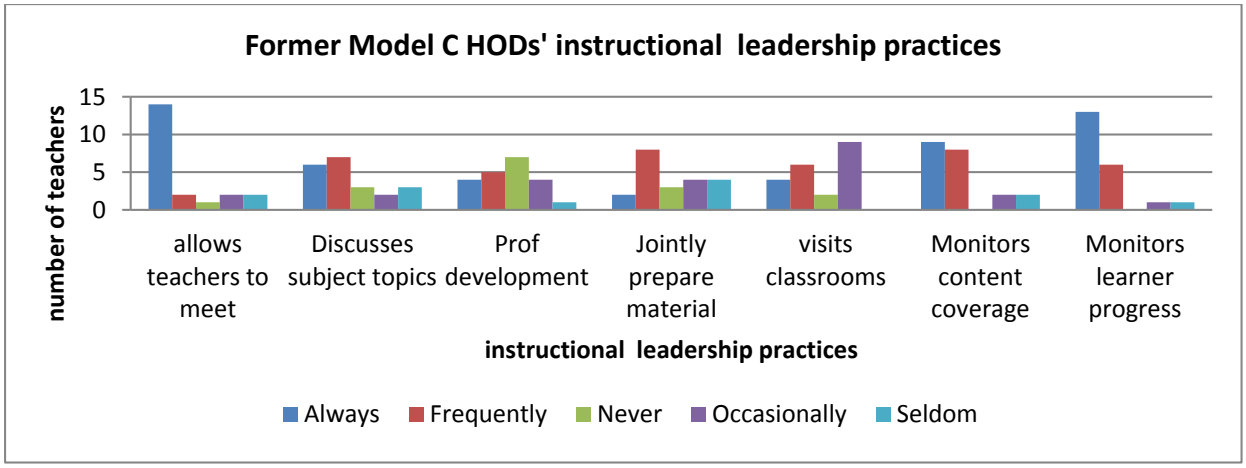

Figure 2: Former Model C teachers' views on HODs' instructional practices

The teachers concurred with HODs that they occasionally did classroom visits and rarely developed teachers professionally. Teachers responded that their HODs frequently discussed subject topics with teachers and jointly prepared instructional material.

A comparison of the similar practices from the perspectives of the township and informal settlement schools is presented below. Teachers from township and informal settlement schools (35%) responded that their HODs never developed them professionally and they occasionally discussed subject topics with teachers or visited classrooms.

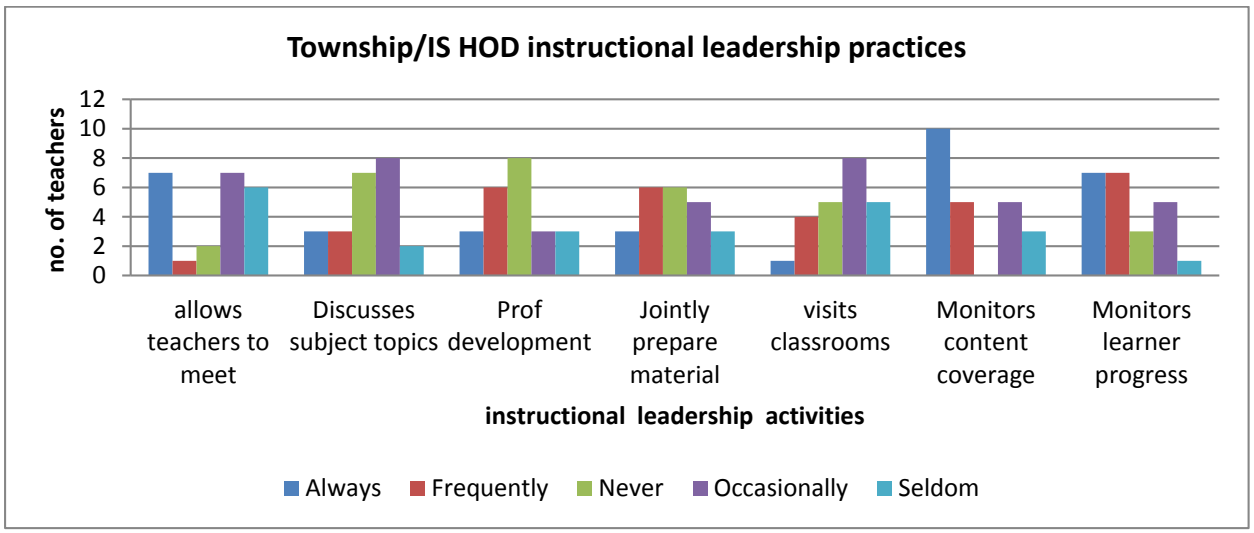

Figure 3: Township and informal settlement teachers' views on HODs' instructional practices

Forty-three percent responded that their HODs always monitored content coverage, learners' progress and allowed department teachers to meet. The data shows that teachers from all schools concur that all HODs always allowed teachers to meet, monitored the content coverage and learners' progress. The classroom visits and professional development of teachers were the least performed duties by all HODs. We discuss this observation later in this paper.

Teaching NS

Eighteen HODs (60%) were actually teaching the subject (figure 4). These HODs would understand the subject challenges, prove to have the needed subject expertise and be in a position to work with the teachers in the subject instead of working for them. The HODs did not only teach NS but they also either taught physical or life sciences or mathematics. The number of HODs who taught physical sciences (12) was almost equal to the number of those who taught life sciences (13).

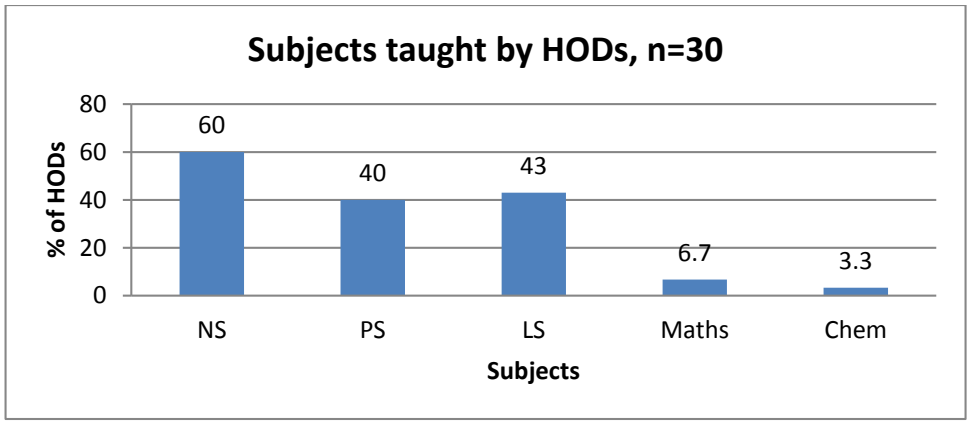

Figure 4: Subjects HODs taught

Table 9 below compares the extent to which HODs taught NS according to school types. Some of the HODs taught NS in grades 8 and 9 and PS in grade 10 and or 11 and or 12. The table only reports data on NS and PS teaching. More than half of the NS syllabus lays the foundation for PS in senior secondary science. Comparing the teaching of NS and PS across schools assisted the researchers to understanding the level of expertise of HODs to support this big part of the NS curriculum. If HODs taught PS then they would be in a position to understand the topic progression and areas that need to be emphasised in NS before PS topics are introduced. The data reveal that not all HODs taught NS in their schools irrespective of the school context.

Table 9: Subjects HODs taught according to school type

Subject grade	Township N=17	Former Model C N=10	Independent N=3
NS 7	4	1	0
NS 8	11	8	3
NS 9	12	7	3
PS 10	8	1	1
PS 11	3	1	1
PS 12	2	0	0

Approximately 68% of the HODs from the township schools taught NS and 75% from the former Model C schools taught NS. During interviews we confirmed that only one school HOD out of the seven schools that we followed up with taught NS. The other HODs were also teaching PS in grades 10-12.

HODs' expertise

We explored the extent to which HODs were familiar with NS content and understood what was expected of NS learners from each grade from the teachers' perspectives. The responses from all teachers irrespective of the type of school indicated that they did not agree that HODs were familiar with content or understood subject expectations at different grades (figure 5). Former Model C schools strongly agreed (76%) that their HODs understood the subject expectations but only 47.6% agreed to HODs' familiarity with content while 34.8% disagreed. Just over half of the township schools' teachers disagreed (56.5%) that their HODs were familiar with content and only 39% strongly agreed that their HODs understood the subject expectations. The comparison depicts that former model C schools were outright with their response either agreeing or not agreeing. The township teachers however were modest about their rating.

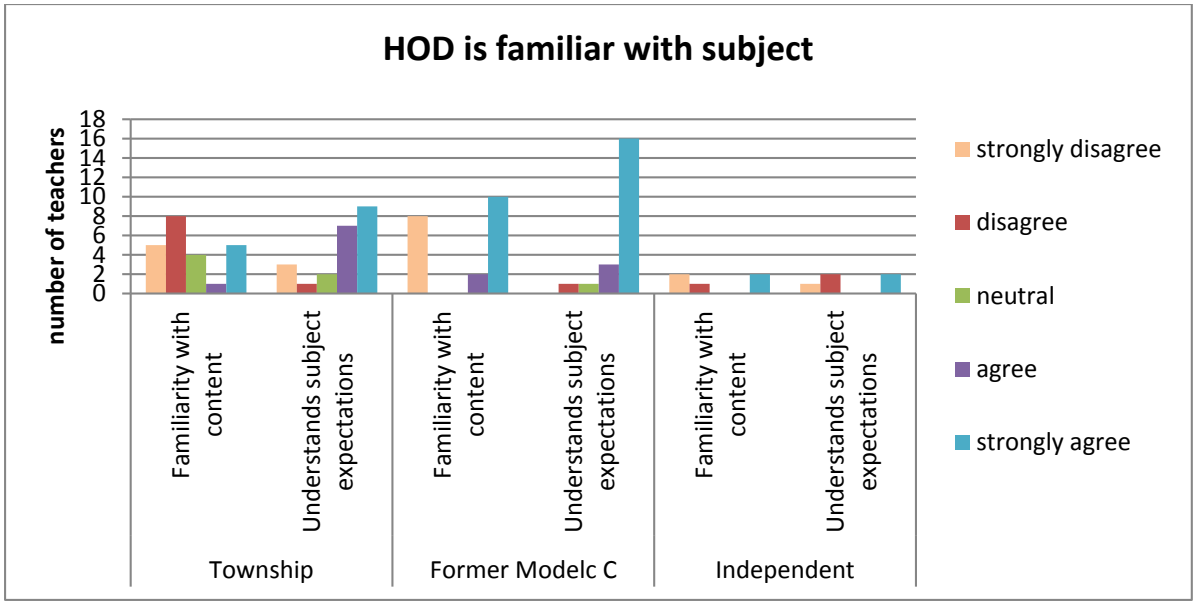

Figure 5: HOD's familiarity with the subject – teachers' views

We then wanted to know who provided the help that teachers needed. Teachers were asked who among a list of people were found to be most helpful in planning instruction. In this report, we only compare the responses for senior teachers and HODs. Although township schools had not explicitly indicated having senior teachers, they found them to be helpful and an equal number of teachers chose not to respond to this question (10). Former Model C schools found the senior teacher more helpful (95%) than the HOD (71%). There were teachers who indicated that they did not need the senior teacher's help.

Table 10: Most helpful person in the school

	Township/IS		Former Model C	
	Senior teacher	**HoD**	**Senior teacher**	**HoD**
did not need help	1	2	0	3
least helpful	0	2	0	0
less helpful	1	1	0	2
neutral	1	6	0	1
helpful	0	2	9	3
most helpful	10	9	11	12
no response	10	1	0	0

Only one school (Mooredale) out of the seven that we followed up with interviews mentioned using the expertise of the senior physical sciences teacher to support the teachers with the common assessment tasks and physical sciences topics of the NS curriculum. The HOD arranged and facilitated this interaction between senior teacher and NS teachers. At the subject meeting, this senior teacher was given an opportunity to report on the progress, the expectations for the next week and address concerns from the teachers on the physical sciences strands of the subject. None of the other schools reported the existence or using the expertise of a senior teacher.

Principal's support

The HODs were also asked to rate the support that they received from the principal. The support was categorised into specific areas such as provision of space, time and resources for department activities involving doing instructional work, buffering the school from outside influences and different forms of encouragement.

Table 11: Extent of principal's help to the HOD

	Township/IS	**Former model C**
least helpful	1	1
less helpful	3	0
neutral	2	0
helpful	5	4
most helpful	5	6
Mean	3.2	2.2

HODs from all the school types, on average rated the principals as helpful. However, some HODs found them to be either less helpful (10%) or were neutral (6.7%) about the kind of support that they received from the principal. We looked at specific areas where HODs found principals to be supportive or not in table 12 below.

Township schools HODs strongly agreed that their principals encouraged lesson observations and asked about instructional practices but they were neutral about the principal attending departmental meetings. Former Model C schools' HODs strongly disagreed that the principals attended their departmental meetings but strongly agreed that the principals buffered the school from outside influence, encouraged lesson observation, new ideas and asked about instructional practice.

Table 12: Principal support on instructional issues

	Township /IS				**Former model C**			
	strongly disagree	**neutral**	**strongly agree**	**Mean**	**strongly disagree**	**neutral**	**strongly agree**	**Mean**
Asks about instructional practice	3	1	6	3.33	2	2	3	2.33
Encourages new ideas	3	4	2	3	2	2	3	2.33
Encourages lesson observation	2	1	6	3	1	2	3	2
Attends subject meetings	1	6	1	2.67	5	3	2	3.33
Buffers outside pressures	4	1	4	3	1	0	4	1.67

Township and informal settlement schools strongly disagreed that they received support from principals in terms of space and time to carry out their duties. Seventy-three percent of township and informal settlement school HODs indicated that the principal did not provide space and time for departmental meetings (figure 6). Very few of the former Model C schools responded to the questions about the principal support with respect to space and time.

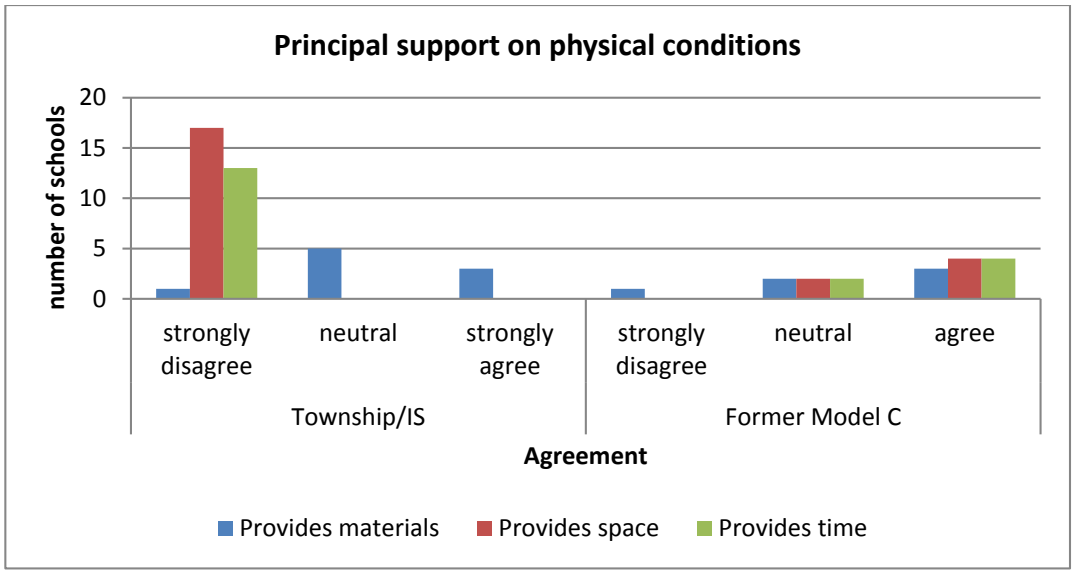

Figure 6: Principal support on physical conditions

DISCUSSION

There are several dimensions of formal systems and organisational infrastructure arrangements within the schooling system e.g. standards and curriculum. These arrangements are likely to affect how the school and every organisational unit within it are run. In this paper, we focused on the science departments as a unit of analysis. We also focused on how organisational infrastructures (Spillane & Hopkins, 2013) affected the work of the sciences HOD as the instructional leader. This paper also looked at the leaders of science departments and how the schools' organisational systems had specified the attributes and characteristics of the leaders that would be appointed as an HOD. Different schools organised and arranged their systems, grades and subject department infrastructures differently. There was no uniform way for these arrangements. Some of these arrangements could be linked to the way schools had been formerly segregated in the South African education system. A few emergent themes from the findings highlight these issues.

In this study, township schools' HODs rated their principals as helpful although there were a few HODs who were either neutral about the kind of help they receive or they found the principal to be less helpful. Township schools' HODs however, indicated that their principals did not support them in terms of providing space and time for them to do their instructional leadership work. In the township schools that we followed up with, we witnessed the shortage of space for HODs in

terms of meeting, professional development, storage and filing space. We conducted interviews in very crammed spaces, which were originally laboratory storerooms. These rooms were packed with textbooks, some laboratory equipment, some learners' books and teacher files etc. In other schools, we conducted interviews in the deputy principal's offices because the HODs do not have any space other than his/her classroom. School conditions such as socio-economic status and cultural context are an important component for providing effective instructional leadership as discussed in the conceptual framework (Robinson, 2010). Hallinger and Heck (2011) also argue that leaders display a certain type of leadership style contingent to the context of the schools. In this study HODs used the only space available to them to hold meetings which are cramped laboratory store rooms. They could not use the classrooms as was the case with former Model C schools because they were used as serving points for the school feeding scheme which former model C schools did not have. There were a number of other organisational infrastructural reasons that made it impossible for HODs to use classrooms during the lunch break but those were not part of this study.

On the other hand, former Model C schools were mostly silent about this kind of infrastructural support. It could be argued that the HODs from the former Model C schools received more help from the principal than those from township or informal settlement schools. It could be possible that former Model C schools did not have space challenges because their schools were well resourced. In one former Model C school that we followed up with, we conducted interviews in the HOD's office that had enough space and furniture and we observed subject department meetings in classrooms. Although this difference in organisation could be based on how the school leadership has allocated space to its management team, it is an undisputable fact that the former Model C schools have better facilities than township and informal settlement schools. The school organisation of its infrastructure do not provide township HODs with the space that is conducive to do their instructional leadership work.

Release time is one of the HOD role challenges facing some HODs across different contexts and some countries (Collier *et al*., 2002; Glickman *et al*, 2011). Only two HODs of those we followed up with interviews mentioned that they had some release time to do their HOD work but most do not. These HODs indicated that they have fewer teaching periods and hence have

some release time. The allocation of release time is a prerogative of the school leadership as they are the ones who could design staff timetables for each school year such that HODs got some release time from their teaching duties to do their HOD duties. The former Model C schools HODs only responded that they were being overworked but not specifically with reference to release time. The findings reveal that the challenge of the release time is still a challenge to HOD instructional leadership in all countries despite the shift to distributed approach to leadership (Koh *et al*, 2011). Those to whom leadership had been 'stretched over' such as science HODs did not receive the accompanying release time.

Having compared the allocation of space and release time of HODs by different school types and arrangements, we looked at how these organisational infrastructure arrangements translated into the running of the subject departments. Firstly, in this section we discuss how the instructional leader's qualifications influence NS teaching in the different schools. Secondly, we discuss one of the means of influencing instruction and the subject/departmental meetings.

Attributes of science HODs

Qualifications of HODs

The HOD's role and position, although formal, has not been clearly outlined in the education department's policy documents in South Africa (DoE, 1999). The PAM document only mentions that an HOD will be responsible for the effective functioning of the department and organise relevant/related extra-curricular activities so as to ensure that the subject, learning area or phase and the education of the learners is promoted in a proper manner (DoE, 1999, p10). This role ambiguity (Zepeda & Kruskamp, 2007) lends it to various interpretations by different individuals in different schools (Stephenson, 2010). The context in the different schools also shapes how the role is enacted by HODs and perceived by school leaders and teachers. For a federal subject such as NS, it was important that the appointed HODs were able to support teachers in all the science disciplines of the subject. If not, the school should have had an organised structure and system of how all the disciplines would be supported.

We looked at HODs who occupied formally designated positions. Each school in the study had at least one HOD responsible for NS. The qualifications of the HODs differed from school to

school. The HODs also have other subjects, especially FET, that they are responsible for other than NS. It is not that the HODs are not qualified; they are qualified as teachers and have qualifications in some of the subjects that they led in the departments but not NS. This depended on whether the infrastructural organisation of the department was that of a single subject or a group of subjects. Attributes of HODs as one of the components in the conceptual framework and the organisational arrangement of departments as part of the school conditions component of the conceptual framework proved to influence the way HODs led NS instruction in the schools we studied. We discuss the organisational arrangement of subjects in the departments further in the sections that follow.

Institution of professional qualification

While there was no significant difference in the type of institution where former Model C school HODs had professionally qualified, there was however a significant difference with the teachers. A majority of former Model C school teachers had qualified at universities whereas the opposite was true in township schools and informal settlement schools where a majority of teachers and HODs had qualified in teachers' colleges. This difference could be a result of the segregation in that former Model C schools were for white children and their teachers were predominantly white as well. The teachers in these schools had therefore mostly qualified at universities or colleges that were linked to universities unlike the African teachers where teacher colleges were not linked to universities. Until recently, a majority of the teachers in the country had a 3-year qualification, which is also a minimum requirement when applying for teaching jobs (CDE, 2015). This minimum qualification with a status lower than the 4-year qualification might contribute to the type of instructional practices of the teachers and HODs and level of preparation for the beginning teachers. This is one very clear example of where the former segregation of schools resulted in learners from the townships flooding the former Model C schools for 'better education'.

HODs teaching NS

Not all HODs in the study taught the subject or knew what was going on in the NS classrooms. During its allocation of teacher workloads, each school decided whether the HOD would teach the subject or not. It is an arrangement that schools are free to make. Those HODs who do not

teach NS are largely also teachers of senior secondary subjects such as PS, LS and mathematics. They would therefore dedicate most of their time to these subjects and they would know what is going on in those subjects. The NS teachers raised a concern that their HODs are not familiar with the NS subject content.

Some teachers from all school types do not agree that HODs are familiar with NS content because their HODs do not teach NS. HODs are seen as lacking expertise in terms of all types of content knowledge necessary to support the teachers and what is expected of the instructional leader. Literature suggests that an HOD leads instruction by example, providing demo lessons and coaching the teachers (Ghamrawi, 2010). The HODs are expected to be excellent and experienced teachers in their subject who are respected by their colleagues. This is not the case in the schools that participated in the study. There are other contextual factors in these schools that influenced the allocation of subjects to HODs such that they do not teach NS.

Distributing leadership to senior teacher

A few schools in the study had a senior, master or lead teacher system where a particular teacher was assigned the responsibility of supporting other teachers in a particular subject. These positions are either formalised or informal. This system is anecdotally more effective in former Model C schools because they remunerate the senior teachers (from the SGB funds) for the additional hours that they put in supporting other teachers in the subject. In township schools, however, teachers do this voluntarily, either because of their agency (Lai & Cheung, 2013) or without remuneration because the schools have no extra funds other than the salary paid to the formally appointed HOD. Guthrie and Schuermann (2010) affirm that distributed instructional leadership works well with skilled, capable, and competent teachers.

The senior teachers were found to be most helpful in all schools compared to the HODs although township schools did not respond to this question. One possible explanation could be that they did not have senior teachers in their schools. The role of the senior teacher is very important especially in schools where the HODs do not teach NS and those that did, do not have expertise in certain strands of the subject e.g. the PS strand. The concept of the senior teacher encourages distributed leadership especially in departments comprising a group of subjects. Timperley

(2005) argues that distribution of leadership is a result of situation and task at hand. The situation in the schools in the study was that 1) HODs had not specialised in science, had no release time because they were also teachers albeit of FET subjects; 2) NS teachers themselves had not specialised in some strands and needed help. Distributed leadership was a solution that would address this challenge amicably. This, however, is not the case in our township schools. It is not formalised by senior school leadership and there is no reference to these teachers during our interaction with the HODs and teachers except that some teachers indicated that they were senior teachers.

Staff composition of science departments

Most common in all school types was the fact that the NS teachers were older than 40. This is the current reality in the South African education system that most teachers in the system, especially mathematics and sciences teachers, are older than 40. In 2013, there were four times more teachers in their late 40s than in their early 30s (CDE, 2015). Only the former Model C schools had a few teachers younger than 25 and those that were older than 60. This could be explained by the fact that former Model C schools are able to keep their good, retired teachers in the schools for longer by employing them in SGB paid positions because these are fee-paying schools. Because former Model C schools supposedly produced good results, have better resources and working conditions than township and informal settlement schools, they are able to attract younger teachers as well.

The number of teachers that reported to one HOD varied from school to school. The science departments in all schools are mostly made up of less than ten teachers. Most of the schools' science departments comprised more than NS as a subject irrespective of the school type. The science departments tended to include teachers of all sciences including agricultural, earth, environmental, life, natural and physical sciences. In some cases, the science departments included mathematics, mathematical literacy and technology education. It was expected that technology education would be included in the science departments because with the curriculum revision it had been part of the NS curriculum although it was later excluded in the new grade 8 and 9 curriculum (DBE, 2011). A number of science and mathematics initiatives in South Africa are termed mathematics, science and technology (MST) or science, technology, engineering and

mathematics (STEM) projects, which would always include mathematics and technology. It is natural then for the science departments to comprise all these subjects. This finding was different from studies in other countries (Blasé & Blasé, 2000; Brown *et al*., 2000; Harris *et al*., 2011) where a department comprised one subject such as mathematics or English. In these schools the different subjects would not compete for time and attention from the HODs.

The department of education's policies and staff establishment does not specify what the composition of the science department should be; it only allocates the HOD position to the school. The school must appoint the HOD to his/her department and allocate subjects that will form part of it. Two schools in this study (Knowledge and Mooredale) were confronted with this situation. NS was separated from other subjects to be a department on its own. The biggest challenge with the arrangement of the science department with subjects from junior and senior secondary phases is that the subjects tended to be treated unequally. The senior secondary school subjects are used in the systemic exit examination to measure the quality of education nationally and they therefore receive more attention than junior secondary school subjects. This was confirmed during the departmental meeting observations as well, where the largest amount of the subject meeting time was dedicated to senior secondary school subjects such as physical and life sciences. We discuss this observation in detail below.

Subject/departmental meetings

Regarding meetings, we observed three major differences in the schools. These differences could not necessarily be traced to school segregation.

Firstly only one township school, Knowledge, has an NS subject department while the other five township or informal settlement schools that we followed up have departments comprising a group of subjects. Knowledge's arrangement is an exception to the rule in that the organisation of subjects is a breakaway from a bigger department after the school realised that the department was too big and NS issues were lagging behind. Also, this HOD is particularly organised in terms of filing and keeping records. She is very conversant with the subject and its demands and has practical examples of how she supports teachers. This, could be argued, is because she has

taught the subject in the previous years. She also has some release time and could therefore focus on supporting teachers in her department as encouraged by Glickman *et al.* (2011).

Secondly, the one former Model C School that we could follow up has a department comprising a group of subjects and is headed by a mathematics HOD, however it is the only one where there is an arrangement for subjects to meet separately and address particular subject concerns directly. This is also the only school in the study that utilised the expertise of the senior PS teacher to provide support particularly with PS assessment tasks and teaching the two PS strands of NS. Timperley (2005) argues that leadership can be distributed based on the task and the situation. This was not the case in the schools that we studied.

Thirdly, in all the schools that we followed up and where we observed meetings, only the former Model C School had the principal sit in at the subject meeting as an observer but also to understand the subject challenges first hand. This is seen as a very good example of support that the principal could show to the HODs as suggested in the literature (Angelle & DeHart, 2011; Blasé & Blasé, 2000; Klar, 2012).

These differences in the arrangement of the departments led to the varying quality of the discussions during subject meetings. In two schools (Knowledge and Mooredale) because the meetings were subject meetings and not departmental meetings, issues pertinent to the teaching and learning of the subject were addressed. The whole meeting was spent on NS without sharing it with other subjects. Teachers were able to voice their concerns about the subjects and the learner receptiveness. The meetings ended with concrete suggestions of the next steps to improve the teaching and learning of NS.

What was common in all the other schools was the content of departmental meetings, which focused on compliance issues and preparation for common tests or examinations. Because there were both junior and senior secondary subject teachers in the departmental meeting, they rushed through the discussion on the junior secondary subject (NS) and spent the rest of the time on the senior secondary school subjects and all the deadlines that had to be met. The frequency of the meetings was most commonly once a term in all township schools. This was contrary to the

findings revealed by literature where subject meetings were used for staff development and preparing instructional materials (Burch & Spillane, 2003).

The exception is Mooredale (former Model C School) which had subject meetings more frequently (every month). The frequency of the meetings results in more subject instructional and pedagogical approaches being discussed in this school than the rest of the schools. Burch and Spillane (2003) affirm that the frequency and content of teacher interactions with one another is what makes a difference and this becomes a fundamental part of the professional life of teachers instead of scattered workshops her and there. The township schools that met only once a term tended to focus on assessment and other deadlines, considering the short duration of the meeting as well, which we discuss below. Sometimes the deadlines and urgent issues resulted in the cancellation of subject or department meetings.

The departmental meetings happened during lunchtime and irrespective of school type, the meetings were very short. Some schools mentioned that they tried to have the meetings in the afternoon after lessons or during the sports day. In a short space of time, less than an hour, all subject concerns that had been accumulating during the term had to be addressed. It was therefore not possible to do justice to subject instructional discourse. There could be two reasons for the short duration of time and lower frequency of meetings: Firstly, the school leadership is not prioritising these meeting and do not attach much importance. This shows that the meetings are not formalised and prioritised by the school leadership to the extent of allocating them time. They are considered less important than extramural activities, which were at least allocated time. Teachers had to sacrifice their own lunchtime to attend these meetings. This was also evident in the number of times that these meetings were postponed in some schools during the data collection cycle. Principals did not prove very supportive to HODs in terms of scheduling and protecting time for these meetings contrary to the studies in other countries (Klar, 2012).

Secondly, the school leadership preferred that HODs provided grade leadership (that meant all subjects in the grade) and or lead phases (e.g. grades 8 and 9; grade 10-12) instead of being loyal to their teams and subject disciplines (Bennett, Wise, Woods & Harvey *et al*., 2003).

Although this preference by principals is not explicit, it is conspicuous in the allocation of school committees that science HODs lead and other administrative duties that are allocated to them.

The fact that the school leadership did not provide time or prioritise these meetings is also seen in the way that subjects are allocated in different departments. The allocations show very little appreciation of the role that the HOD plays in supporting the teachers in his/her department. The overall analysis suggests that there are more interactions regarding senior secondary subjects teaching than NS teaching in the meetings. HODs resorted to curriculum management as a refuge for avoiding instructional leadership as observed by Barnett and Aagaard (2007). There is more discussion about assessment and compliance demands in township schools than the content and actual teaching of NS that was witnessed at the former Model C schools.

CONCLUSION

The conclusion presented hereunder takes cognisance of fact that generalisations are limited to the schools in the study. The success of the science HOD in supporting instruction depends on how the school has arranged its systems and infrastructure to support instruction. The school leadership plays a major role in designing these organisational infrastructures. The instructional leadership practices of the HODs are shaped by these organisational structures and systems and are contingent to what the school context is. Although the segregation of schools happened over twenty years ago, the playing field has not been levelled yet and the schools are no closer to desegregation. Former Model C schools are better organised by way of human resource and infrastructurally to support NS instruction. The findings of this study have offered evidence that the differences in instructional practices are related to differences in organisational infrastructure linked to the segregation of schools. The findings show that a department comprising of a subject is better managed than the one with a group of subjects. A science HOD for NS alone supports instruction better than leading many subjects in the department as in Knowledge and Mooredale schools. The findings also reveal that the principals of township schools are not as supportive to the instructional leadership role of the HODs as former Model C principals. The principals have not put systems in place to support the functioning of subject departments especially regarding NS.

The findings and analysis suggest that the department of education should relook the arrangement of departments in schools and make recommendations to schools to rearrange the subjects such that junior secondary subjects are not grouped with senior secondary subjects. The rearrangement of departments will not have any financial or human resource risks but would enhance the instructional leadership practices of science HODs with regard to NS. This will need to be coupled with a plan to manage the transition and progression from the junior secondary to the senior secondary phase. The NS HOD will be able to provide enough attention to the subject while the physical and life sciences HOD would focus on preparing learners for matric examinations. In this way, the NS teachers would not feel neglected. We therefore argue firstly, for the separate arrangement of HODs into GET and FET HODs and secondly allowing the HODs to be subject leaders for subjects that they specialise in and not grade or phase leadership, as is currently the case in some schools. There is a need to specify the arrangement and composition of subject departments, especially federal ones such as science, in the policy document to facilitate effective leadership of departments and hence improve instruction.

Limitations

Our work is limited in that we did not do on the job HOD observation on a day-to-day basis; however, subject meeting minutes suggested some activities that the HODs engaged in on a daily basis. Future research might systematically do case studies of the different school types to examine instructional leadership differences. The limitations existing as a characteristic of the small sample size means that the results could not be generalised but only be interpreted for this study's findings.

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ARTICLE 4

TEACHERS' VIEWS ON THE QUALITY OF NATURAL SCIENCES INSTRUCTIONAL LEADERSHIP IN SIX GAUTENG SCHOOLS

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ABSTRACT

With the increase in demand for practical school-based assessment tasks, natural sciences (NS) teachers are increasingly in need of professional support that will improve their subject instruction. The demand is for the provision of instructional leadership, either formally by the head of department (HOD) or the district subject advisor, or informally by the senior, lead or master teacher, or a peer in the schools, so that NS teachers can develop quality instructional materials. This paper seeks to understand teachers' perspectives on the type and quality of instructional leadership for NS teaching and how this leadership is adapted to implement the curriculum successfully in the classroom. This research identifies key instructional leadership areas that reflect the status of teachers' expectations of the leadership provided by HODs at schools. This was a mixed methods study, in which the dataset consisted of questionnaires completed by 112 teachers, from which a subset of six schools were purposefully selected, and at which semi-structured interviews were conducted with NS teachers. Ten teachers from the six schools were chosen purposively but also for ease of access and availability. Five cluster meetings held by subject advisors were also observed. The study found that some of the NS teachers were novices in the teaching of some sections of NS and thus tended to seek help from their peers because of insufficient (less than expected) and inaccessible leadership provided by HODs. This paper argues for the distribution of leadership by recognising the contribution made by senior, leader or master teachers to the professional development of NS teachers in general. It also argues for a differentiated allocation of science HODs, such that junior secondary school

subjects are not grouped with senior secondary school subjects. The paper will contribute to an understanding of the function of subject leadership beyond formal positions in the South African context.

Key words: instructional leadership, senior teachers, head of department, natural sciences

INTRODUCTION

Compared to their senior secondary school counterparts, the primary and junior secondary science HODs have a more complex task of leading in a multidisciplinary context, where the offerings are less specialised. Natural Sciences (NS) is a junior secondary subject that belongs to a group of science subjects (Ng, Nguyen, Wong & Choy, 2015) constituting the science department in secondary schools. In the South African context NS lays the foundation for at least four high school subjects, viz., physical sciences (PS), life sciences (LS), geography and agricultural sciences. The curriculum in South Africa has been revised and the sequence and progression of topics within NS have been reorganised. One of the key prescriptions of the new curriculum in South Africa is the need for school-based assessment tasks for each science discipline of NS (DBE, 2011).

The multidisciplinarity of NS and complexity of the HOD role has led us to explore the perspectives of NS teachers regarding the quality of instructional leadership that they receive. Furthermore, we explored the support provided for teaching NS in the context of it being a junior secondary school subject that competes with main gateway subjects such as mathematics and PS within the structural arrangement of science departments in schools (Naicker, Chikoko & Mthiyane, 2013). Spillane and Hopkins (2013, p. 2) call this structural arrangement of departments in schools 'a system and organisational infrastructure'. This arrangement of departments in most secondary schools brings together a group of subjects, such as mathematics, mathematical literacy; life, natural and physical sciences, and is headed by an HOD. The HOD, who is a subject specialist (Angelle & DeHart, 2011; Wanzare, 2013) in one or two of these subjects, is responsible for establishing and ensuring high standards of teaching and learning in the subjects. Considering a conglomerate subject such as NS, with its particular demands, culture

and philosophies, we focus on the support that NS teachers need and receive in order to improve their instructional practices.

In this paper we firstly focus on biographical data of teachers from all the schools in the study, because this informs the needs and expectations of the teachers regarding HODs' professional capacities. The teachers' needs are likely to challenge the HODs' ability to build relationships and collegiality (Ghamrawi, 2010) and to develop teachers, as well as the agency of the HODs or other teachers regarding equipping and resourcing his or her department (Angelle & DeHart, 2011; York-Barr & Duke, 2004). The biographical data included profiles of the teachers, information on their subject proficiency and their experience in teaching the subject. The extent to which the HODs negotiated, distributed and shared leadership with members of his/her department would also be investigated.

Secondly, we investigate the means of influence that HODs use to maintain focus on the core of the curriculum, i.e. teaching and learning (Spillane & Hopkins, 2013), as the vision of the department. Some of the means of influence included informal interactions (Printy, 2008) or formal means (such as subject meetings) and co-creating and using routines and artefacts (Halverson, 2003; Naicker *et al*., 2013). The third focus is on the professional development of NS teachers. Since the change in curriculum, NS teachers need more support to develop and score practical assessment tasks, among other tasks that are now prescribed by the new curriculum (DBE, 2011). This support could involve mentoring (Koh, Gurr, Drysdale & Ang, 2011; Naicker *et al*., 2011) and demonstrations, which some teachers prefer because they would rather learn from one another's classroom practice than from formal programmes offered at universities. Such professional development support should be based on the teachers' own contexts, goals, knowledge and learner needs (Vercio, Ross & Adams, 2008) as well as reflective and collaborative work expected at the schools (Glickman, Gordon & Ross-Gordon , 2011; Wanzare, 2013).

We used a mixed method study of six schools in two Gauteng school districts to examine how teachers view NS instructional leadership at their schools. We specifically examined how different schools provided support in the form of professional development, classroom

observation, mentoring and coaching, whether by the HOD, senior teacher or peers. In this paper we identify different modes of instructional leadership and explore opportunities for and practices of HODs or teachers to support instruction, because leadership is enacted within the practical constraints of a local context (Hallinger & Heck, 2011). Spillane (2006) argues for distributed leadership, and we explore whether the distribution is formalised or whether teachers use their agency, as suggested by Sherer (2008), to take up leadership opportunities.

Based on our analysis we argue, firstly, that teachers need available and visible leadership. The access to leadership positions should not only be based on seniority or position, but also the expertise and experience of the teachers as well (Ghamrawi, 2010). Secondly, we argue that the specialisation of NS teachers informs the kind of professional leadership and support that they will need and expect their institutions to provide. Thirdly, we argue for the need to institutionalise the concept of master/senior teachers, particularly for providing support to teachers in a multidisciplinary subject such as NS, which comprises five or more subjects but has a lower status than PS and mathematics in the same department. In conclusion, we recommend that the allocation of science HODs be separated into junior and senior secondary phase HODs and that school leadership recognises the senior or master teachers as having sufficient expertise to provide instructional leadership, and affords them the kind of support and opportunities that they need to improve instruction.

In the next section of the paper, we first discuss the conceptual frames and literature that informed the analysis of data. We then discuss the mixed methods approach that we used to collect data. Our findings advance and support the main proposition of our conceptual framework, namely, that teacher interactions about instruction, whether formal or informal, are necessary means of improving instruction. We then relate the need of NS teachers for instructional support to their interactions with colleagues, HODs and subject advisors that will lead to some form of development. We do this by showing how teachers exercise their agency to support one another, even if the teacher providing support lacks the formal title of HOD. We conclude with a discussion of the implications of our findings for further research, policy and practice.

LITERATURE AND CONCEPTUAL FRAMEWORK

Studies on teacher leadership in South Africa have focused on the context and culture of schools where such leadership is practiced (Naicker *et al*., 2013; Smith, Mestry & Bambie, 2013). Most studies have focused on principals as instructional leaders (Bush, 2013) and those that targeted HODs investigated all HODs in the schools and focused on senior secondary work (Bambi, 2013). This study investigates subject-specific instructional leadership (Spillane, 2005) because subjects have different cultures and philosophies and some subjects, such as NS, are conglomerate subjects. The phase where the subject is offered and the status of the subject in the schooling system influence how the subject is taught and how resources are allocated for teaching the subject (Turner, 2003). HODs see themselves as subject experts, while the school leadership expects HODs to provide whole school leadership at grade or phase level (Bennett, Wise, Woods & Harvey, 2003). Changes in the curriculum necessitate that teachers be prepared and receive instructional support and guidance to implement the changes successfully. HODs have better expertise than principals to provide this support and guidance in schools (York-Barr & Duke, 2004).

Instructional leadership

Instructional leadership involves sharing the vision with followers, monitoring the instruction and assessment standards, allocating resources and reflecting on the outcome of the instruction (Koh *et al*., 2011; Harris, Busher & Wise, 2011). York-Barr and Duke (2004), however, explain instructional leadership as having shifted from these functions, to a process whereby teachers, individually or collectively, influence each other in order to improve their instructional practice. This influence over colleagues is regarded as a key component of leadership practice (Melville, Jones & Campbell, 2014). It is teachers' views about being influenced by peers in professional matters that are therefore considered as indicators of leadership success. The leadership process involves the leaders' ability to involve their colleagues collaboratively in mutual development and learning, with the aim of improving teaching and learning. Lai and Cheung (2013) define instructional leadership as a collective undertaking that is constituted by collaboration of leaders and followers to perform leadership tasks at various contexts and levels in order to focus on changing and improving the culture, teaching practices and student learning. It includes key aspects of teachers' professional lives, such as curriculum and staff development, the planning

and assessment of learning, and organisational and institutional evaluation. In this paper, instructional leadership will be used to mean all processes and practices by anyone in the school and the education district that positively influences professional matters relating to the teaching and learning of NS.

The South African Department of Education (DoE, 2000) identifies the following as areas of instructional leadership when it conducts whole school evaluation: setting up staff development programmes, classroom visits and follow-up, monitoring learners' work, assisting teachers with lesson plans, discussing learner progress, moderating tests and examinations and induction of new teachers. We explore the views of NS teachers on these instructional leadership practices. Teachers know the kind of support, leadership and development that they need and they know the people within and outside the school who are likely to provide this support. It is in understanding this need and appreciation of their colleagues that teachers exercise their agency and look for help or take up leadership opportunities in and around the school (Sherer, 2008). Below we explore literature on the reasons for teachers' need for instructional leadership and support.

Changes in the curriculum

The South African Department of Basic Education (DBE) recently introduced a new Curriculum and Assessment Policy Statement (CAPS) with the aim of raising standards of education outcomes in the country (DBE, 2011). In addition to CAPS, school-based assessment tasks (SBAT) have been introduced for each subject. Teachers are expected to create their own assessment tasks. Because teachers are the agents who implement the curriculum in the classroom, curriculum change can only be implemented successfully if teachers are adequately prepared for change. Although SBATs are important for the development of teacher professionalism (DBE, 2011), it has been observed that NS teachers are not fully equipped with the skills and knowledge demanded by the subject (Umalusi,[1] 2008). The Umalusi (2008) evaluators suggest that teachers lack 1) resources to prepare for practical work, 2) subject expertise, 3) knowledge and skills to develop SBATs, and 4) time to plan and reflect on the curriculum. In the same context, Kriek and Basson (2008) argue that the challenges identified

[1] Umalusi is the Quality Assurance and Examinations Council, responsible for the schooling sector in South Africa.

regarding training, professional support, lack of resources and teachers' poor subject content knowledge, cannot be fixed by changing the curriculum. The recognition of these challenges by school leaders has marked an increasing shift of responsibility to HODs, in particular, as curriculum leaders, to support teachers in the development of SBATs and the implementation of the new curriculum. The role of HODs as instructional leaders has become invaluable in schools. However, the ability of the HODs to meet this demand could be limited for a number of reasons, ranging from role overload (Feeney, 2009) to role conflict and ambiguity (Kruskamp & Zepeda, 2007), to lack of release time (Glickman *et al*., 2011) and own specialisation. We need to determine what the NS teachers' views are regarding instructional support in junior secondary schools.

The role of the HOD

The HOD, as a formal instructional leader, is identified and appointed from among experienced teachers who are either lead, master teachers or consultants who had been brought in as mentors or action research facilitators (Melville *et al.*, 2014). In South Africa, the HOD position has a statutory delegated authority (Mbatha, Grobler & Loock, 2006). As part of the role, HODs are expected to set subject goals and expectations for achievement, to monitor achievement levels (for both teachers and learners), evaluate instructional practices and learning, maximise the effort of the instructional organisation and conduct staff recruitment and appraisal (DoE, 1999). The HODs' role is characterised by complexity and contingency (Hallinger & Heck, 2011) and this is compounded by conflicting expectations of principals and teachers. HODs have a dual hermaphroditic role – they are expected to be teachers and administrators (Siskin, 1994), administrators and managers and managers and leaders. Wise (2000) maintains that the legitimation of the HOD's role emanates from acknowledgement by members of the subject department that the HOD is generally knowledgeable about the subject and the development of all relevant instructional materials. Furthermore, HODs are expected to conduct class visits, model best practices, provide templates and guidelines and provide teachers with feedback to improve their teaching (Wanzare, 2013).

Literature reveals that HODs' time is consumed by administrative work and that they do not often get release time (Brown, Rutherford & Boyle, 2000) to focus on instructional leadership

issues. The Personnel Administrative Measures (PAM) document (DoE, 1999), which guides HOD functions and mandates in South Africa, expects HODs to teach 85% of the time and to dedicate only 15% of their time to HOD duties. There is very limited opportunity for HODs to lead by example, identify and model good practices and share this with the teachers they lead. This lack of time and sometimes expertise in the subject suggests that HODs extend leadership (Spillane, 2006) to teachers with expertise and experience in their departments.

Distributed leadership

Leadership need not be located only in the principal, as some studies have reported (Hallinger, 2005; Leithwood & Jantzi, 2000) but can be 'stretched' over multiple leaders (Bendikson, Robinson & Hattie, 2012; Timperley, 2005), including HODs and even teachers. Leadership has ceased to focus on certain strong leaders with exceptional powers and is now described in terms of 'activities and interactions that are distributed across multiple people and situations' (Timperley, 2005, p. 395). Even then, subject leadership need not be located only in HODs because they have formal positions. Spreading leadership responsibilities over multiple leaders becomes even more relevant in light of the fact that science HODs have to lead a federal department, where their expertise might not cover all science disciplines. Spillane (2006) warns that instructional leadership should move beyond the principal or head teacher to include other potential leaders too. This change shifts the focus of leadership to the relationships of actors (both leaders and followers) and on their situations. Spillane (2006) concurs that the distribution of leadership among both positional and informal leaders and the actual division of labour in the workplace strengthens the effectiveness thereof.

Conceptual framework

The conceptual framework used in this study shows how the instructional leader's characteristics and his/her knowledge of the content and context and its problems can be integrated to provide leadership through effective interactions with department members, and influence their teaching choices (Robinson, 2010). Six major components of leading instruction have been identified in the literature and are discussed briefly.

The first component of the framework is the leader's personal attributes, such as subject proficiency, professional credibility (Angelle & DeHart, 2011; Wanzare, 2013) and agency in resourcing the department. The second component is leadership practices which include vision setting, building collegiality, developing teachers and the way in which leadership is distributed among the department's members (Koh *et al*. 2011). The third component involves the way HODs negotiate their influence through the schools' social, political, economic, cultural and other contextual problems (Robinson, 2010).

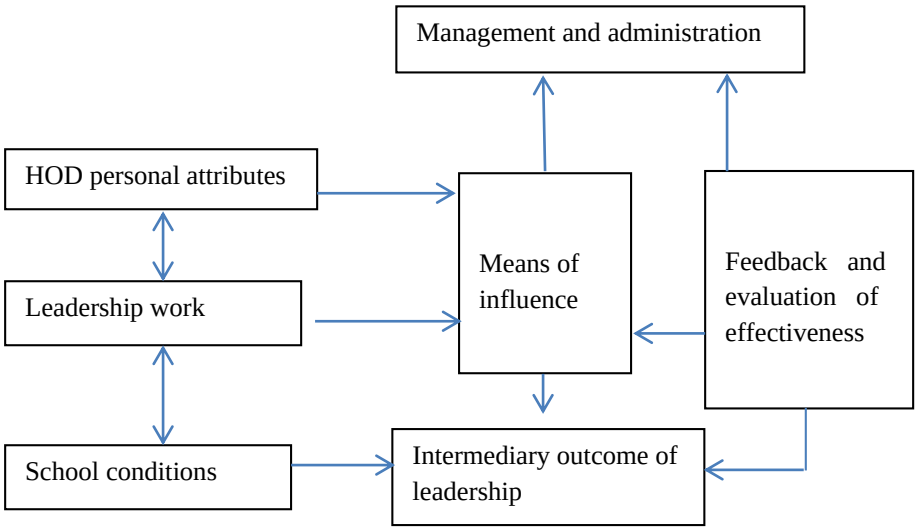

Figure 1: Abridged version of the conceptual framework for leading instruction (adapted from York-Barr & Duke 2004).

The fourth component investigates the way HODs influence teaching choices through setting instructional objectives, planning instruction and developing reflective practice using mentoring, coaching, professional development, classroom observation feedback sessions, subject meetings and action research (York-Barr & Duke, 2004). The fifth component encompasses management and administration, which overarches the role of managing people and resources (see Figure 1).

The sixth and final component introduces the feedback loop and evaluation of the effectiveness of leadership. This paper focuses on only one component, the means of influence adopted by those who provide instructional leadership, whether formally or informally, to improve NS instruction.

Using the conceptual framework developed above, this study examines the kind of instructional support that teachers receive and identifies people who provide such leadership and support, by asking the following questions:

1. What are NS teachers' views regarding the kind of instructional leadership and support they need and receive to improve teaching and learning?
2. Who are the key role players who provide instructional leadership in NS teaching and learning?

METHODS

The current study was a mixed methods sequential explanation of HODs' and other teachers' instructional leadership practices, which integrated data collected from distinct quantitative (numerical) and qualitative (narrative) phases (Creswell & Plano-Clark, 2011). We first collected and analysed quantitative data from the first phase. The second phase built on the first phase. Qualitative data were collected and analysed next to help elaborate on the quantitative phase results (Creswell & Plano-Clark, 2011). The findings were integrated, thereby achieving a deeper and broader understanding of and corroborating the research problem. The researchers considered the importance of matching the research methodology with the purpose and context of the research in order to generate an understanding of what NS teachers think about the instructional leadership, the support they receive and the kinds of steps they take to meet their professional needs (Cohen, Manion & Morrison, 2011). In total 243 schools from four Gauteng Provincial Districts were invited to participate in the quantitative survey study. A subset of this sample (Teddlie & Yu, 2007) was selected for in-depth semi-structured interviews, participant observations of department/subject meetings and document analysis.

Sources of data

Data were collected using self-report techniques (questionnaires and semi-structured interviews), observational methods (participant observation) and secondary data analysis from artefacts and school documents (Teddlie & Tashakkori, 2012). The quantitative study used full-group data for 243 secondary and combined schools (all the schools with Grade 8 and 9) in four of the 15 districts in the Gauteng Province. The questionnaires targeted NS teachers, and explored their perspective on science HODs' instructional leadership practices and the frequency thereof, and

who else the teachers found useful in meeting their professional needs. The last section of the questionnaire collected biographical data of teachers. Completed questionnaires were collected from 77 schools (31%). The data from questionnaires were analysed for trends and from the data schools were identified for qualitative data collection. The qualitative data were collected from a purposeful sample of schools using semi-structured interviews, meeting observation and documentary analysis (Creswell, 2014). Ten NS teachers from six schools in two districts were engaged in in-depth semi-structured face-to-face interviews; field notes were also taken. The interview schedule focused on the teachers' need for professional support and the different role players who provided such leadership and support.

We also observed five cluster meetings that had been arranged by the two district subject advisors. The teachers who attended cluster meetings taught Grades 7-9. The venues were packed, even overflowing. No register was taken; some teachers came late, some left early, as they travelled in groups. The meeting agendas were the same for each cluster in the district but differed for each district. The cluster meetings of the two districts that we observed differed in the kind of instructional support that was provided. One district provided an outline of the upcoming term's content. The subject advisor used the 'chalk and tell' approach and missed many opportunities to share information with teachers about misconceptions that she had identified in the content. She merely read the content of her presentation, outlining the content for the term. Even when the teachers displayed doubt and misconceptions in their understanding at the meeting, for example, about the definition of certain concepts, the subject advisor did not take the opportunity to address and correct those misconceptions. The second subject advisor only explained the structure of the common examination that would be written and made announcements about upcoming science competitions. These announcements could have been sent to each school with the examination guidelines.

Analysis

Quantitative data were analysed descriptively. Interviews were recorded and transcribed and the data were coded and interpreted into themes using literature on instructional leadership and the conceptual framework.

FINDINGS

This section presents initially the profiles of the teachers in the study and then arranges the findings according to the themes that were highlighted by literature.

Profiles of the teachers in the study

Teachers were asked to indicate their qualifications and specify the areas of their specialisation. Although most teachers were qualified as teachers with either secondary education diplomas or degrees, 8.1% of teachers were not qualified to teach at secondary school level at all – they possessed matric or primary teachers' certificates or diplomas (PTC/D), as shown in table 1.

Table 1: Qualifications and gender of teachers, N =103

Qualification	number	%	male	%	female	%
Matric	5	4.4	1	1	4	3.8
Primary Teachers' Certificate or Diploma	5	4.5	3	2.9	2	1.9
Secondary Teachers' Diploma	17	15.2	7	6.8	10	9.7
Advanced Certificate in Education	20	17.9	7	6.8	13	12.6
B degree	24	21.4	11	10.7	13	12.6
Postgraduate Qualification	32	28.6	13	12.6	19	18.5
Total	103	100	42	40.8	61	59.2

Among the 28.6% of respondents who possessed postgraduate qualifications, 12.5% of them (postgraduates) had specialisations that were not related to what they were teaching (science). The table also shows that the majority of NS teachers in the study were female (59.2%).

Table 2 displays the ages of respondents and the types of institutions where teachers had qualified. Age and type of institution were combined because older teachers in township schools anecdotally had attended teacher colleges. The institutions of initial teacher training were formerly just as segregated as the schools.

Table 2: Institutions of professional qualification and age range of teachers, N=98

Institution	<25 yrs.	%	25-29 yrs.	%	30-39 yrs.	%	40-49 yrs.	%	50-59 yrs.	%	60+ yrs.	%
College	0	0	0	0	8	8	31	32	8	8	1	1
University	8	8	4	4	18	18	14	14	4	4	0	0
Unqualified	0	0	0	0	0	0	1	1	0	0	1	1
Total	8	8	4	4	26	27	46	47	12	12	2	2

Most of the teachers, 61%, were 40-years and older and two thirds of those older than 40 years had qualified from teacher colleges and not from universities. This meant that they had 3-year qualifications, as opposed to those who had qualified at universities with 4-year qualifications. About 12% of the teachers were younger than 30 years and all of these teachers had qualified from universities. There were no unqualified teachers younger than 40 years of age.

Table 3: Teaching experience of teachers

Experience teaching subject	Grade 8 Natural Science		Grade 9 Natural Science		Grade 10 Physical Science (%)		Grade 11 Physical Science (%)		Grade 12 Physical Science (%)	
	N	%	N	%	N	%	N	%	N	%
1-2 years	23	20.5	18	17	15	13.4	9	8.0	5	4.5
3-5 years	20	17.9	20	17.9	14	12.5	10	8.9	5	4.5
6-10 years	22	19.6	22	21	6	5.4	4	3.6	4	3.6
>10 years	17	15.2	17	15.2	12	10.7	7	6.3	4	3.6

Table 3 shows that more than a third (36.7% on average) of the teachers had less than five years of experience teaching grade 8 or 9 NS. Only just over a third (35%) of the teachers had more than 5 years NS teaching experience. More than a third (41%) taught grade 10 PS, over a quarter (26.8%) taught grade 11 and 16% taught grade 12 PS irrespective of the experience. PS teaching was explored because of the poor performance of South African learners in this subject and the shortage of PS teachers. It was important that teachers had experience of teaching the subject in the junior and the senior secondary levels, for the sake of continuity and progression. Teachers should be able to teach across the grades and phases e.g. teaching grades 6 and 7 or grades 9 and 10 to build competency in the subject matter knowledge. The teacher would then build his understanding of what junior secondary learners are exposed to, how they respond to the content

and also what is expected in the senior secondary level, so that the teacher can prepare the learners accordingly (Smith *et al*., 2013).

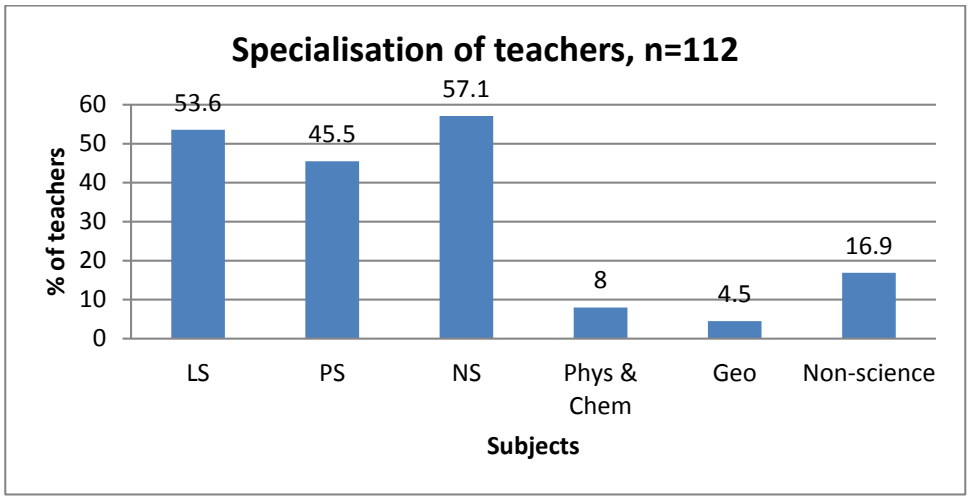

Figure 2: Teacher specialisation

Just over half of the teachers in the study (53.6%) had specialised in LS, which covers a quarter of the NS syllabus (life and living). About 46% of the teachers had specialised in PS, which covers half the syllabus (matter, materials and energy). Almost two thirds (57%) of the teachers had specialisation that enabled them to teach all the NS disciplines.

Seventeen per cent of the teachers were not qualified to teach any of the NS science disciplines. We interviewed ten teachers who had responded to the questionnaire and agreed to be interviewed. These teachers were selected because, 1) their HODs also responded to the questionnaire, 2) their schools were representative of the diversity of schools in Gauteng, and 3) the location of their schools was convenient for the researchers in terms of travelling distance. Table 4 below provides biographical information of the sample of teachers we interviewed.

Some of these teachers were teaching NS for the first time. Three of these teachers, each from a different school, had the following to say about the experience of teaching NS:

> *I can't really say it's 4 years because this is my first year in natural sciences (Teacher 4, Knowledge).*

> *No, it is my first year I am doing NS (Teacher 7, Willowdale).*

I am not sure because I am new this year in NS (Teacher 2, Sheba).

Table 4: Biographical data of teachers interviewed

Interviewee	Gender	Age range (years)	Institution of qualification	Qualification	School	Experience teaching NS (years)
Teacher 1	F	<25	University	B degree	Promise	3
Teacher 2	F	40-49	University	B degree	Sheba	1
Teacher 3	M	40-49	Teachers' college	Secondary Teacher's Diploma	Knowledge	>10
Teacher 4	F	40-49	Teachers' college	Secondary Teacher's diploma	Knowledge	<1
Teacher 5	M	40-49	University	Advance Certificate in Education (Afrikaans)	Fhutura	2
Teacher 6	F	40-49	University	Advance Certificate in Education	Willowdale	>25
Teacher 7	F	30-39	Unqualified	Hospitality - unqualified	Willowdale	<1
Teacher 8	F	30-39	University	IT - unqualified	Alpha	5
Teacher 9	F	40-49	University	B degree	Knowledge	6
Teacher 10	F	40-49	Teachers' college	Secondary Teacher's Diploma	Sheba	>10

The section below presents the findings of the study according to the six themes that were significant in the literature.

1. Help with practical work
2. Specialisation effect
3. Role players providing instructional support
4. Subject advisor support from the district
5. Professional development at schools
6. Compliance practices

Help with practical work and resources/apparatus

The teachers were asked about the kind of support that they needed urgently and how they were being supported. One of their top priorities was assistance with experiments, developing assessment tasks, and securing apparatus for experiments and other consumables and resources,

such as textbooks. It was the third school term when we collected data, and this teacher did not even have the NS textbook.

> *[We do not have the] natural sciences textbook. It has been ordered (Teacher 10, Sheba).*

A teacher from another school also lamented the lack of apparatus needed to do the experiments or practical assessment tasks, saying, "*the challenges that we have, is not that the practicals that we are doing are difficult, no, umm, the apparatus is the problem that we struggle looking for the apparatus because we don't have a laboratory here and since we came to Gauteng we have never been given the apparatus" (Teacher 9, Knowledge).*

Other teachers from this and other schools shared the experience.

> *There is no challenge as such but when it comes to the apparatus and the science lab there and that's where you get the challenge (Teacher 3, Knowledge).*

> *And another one, we don't do practicals. We must do practical for Grade 8 and 9. We don't have those [apparatus] things (Teacher 5, Fhutura).*

> *I said, "Sir, please help me here before I can do it [experiment] with the learners". So he supports you with material, I get material – anything that I need I have been able to get from him (Teacher 1, Promise).*

In one case the school did not have enough laboratories and the HOD supported the teacher by permitting her to use the HOD's laboratory.

> *She would provide me with material because I didn't have a lab; if I needed to do practicals I would always use her class, her lab … There were more science teachers than the labs. So if you wanted to do a practical you had to ask a teacher who is occupying a lab so that you use their class (Teacher 1, Promise).*

The HOD also provided support by demonstrating how the experiment should be done.

> *I didn't know how to use that, I have never used it (ticker timer), I have only read [about] it. I had to ask him to demonstrate for me (Teacher 1, Promise).*

The lack of equipment for practical work is one of the key contextual school conditions that HODs at most South African schools have to manage and address, and provide effective leadership to improve the teaching and learning of NS.

Specialisation effect

Because NS is a multidisciplinary subject some teachers struggle with certain topics within the subject. Both teachers from Sheba were LS specialists and were comfortable teaching a quarter of the NS syllabus. This caused a need in the school to develop and equip the teachers for the other science disciplines. The HOD had a big role to play in identifying and correcting this situation.

> *I am good in the field of botany and zoology, but coming to the physics part of it I am struggling (Teacher 10, Sheba).*

Another teacher from this school had a similar problem.

> *As I am saying it is a challenge, because much of the work in there [NS] needs a physical sciences teacher. No, there isn't much, as a life sciences teacher, there's only one part so also much of my time has to be spent revisiting like the periodic tables, the reactions, all those equations ... It is time consuming and it is like now I am also studying on my own (Teacher 2, Sheba).*

In contrast, the teacher below, from another school, was challenged by a different section of the subject:

> *It [teaching NS] is comfortable but the biology part is more demanding and maybe because I am more of the area of physics and chemistry you will find that the biology part there is lots of things which you have to teach. [It could be] because biology is not my real area [of specialisation] (Teacher 4, Knowledge).*

One of the senior teachers concurred that teachers were usually only comfortable with certain sections of the syllabus.

> *They are very eager to do the life sciences but not eager to do the physical sciences (Teacher 6, Willowdale).*

She expressed the opinion that teachers were not adequately prepared for all the subject disciplines.

> *So, basically, you are going to get a teacher that is not fully rounded off in NS. So the physical sciences is, how would I say, the part that they are not comfortable with. The life sciences is fine, they are not prepared to do the experiments, and this is where the subject becomes less and less, how could I say, developed (Teacher 6, Willowdale).*

The teacher from another school struggled with a different quarter of the syllabus, the earth sciences section.

Yah, the problem is earth and beyond. Yah, I think it's geographic. Especially when you go underground, coming to mining and bla, bla. You see I get lost that side. I don't know what to teach learners, to be honest (Teacher 5, Fhutura).

A teacher from Alpha School affirmed.

Last year I was struggling with earth and beyond because I do not know geography myself. I told the HOD and he said he does not have a geography qualification, only maths. I asked the geography teacher to help me (Teacher 8, Alpha).

Teachers struggled with different sections of the four strands of NS, depending on their area of specialisation. The effects of specialisation were not only impacting teachers, but the HODs as well because they have to develop the content and pedagogic knowledge of the teachers. We wanted to find out which colleagues or other people who provided subject leadership to the teachers if the HOD, such as the one in Alpha, could not assist.

Role players providing instructional support

Responses from all the teachers in the study show that HODs were taking responsibility for the quality of science teaching and learning. We asked teachers to rank the HODs' responsibilities in order of importance using a scale 1-5 where 1 represented strong disagreement and 5 represented strong agreement. The highest ranking responsibility was taking responsibility for the quality of science teaching and learning. The next highest ranking responsibility was the setting of common exams, followed by making common decisions and the setting of goals and priorities, as revealed in Table 5.

The other responsibilities involved standards and goal setting, and these were not necessarily contributing to improving instruction directly except setting the goal post. The last four responsibilities however, provided a better picture of the instructional leadership practices of the HODs. They took moderate responsibility to familiarising themselves with the grades 8 and 9 subject goals (ranked 7th) and developing their understanding of what was expected of the learners in each grade (ranked 10th with a mean score of 2.69).

The mean score for providing opportunities to learn, coordinating professional development and helping teachers do well was 3.55 and providing classroom observation feedback was 3.51. This rating was at the border of agreeing and being neutral. These responsibilities were ranked very

low, 8 and 9 out of 10 activities. It can be concluded that HODs did not consider these instructional leadership practices very important to improving instruction.

Table 5: Ranking of HODs' responsibilities, N=112

Responsibilities of HODs	Mean	Rank
HOD takes responsibility for quality of science teaching and learning	4.01	1
The teachers in my department work together to develop common exams/tests for particular subjects	3.95	2
There is a great cooperative effort among my department's members in making decisions	3.93	3
The HOD sets clear goals, priorities, makes plans, and sees that they are carried out	3.92	4
HOD sets high standards of science teaching and learning	3.82	5
HOD coordinates the content of my subjects and rotates assignments	3.73	6
The HOD is familiar with the content and specific goals of the subjects taught by teachers in our department	3.64	7
HOD provides opportunity to learn, coordinates professional development and helps teachers do well	3.55	8
HOD provides classroom observation feedback	3.51	9
HOD understands what learners do and are expected to do in each grade	2.69	10

Though HODs were taking responsibility for the quality of teaching and learning, it was not evident from the interview data how the HODs were doing this, except by doing some management and administrative work for the teachers and submitting departmental reports to senior management. We followed up by conducting interviews with the teachers. Teachers were asked how their HODs supported them. One of the teachers responded:

> *She observes our lessons, the learners' books, checks with the work schedule and how you have been moving with the work schedule and then if there are any problems she highlights them and if you also have problems you also highlight them to her (Teacher 4, Knowledge).*

The teacher from Fhutura was not satisfied with the kind of support she received from the HOD. She expressed her expectations of the HOD.

> *He checks... We are not satisfied in such a way … Yes, [we expect him] to go deeper or to support more…, we've got problems on 1, 2 and 3 but delegates [senior teachers] would help us. They will go deeper in researching those things (Teacher 5, Fhutura).*

We probed to find out who else provided instructional support. We investigated if there were any senior/master or lead teachers at the schools. This school did not have a senior teacher who assisted with natural sciences.

Coming to natural sciences, we don't have. Yes there's an HOD (Teacher 5, Fhutura).

In the questionnaire responses NS teachers rated the senior teacher as the most helpful person slightly more helpful than the HOD and the subject advisor (Figure 3). Because some teachers had indicated that they were senior teachers, we explored other examples of teacher leadership. Teachers were very aware of their subject expertise shortcomings but they also knew who could provide the instructional leadership and support that they needed.

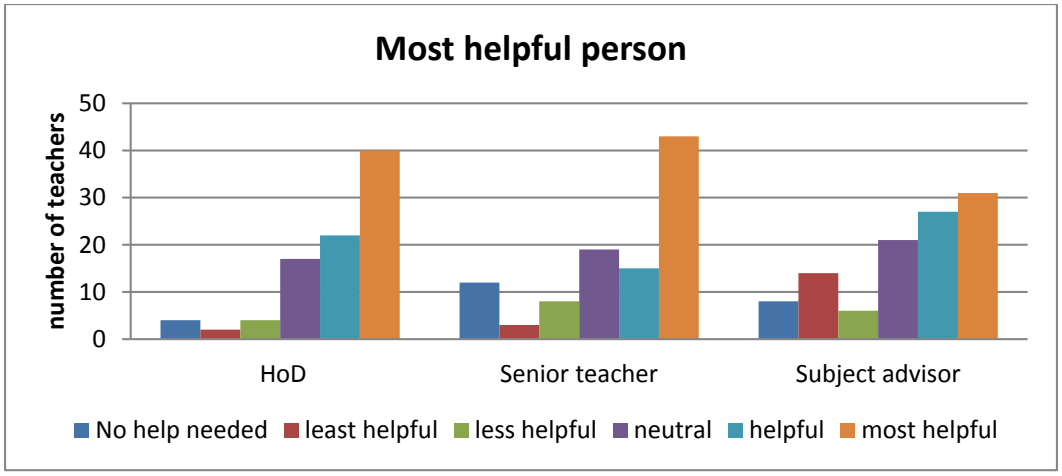

Figure 3: The most helpful person according to teachers' view

In high performing schools (Naicker *et al.,* 2013) the principals ensured that experienced teachers assisted novice teachers in the classroom. For the schools in the study, it was not a matter of teaching experience of NS teachers but rather a matter of expertise and insufficient content and pedagogical knowledge to teach certain sections of the subject that these teachers would seek help from other teachers or HOD. In these schools support was not planned by school leaders, but happened sporadically. The teachers quoted below provided instructional leadership and freely shared their expertise, thereby complementing each other without involving the school leadership.

The other lady came for the physics part of NS. She came to consult with me on something that she didn't understand and we are sharing material. It was the one of calculating weight on the moon. She said she didn't know how to do calculate weight. I don't know because she also teaches isiZulu (Teacher 1, Promise).

The teacher from Knowledge School provided instructional support in another strand of the subject.

> *Last time I even helped Mrs Kim with the part of the cells. She's fully in physics so when she comes to using the microscopes it was not easy with the objective etc. (Teacher 9, Knowledge).*

This same teacher received help from her colleagues in the section of the syllabus in which she was not specialised.

> *I'm usually being helped by Mr Sand and Mr Max (Teacher 9, Knowledge).*

The teacher from Fhutura indicated that he frequently needed help from colleagues, rather than from the HOD.

> *I'm always relying on other teachers; they just show me that now we are doing 1, 2 and 3 because we're sharing [teaching the same grade] and they help me. They just assist me (Teacher 5, Fhutura).*

It is evident that teachers were very open to helping each other and showing some teamwork and collegiality.

> *I think it's a good spirit now because we are working as a team, as a family (Teacher 3, Knowledge.)*

Subject advisor support

We wanted to find out if teachers received support from subject advisors from the local district office or the province, in addition to support from the HOD and other teachers in the school. We observed cluster meetings organised by the subject advisors, about which teachers responded as follows:

> *I can say they [cluster meetings] are useful, depending on the active participation of every member. I like being a listener (Teacher 10, Sheba).*

Teachers from another school confirmed their attendance of the cluster meeting, but stated that it was only for CAPS training.

[We do attend workshops] from outside. Yes, we go outside … [called by] the district, the facilitator. Since from the beginning of the year we attended once, Saturday, it was once. [It was for] CAPS training (Teacher 5, Fhutura).

Not lately, no. When we did, it was CAPS (Teacher 4, Knowledge).

Alpha School seemed to benefit extensively from the subject advisory services. The fact that their HOD was a mathematics specialist could be a contributing factor to their reliance on the NS subject advisor for instructional support. The teacher from Alpha affirmed.

We attend cluster meetings once a quarter. When we attend, we can ask questions like how to treat certain topics (Teacher 8, Alpha).

The HOD from Alpha school indicated that when he did classroom observations and picked up challenges he referred teachers to the subject advisor.

When I see shortcomings, I refer the teachers to the facilitator [subject advisor] (HOD, Alpha).

This HOD also mentioned that he received materials from the subject advisor and relied on these colleagues for subject support.

We receive material from the subject advisor but only on the FET side, not GET. I only saw the specialist once at the school. Otherwise, we go to them when we need assistance (HOD, Alpha).

A teacher from another school confirmed the visits by subject advisors.

Where the subject advisor usually comes to our school then after that it's when we sit down and check the matter that we have discussed there and how we are going to deal with it (Teacher 9, Knowledge).

Subject advisors also visit the schools, mainly to monitor the implementation of SBATs.

Subject advisors will visit schools, depending on their schedules (Teacher 10, Sheba).

Not all teachers, however, saw the need for support from district officials. The teacher quoted below is a senior teacher and probably feels competent to teach NS without the help of the subject advisor. She was a very experienced teacher, with more than 25 years teaching experience.

I have nothing to do with them [district officials] (Teacher 6, Willowdale).

The findings suggest that subject advisors did provide instructional support to most schools in the form of school visits and cluster meetings. Teachers seemed to benefit more when they approached the subject advisors for specific help, than from generic help that was provided at cluster meetings, given that these meetings lasted about 90 minutes, took place once a term and each was attended by more than 50 schools' teachers. Almost all schools in the study demonstrated the need for organised professional development of most NS teachers, because teachers were usually qualified to teach only certain sections of the syllabus and always needed instructional support from colleagues to help them teach those sections that they were not qualified to teach. We probed to find out if the schools provided any professional development.

Professional development at school

Table 6 shows that half the teachers had received either less than six hours or no professional development at all. Approximately 20% of the teachers indicated that they had received more than 15 hours of professional development in the last 12 months, which was about two days of

Table 6: Number of hours of professional development, N=112

No. of hours	No. of teachers	%
None	15	13.4
<6 hours	34	30.4
6-15 hours	26	23.2
>15 hours	22	19.6
No response	15	13.4

training or development. It was later established during interviews that the only professional development that teachers ever attended and that they reported on was CAPS training. Some teachers (13.4%) indicated that they had not attended any development session in the last 12 months. The teachers who were interviewed concurred that they had not received any professional development.

No, we didn't have (Teacher 1, Promise).

The teacher from Sheba was very frank, saying that there was no organised professional development at her school.

> *No informal teacher development (Teacher 10, Sheba).*

Another teacher from this school concurred and said she had not even attended the CAPS training.

> *No, I never attended. Another difficulty, truly speaking, I never attended the CAPS training for NS. No, (because) I was not teaching NS. I need it, because as teachers, learning is lifelong (Teacher 2, Sheba).*

The teacher from Knowledge School concurred.

> *Umm, not really, so far not [no professional development] really (Teacher 4, Knowledge).*

Teachers were then asked about the frequency with which HODs provided this support using a scale of 0 to 4 where 0 was never did that activity and 4 was always practiced. Table 7 shows the mean frequencies of the instructional leadership practices from the teachers' perspectives. The findings on the frequency of instructional leadership practices showed that the most frequent practices involved monitoring and controlling learners' books, tracking their academic progress with means above 3 and using this information to provide feedback to the teachers. These practices were compliance activities that HODs used to monitor content coverage. They collected learners' books and went through them, comparing the number of activities in the books with what is expected by that time in the year plan. They would then stamp and sign the books. Feedback would involve informing the teacher whether he/she is on track.

The responses of teachers in the study showed that HODs occasionally or never developed and prepared material with the teachers (mean=2.32), and occasionally discussed how to teach particular concepts or lead professional development (mean= 2.29). These practices were ranked 11th and 12th in the questionnaire. About (17.9%) of teachers indicated frequent provision of professional development, despite receiving less than 15 hours of professional development, as indicated in Table 6 – evidently HODs did not lead the professional development (ranked last in table 7). This correlated with the qualitative data, that the professional development teachers reported on was mostly CAPS training.

Table 7*:* Frequency of instructional leadership practices, N=112

Instructional Leadership practices	Frequency of IL practices	
	Mean	Rank
Monitors and controls learners' activity and assessment books	3.22	1
Carefully tracks learners' academic progress	3	2
Provides regular and useful feedback/suggestions on my teaching	2.98	3
Actively monitors quality of science instruction	2.83	4
Monitors subject content coverage	2.71	5
Does classroom observations	2.68	6
Works directly with teachers who are struggling to improve instruction	2.61	7
Knows what is going on in science classrooms	2.61	7
Visits other teachers' classrooms to observe their teaching	2.42	9
Allows informal observations in his/her own classroom	2.37	10
Works with my department to prepare teaching material	2.32	11
Discusses teaching of a particular concept with the staff	2.29	12
Leads professional development sessions in which you participate	2.20	13

However, the questionnaire responses painted a positive picture regarding teachers receiving professional development. Figure 4 shows the areas in which teachers had received training in their schools. The questionnaire did not specify who provided development and what type of development was provided. Most teachers indicated that they were professionally developed on subject content (62.5%), assessment (60.7%) and practical work (58%). Less than half of the teachers (46.4%) indicated that they were developed in pedagogy.

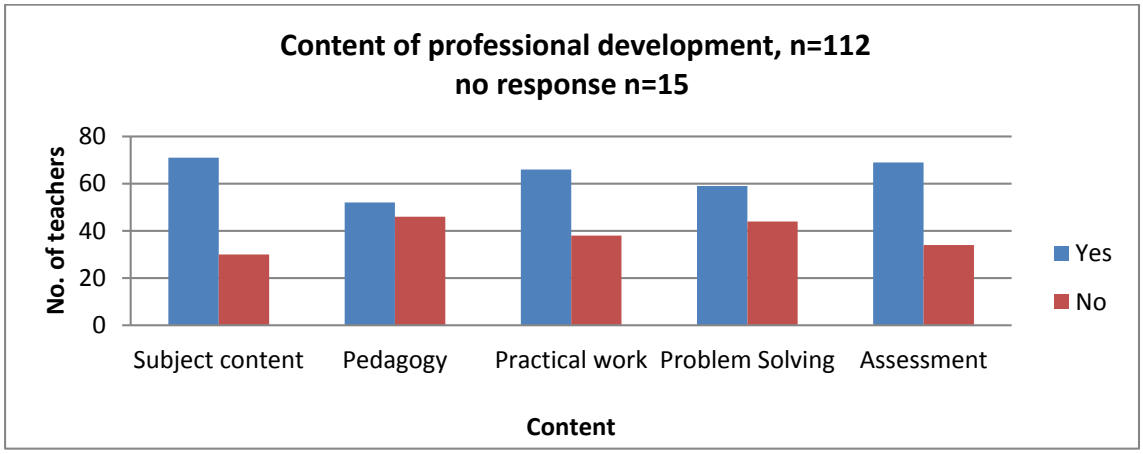

Figure 4: Content of professional development sessions

The interviews revealed that some HODs did lead some professional development activities.

> *Yes, at the end of the year we had something like that where she was interacting with us. [She showed us] how to tackle the topic of matter and material but under the banner of atoms (Teacher 3, Knowledge).*

The teacher from Fhutura indicated that they received some corrective training after doing something wrong, particularly regarding experiments and assessment.

> *No, at school we don't have. We only have if maybe we set something wrong, maybe we want to set a test or maybe a practical, since this now starts with CAPS, he[HOD} calls three of us and when we're there he shows us this one and this one to correct us (Teacher 5, Fhutura).*

Just over half (56%) of the teachers responded that their HODs frequently did classroom observations, in contrast, almost a quarter said they were only occasionally or never observed in class. We followed up with teachers through interviews to establish whether they were actually observed in the classrooms and whether they had received feedback. When we probed further regarding classroom observation, it became apparent that the classroom observation that they mentioned was compulsory observation for IQMS,[2] which is a compliance activity. We discuss compliance activities later in this section.

It was confirmed that only the HOD from Knowledge School did classroom observations that were outside IQMS and they were unannounced.

> *The natural sciences, she is doing class visits … She just comes so at any time she can walk into the class (Teacher 3, Knowledge).*

Another teacher from this school confirmed this practice.

> *She observes our lessons, observes the learners' books, checks with the work schedule and how you have been moving with the work schedule and then if there are any problems she highlights them and if you also have problems you also highlight them to her and then finding a way forward (Teacher 4, Knowledge).*

[2] IQMS refers to Integrated Quality Measurement Systems. The IQMS evaluation is conducted on three levels: Developmental appraisal of the teacher to identify strengths and weaknesses; performance evaluation for pay progression, and whole school evaluation to measure the overall effectiveness of a school, including teaching and learning (DBE, 2009).

The teacher from Fhutura confirmed that classroom observations were done at her school and she received feedback.

> *Yes, they do classroom observations. It's useful, yeah. I always get feedback. He's always telling me that I must fix my classroom (Teacher 5, Fhutura).*

In Sheba School they conducted curriculum management meetings every second week, where the HOD would monitor the work of teachers and learners' progress. There was no mention of classroom observation feedback being provided at this school.

> *Ja, we do, that is during this curriculum management meetings time, when he must just come (Teacher 10, Sheba).*

Professional development and classroom observations are effective modes of instructional leadership. The findings suggest that these instructional leadership practices were not enacted in the schools despite the great need and opportunity presented by teachers who struggled teach certain sections of the syllabus. The school leadership seemed to shy away from proactively leading professional development of their teachers, whether by doing it themselves or by inviting external help, except in few cases, like in Alpha School where the HOD frequently referred NS teachers to the subject advisor.

Focus on compliance

In a study by Brown *et al*. (2000), HODs did not get release time to carry out their HOD duties, but spent most of their time doing administrative work. In a study by Malinga and Jita (2015) it was established that HODs only did compliance activities and did not necessarily provide effective instructional leadership. Some of the compliance activities involved conducting IQMS classroom observations, holding subject or departmental meetings and monitoring learners' books for content coverage. The quality and effectiveness of these activities were questionable and were reduced to merely ticking the checklist. We probed for compliance activities that HODs engaged in at the schools we followed up with semi-structured interviews.

One of the teachers from Sheba School described how the curriculum was monitored at his school.

You submit to the HOD, and the HOD gives it to the deputy and then they count the number of exercises you are doing and look at the work – if it is of standard or not. They check the books and then they stamp and then they recommend (Teacher 10, Sheba).

Another teacher from this school confirmed this, though she believed that not everything that was done was beneficial, but was merely being done to comply with policy.

No, certain things you know sometimes we just do them because, I mean, that is the policy, though sometimes they are not beneficial (Teacher 2, Sheba).

She went on to describe what was done simply to comply with policy, in her view:

The management plan, when to submit, all those things, of which as I am saying most of the things are repeated at meetings (Teacher 2, Sheba).

A teacher from another school also described what was done for compliance.

Monitoring of the learners' books, but that monitoring of the class books is intertwined to the class visits. So, when she visits a class randomly she picks up the books from the learners (Teacher 3, Knowledge).

Another major compliance issue was frequent subject or departmental meetings. This role is prescribed in the HOD's job description (DoE, 1999). HODs reported that they held these meetings at least once a school term (Malinga & Jita, 2015) although, in some schools, these meetings were sometimes skipped due to other pressing demands on HODs' time. We asked about the frequency of certain topics or activities being raised at the meetings.

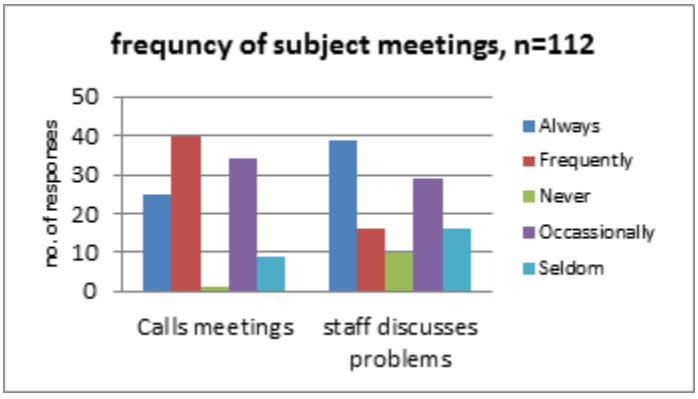

Figure 5: The frequency of subject meetings

The teachers agreed that HODs always or frequently called meetings and discussed staff problems in meetings (Figure 5). Some teachers (37.5%) confirmed that their HODs occasionally or seldom called meetings.

We analysed the subject meetings to determine if any instructional support and leadership was provided at these meetings to the teachers as a group. The teachers were asked what was discussed at subject or departmental meetings and they responded in the following manner.

> *We discuss if there are any problems, how far we are with the syllabus, if there are any problems in the assessment tasks, how we moderate each other's work, who is going to prepare the preparation or the exam or the test or things like that (Teacher 1, Willowdale).*

A teacher from another school mentioned that they discussed important pedagogical issues at their meeting.

> *If the learners are failing they want to know what support we are giving the learners (Teacher 1, Promise).*

They also occasionally discussed particular subject concepts or jointly prepared teacher material in these meetings.

Figure 6 below displays the topics that are discussed at the subject meetings. There was no evidence of discussion at meetings of teachers' performance, neither was there evidence of a review of learner achievement data or a schedule of class visits or observation. More than a third of the teachers (37.5%) expressed neutrality about discussions on professional development in subject meetings. It had been gathered that professional development was rarely done in schools, as discussed earlier. Almost two thirds of the teachers (61.6%) rated content coverage as a frequently discussed item. This was also ranked as one of the most frequent practices of HODs in Table 8, namely, monitoring content coverage through checking learners' books. This teacher mentioned that they monitored curriculum coverage based on the examination question paper that had already been set. They used the question paper as the benchmark and target to teach towards.

We usually sit down and share the[question] paper and see how far we are on the paper set up and she will usually call us and say we have to see how far we are so that we can speed up the situation so we can cover the syllabus (Teacher 9, Knowledge).

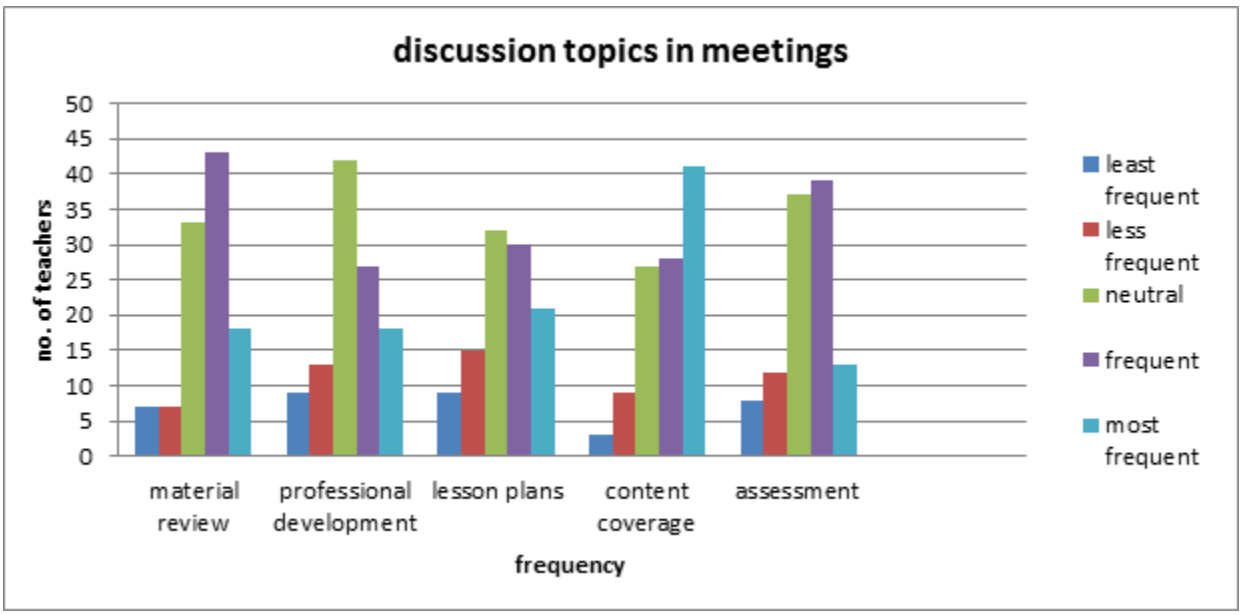

Figure 6: Topics discussed in meetings

Approximately half (46.4%) of the teachers in the study rated assessment as a topic that was frequently discussed in subject meetings. The assessment matters they discussed related mostly to who would set the examination, deadlines for submission of marks and learner progression schedules. Interview data from teachers' transcripts confirmed this. The teacher below revealed that they met to plan the term ahead or allocate roles for setting examination papers and the exam schedule.

It's actually depending, what are the circumstances leading to the meeting, like at the beginning of each term we divulge the route for the learners and then during the course of the term which are setting of the exams so we have to be briefed on how we should set the exams and the due dates and everything (Teacher 4, Knowledge).

Another teacher from this school confirmed that they focused on administrative work and the schedule for assessment tasks.

And in those meetings we decide who is going to make some copies, the date of those formal activities (Teacher 3, Knowledge).

A teacher from another school confirmed that their meetings were also about assessment roles and the schedule.

> *Yes, towards the setting, and for moderation. We have meetings in case when we're going to find out who is going to set the test (Teacher 5, Fhutura).*

DISCUSSION

The findings reported above clearly reveal the challenges involved in leading NS instruction in the current context of South African schools. Even the experienced NS teachers may have been teaching only the theory of the subject for a long time. The new curriculum now specifies an experiment a term for each science discipline of the subject. This requirement has created a number of challenges for and inadequacies in NS teachers. In the past, school visits by district officials focused on Grade 12 subjects, but now the Department of Education has increased the monitoring of the implementation of the SBATs. From the data presented, it is evident that NS teachers needed different types of support and instructional leadership. In cases where teachers did not have access to this support formally, teachers identified their own leaders (support system) who could provide them with the support they needed. This finding is consistent with the argument by Spillane, Hallet and Diamond (2003) that teachers construct their own leadership.

Being appointed to a leadership positions should not only be based on seniority or position, but on the expertise and experience of the teachers (Ghamrawi, 2010; Guthrie & Schuermann, 2010). HODs teach and are also class (register) teachers; therefore, they have little time to do HOD work. Teachers, like all other followers, need instructional leaders who are available when the need arises for guidance and support. Teachers expected their instructional leaders to have sufficient expertise, experience and subject knowledge t to meet their needs. They also expected the leader or HOD to be available to provide support, in the form of demonstrations, mentoring and coaching, as often as possible. In the study, a number of teachers reported needing their HODs for assistance, but the HODs were 'too busy' and did not have release time to do HOD duties. The findings show that there were many reasons why teachers required assistance.

Firstly, the new CAPS curriculum, among other changes, arranges and allocates a term to each NS strand or science discipline. With this arrangement, one SBAT was introduced per term. This means that teachers had to set a practical assessment tasks for each science discipline, even the science disciplines in which they had no expertise in, and consequently they were likely to need assistance in this regard. Science education in South Africa has been characterised by plenty of theory and less practical application. Even teachers might not have been exposed to practical work (Makgato & Mji, 2006) during their own schooldays or during their training, largely due to the lack of laboratory equipment. The findings reveal that schools do not have big enough laboratories to accommodate over 500 learners a week, neither is there enough equipment at these laboratories. Where there are laboratories, there is usually only one or two laboratories and grades 11 and 12 learners are prioritised for experiments because of the national focus on these senior grades. NS teachers need guidance and support from HODs to 1) source apparatus so that they could do the experiments – which could sometimes involve borrowing from other schools; and 2) schedule NS classes for experiments at the existing laboratories, ensuring that laboratories were available for the teachers to prepare and conduct experiments.

The challenge that teachers had to design experiments for learners and assess these practical tasks was compounded by teachers' lack of specialisation in some science disciplines. Some schools allocated the development of these tasks to either senior teachers or teachers who possessed the necessary specialisation. In some schools, the HODs set these assessment tasks themselves, even though development of these tasks could serve as an opportunity for professional development of teachers. We discuss findings about professional development later in this section. The school conditions as described in the conceptual framework played a big role in the type of instructional leadership that HODs in the study displayed. The conditions required that HODs used the right attributes and means of influence to secure apparatus and to ensure that the little equipment they had was not reserved for senior classes only. Leadership involved drawing from the management and administrative components to utilise schedules, routines and artefacts for designing a timetable for sharing the laboratories.

Secondly, more than a third (36.7%) of the teachers in the study were either teaching NS for the first time or it was their second year of teaching. Rivkin, Hanushek and Kain (2005) argue that

learners taught by an experienced teacher achieved better results than those taught by an inexperienced teacher. Even if a teacher was an experienced teacher, NS brings with it new challenges. The fact that some NS teachers were inexperienced is no different from a study done by Rollnick and Brodie (2011), where teachers indicated that there were areas where they were not confident to teach in their work. The fact that HODs themselves do not teach NS could also render them incapable of supporting teachers in the subject. The new curriculum has brought changes that someone not teaching the subject might not know about. The fact that NS drew from at least three science disciplines (life, physical and earth sciences) alone was a huge challenge. Very few teachers have qualifications in all three disciplines. The findings of this study indicated that just over two thirds of the teachers stated that they could teach NS with confidence. This was self-reported data and was not tested in this study.

Some of the teachers who were teaching NS for the first time had not even attended the CAPS training. This led us to the third reason why NS teachers would need strong instructional leadership. The HODs did not attend the training or the cluster meetings, except for the HOD from Sheba School. The fact that HODs did not attend meetings or sessions organised by the subject advisors could contribute to their lack of knowledge regarding the subject demands, therefore they could not provide the assistance that the teachers required in NS. It was at the CAPS training that the new approaches and all subject demands and expectations were outlined. When the school leadership allocated the subjects every year, they did not consider the teachers' preparation for the subject. A new teacher in the subject would need more guidance from, specifically, the subject leader, in order to implement the new curriculum. At the beginning of each year it is the duty of the HOD to recognise and consider that some of the teachers in the team would not have attended new curriculum training, because they would be teaching the subject for the first time. This would open up an ideal opportunity for the HOD to coordinate professional development for the department's teachers. There was no evidence that HODs in this study took advantage of this opportunity. The importance of the role of the HOD or the senior teacher could not be over emphasised in this regard.

The fourth reason why teachers would need strong instructional leadership related to the teachers' area of specialisation, across all ranks. Secondary school teaching required teachers to

specialise in certain subjects. The level of specialisation of NS teachers informed the kind of professional leadership and support that they would require and expect their institutions to provide. HODs might have specialised in one subject but they had to supervise others in subjects they themselves were not specialised in. Some teachers in the study had not specialised in any of the sciences at all. Those that had specialised in one discipline needed help in the other disciplines. Very few teachers had specialised in both LS and PS and a few (often older) teachers may have done an advanced certificate in NS. Although NS is a subject that is designed to expose learners to all science disciplines, it still required enough in-depth knowledge of each discipline to adequately prepare learners who wish to follow that discipline in senior secondary and tertiary studies. It is the schools' responsibility to ensure that the teachers they allocate to teach this subject are adequately qualified, or to put systems in place, like that of senior teachers, to be available to provide much-needed assistance to NS teachers.

Professional development

To implement the changes in the curriculum, the Department of Education had been providing piecemeal, workshop-type professional development, which was not effective (Kriek & Basson, 2008). Lai and Cheung (2013) argue that promoting professional development is the most influential instructional leadership mode for sustained improvement of teaching and learning. The development can take various forms, including and not limited to short meetings, half-day sessions, a few days training, weeklong conferences, seminars and continuous professional teacher development, supervision and evaluation of teachers with feedback and follow-up. Development plans drive the needs of teachers (Vercio *et al*., 2008) and involve critical reflection and follow-up, mentorship and dialogues about the effectiveness of instructional practices on learners' work (Koh *et al*., 2011). Glickman *et al.* (2011), maintain that professional development fosters pedagogical, emotional, social, ethical and cognitive development.

According to the findings the biggest need seem to relate to practical work, as described above, especially designing experiments for the SBAT in areas where teachers were not specialised. In some cases, the problem is a lack of resources and trying to find the apparatus needed for particular experiments. The teachers rely on the HOD to make those resources available for them to do the experiments. In Sheba School, the HOD had to borrow equipment from the

neighbouring schools in order to do the experiments. In Promise School, the teacher, although a qualified PS teacher had never used a certain piece of equipment and confessed to have only read about it in textbooks. She relied on the HOD to show her how to use the equipment. The advantage in this school was that they had the equipment and the HOD had specialised in the area where the teacher required assistance. A study by Malinga and Jita (2015) established that one of the reasons why HODs do not provide NS professional development was that they were not science specialists themselves. Furthermore, the HODs do not teach NS and do not have enough time for their HOD duties because they spend most of their time teaching senior classes. Although this was the case in most schools, there was an opportunity for distributing leadership to senior or lead teachers in the subject, which schools were yet to use to their advantage. We discuss this opportunity later in this paper.

In light of the challenge at hand, the HODs might not have been trained in CAPS, and the district office subject advisory service was an important resource for this development. We discuss the subject advisory service further below. In the context of the HOD who was not trained on the new curriculum, his/her duty became more the coordination than actual facilitation of training. In the study, 39% of teachers responded that the HOD coordinated professional development and 59.8% reported that the HOD arranged training when they needed help. The shortcomings of the HOD could be mitigated by a good partnership with the subject advisory services, as in Alpha school, or the senior teacher in the school. The interview data reveal that most teachers do not receive any development from their HODs or schools. There was no evidence of any planned professional development strategies at the schools in this study. Only the HOD at Knowledge School was reported to have provided development based on teachers' needs. Professional development is provided only when the teachers of some schools need it for a particular topic. The interview responses reveal this, despite the fact that, in the quantitative responses, teachers had indicated an average of 15 hours of professional development over the last 12 months, which happened to be CAPS training that was provided by the provincial office and not necessarily by the school. We discuss this type of development as part of the subject advisory services in the section below. It was evident that teachers needed professional development that focused on both subject matter and pedagogical content knowledge. It is clear that providing continuous teacher

professional development was an important area and one in which HODs could make a difference to the quality of NS instruction.

Subject advisor support

When we explored the support provided by subject advisory services we realised that some schools were benefitting from the services but other teachers were not. Some HODs relied on the district subject advisor, and in Alpha School, the HOD referred teachers to the subject advisor because he himself was not a science specialist. Subject advisors would visit the schools to monitor the implementation of SBATs, which was a compliance activity. During the visit, subject advisors interacted with HODs, even though they did not interact with the HODs at their cluster meetings. The subject advisors work directly with teachers and not through the HODs. Subject advisors do not even have special meetings where they worked with the HODs separately, building capacity or monitoring the curriculum and providing instructional leadership. This kind of meeting between subject advisors and HODs would minimise the number of teachers who attended cluster meetings and improve the content and effectiveness of the meetings. Currently there were at least four NS teachers per school, but there was only one science HOD per school. If the districts and circuits could revisit the operations of this layer in the hierarchy, not only would subject advisor meetings be better organised and more effective, but school-based subject instructional leadership would also be enhanced. The HODs who were not specialists in the particular subjects that they led could be equipped with strategies for influencing instruction and providing effective feedback to teachers. Subject advisors as specialists would provide expertise and professional knowledge on the subject and anything else they may have learnt from other clusters or schools.

Subject advisors arranged cluster meetings at least once a term; at these meetings they met with teachers to discuss areas of difficulty or to plan for the term ahead. In some schools, such as Willowdale, only one teacher per subject attended cluster meetings, and shared what had been discussed at the meeting with the rest of the subject teachers at the school. In a number of cases, this was the only professional development some teachers received. In certain districts, the subject advisors provide necessary individual support to teachers, especially in schools where the HOD had not specialised in any of the science disciplines. The subject advisors that we observed

seemed to perform compliance activities and just ticked on the checklist that they had met with teachers. There was nothing beneficial (subject content or pedagogical content knowledge) that teachers could take with them from these cluster meetings.

Senior/master teacher support

Considering the multidisciplinary nature of NS, HODs were likely to feel inadequate and doubt whether they added value for the teachers that they led. They could also be conscious that some of the teachers they supervised knew more than they did about some subjects or areas of the subject. There was a great need to institutionalise the concept of master, senior or lead teachers. Senior teachers are experienced teachers with a good knowledge of the learning/subject phase and who are committed to high quality teaching and ongoing professional development. They play an important role in providing teaching, which includes academic, administrative, educational and disciplinary aspects, and organising extra and co-curricular activities to ensure that education of leaners is promoted in a proper manner. They also provide guidance and counselling, act as mentors and coaches to less experienced teachers, participate in and facilitate professional development activities (master teacher), assist the HOD to identify aspects that require special attention and assist in addressing them and, when required, act as head of a subject, phase or grade in support of the relevant HOD (ELRC, 2008). The senior teacher resource would ensure that the expertise of different teachers was recognised and deserving teachers were given the opportunity and support to lead in their subjects. In this way, leadership would have been distributed across the followers although it would vary from context to context. Sharing leadership would also afford HODs time to attend to their leadership duties. When functioning well, senior teachers would provide teachers with the subject support that they required and they only had to approach the HOD for other administrative and supervisory requirements.

This senior or master teacher resource is available to schools and it is now an official position in South African public schools. Only 12.5% of teachers in the study indicated that they were senior teachers. The challenge would be finding a way to identify these teachers in the schools (Lai & Cheung, 2013). The findings suggest that the teachers in the study identified teachers who could assist them themselves, whether they were senior teachers or not. They reverted to these

colleagues for assistance. These teachers showed agency, took responsibility for their own development and approached other teachers (who could be identified as senior or lead teachers), whom they trusted to assist them. This act of agency shows that teachers learn best through interaction with other teachers and with experts acting as 'critical friends', provided there was mutual trust (Rollnick & Brodie, 2011). The teachers who were approached to provide assistance demonstrated agency, as defined by Sherer (2008), as they saw the need or the gap and provided leadership. The teachers in these schools showed a strong sense of collegiality and teachers provided professional support and guidance without the need to have a formal title of HOD or senior teacher.

Classroom observation

Classroom observation, whether planned or in the form of a walk-in, is a useful tool for identifying shortcomings or best practices, especially when it is purposeful (Kruskamp & Zepeda, 2007) and initiated by teachers. The findings show that most teachers (56%) indicated that their HODs conducted classroom observations, but that the HODs rarely provided feedback after the observations. Similar to professional development, it was established that the classroom observations that were done in schools were only for IQMS purposes. This compliance activity was mostly a facade. No follow-up was ever done concerning the findings of the IQMS. Classroom observations without constructive feedback were not beneficial and could therefore be interpreted as being done for compliance reasons. There was a strong compliance component at all levels of the instructional hierarchy in the schools of this study. The teachers did some activities just to comply even though they did not benefit from it. Teachers also prepared and presented lessons for IQMS purely for compliance reasons but they did not see it as beneficial. They mentioned that some members of the school-based assessment teams that conducted IQMS were not specialists in any of the science disciplines and therefore were unlikely to provide any useful feedback to the lesson that was presented anyway.

The HODs conducted IQMS classroom observations, had subject meetings and monitored subject content coverage for compliance purposes. Furthermore, HODs had been trained in the 'what', not the 'how', of the job, therefore, HODs found it difficult to supervise. They just

stamped and signed the learners' books or teacher files as evidence that monitoring had been done, but no follow up was done to raise concerns or acknowledge the teachers' good work.

CONCLUSION

Teachers in the study had very clear views about the extent and quality of instructional leadership that was provided at their schools. The findings reveal that the way school leadership currently allocates NS teachers and science HODs in South Africa is rather short-sighted and likely to have contributed to the poor performance of learners in senior secondary science. The findings also reveal that teachers approached their colleagues, not necessarily the HOD, for help with subject matter or pedagogical content knowledge. Very little coordinated professional development is taking place at the schools, except what the provincial or district offices organised. Where development is provided, it is in response to the teachers' request and is generally individual support. Managing assessment seemed to dominate all areas of the HOD-teacher interaction. The subject advisors provided limited instructional support, which could be improved with better organisation. In this paper, we recommend, firstly, that the allocation of science HODs be differentiated into junior and senior secondary phase HODs. This does not necessarily mean that a new position must be created, but that the existing structure should be reorganised to optimise on the quality of instructional leadership. HODs that teach the subject, understand grade expectations and do not have senior secondary pressures should be appointed for the junior secondary phase. Secondly, we recommend that school leadership recognise the senior/master teachers as having proper expertise and the ability to provide instructional leadership, and to afford them the kind of support that they deserve. Acknowledging these senior teachers could ease the overload from HODs and could provide subject-specific instructional support to the teachers of NS. If principals and deputy principals were proactive in monitoring the work of HODs and listening to the views of teachers regarding instructional support as in this study, they would be able to plan interventions and provide effective leadership.

This study only reports findings from a small sample of teachers and cannot be generalised to a larger population of NS teachers. Further research needs to be done on the extent to which schools use senior teachers for NS, and the role that they play in South African schools generally. We also recommend that the relationship between senior teachers and the HODs be

explored further with a view to clarifying their respective roles and to avoid duplication and overlaps.

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ARTICLE 5

SCIENCE HODs AND THEIR CAPACITY TO LEAD INSTRUCTION: AN EXPLORATORY SURVEY ACROSS FOUR DISTRICTS IN GAUTENG, SOUTH AFRICA

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ABSTRACT

As currently structured, Natural Sciences (NS) is a conglomerate subject that comprises five science disciplines. Therefore, either teachers of this subject have to be generalists or if they are specialists, they need to specialise in a number of science sub-disciplines. Heads of Departments (HODs) for NS thus have a complex challenge in ensuring that all the science disciplines within the subject are properly taught to the adequate depth and breadth. NS HODs have the unenviable task of having to manage content overload, role ambiguity and interdisciplinary conflicts among others. This paper explores the instructional leadership capacities of South African science HODs with a view to understanding how they negotiate their work to achieve the required balance. Using a survey, data were collected from secondary and intermediate school NS teachers and the science HODs in four districts of Gauteng, South Africa. The survey explored the professional credibility and capacities of the science HODs with respect to instructional leadership for NS. The findings suggest that the HODs are rather weak on two major aspects of their work: viz. professional credibility and the provision of classroom support to the NS teachers especially in the physical sciences sub-discipline. The majority of the HODs were victims of their own inadequate training and weak qualifications in the specific sub-disciplines which limited their ability to support and develop the NS teachers. The major conclusion of this paper is that unless the schools and their local district offices review the grouping of subjects in the science departments and the allocation of NS teachers and HODs, the potential for much stronger subject-based instructional leadership by the appointed HODs will continue to remain an elusive dream. The paper thus recommends the need for more focused subject specific

training in the natural sciences sub-disciplines in each of the NS sub-disciplines, for both teachers and HODs but more urgently the physical sciences (PS) strands.

Key words: natural sciences, professional credibility, instructional capacity

INTRODUCTION

Many high school learners, some of whom may have excelled in NS in primary schools, often struggle with PS possibly because of the kind of foundational grounding they may have received. The fact that NS combines five science disciplines and no teacher can be a specialist in all of these disciplines complicates the preparation for the transition from NS to PS. Natural sciences is a federal subject that includes agricultural, environmental, life, and physical sciences and a geography discipline. Teachers of NS are recruited as generalists that may not have specialised in any of the science disciplines or in other cases they are specialists in one or more disciplines but rarely are they specialists in all five of the science disciplines that constitute the subject. Even when acknowledged as adequately qualified in reality the NS teachers cannot be equally strong in all the NS disciplines or subject strands (Ho & Ng, 2012). If they are generalists, the tendency is that they do not address the depth of the subject in any particular discipline (Umalusi, 2008). Teachers often focus their teaching only on what they are comfortable with (Ng, Nguyen, Wong & Choy, 2015) leaving out topics or sections of the syllabus that they do not know (Wanzare, 2013). It is not that teachers are not unaccountable or irresponsible but more the fact that they need help to address their own areas of weakness. Where teachers fall short, help has to come from the schools or more specifically from the HODs because of their proximity to classroom teaching and learning (Highfield, 2010).

In this paper, we unpack some of the data on the science HODs in the Gauteng schools, in terms of their practices and capacity for instructional leadership to assist NS teachers in the rather complex context of this conglomerate subject. We begin with a review of literature on the roles of HODs and then explore some definitions of instructional leadership. From the review of the literature, we develop a conceptual framework for analysing the leadership practices of the science HODs in selected schools, before presenting the methodology and the key findings. The

paper concludes with a discussion of the implications of these findings to the science education system in South Africa (SA) and makes recommendations on how the capacity of the HoDs can be enhanced.

LITERATURE AND CONCEPTUAL FRAMEWORK

The literature states that HODs are better suited to lead teaching and learning (Bush, Joubert, Kiggundu & van Rooyen, 2009), they are central to effective teaching and learning (Busher, Harris & Wise, 2000) and they are an essential link to the continuum (Weller, 2001). Furthermore, HODs are the driving force (Collier, Dinham, Brennan, Deece & Mulford, 2002), have frontline knowledge of classroom issues and teachers' need (York-Barr & Duke, 2004), are a missing link between efforts to improve schools and current practices (Melville, Wallace & Bartley, 2007) and are pivotal to any strategy to develop learning-centred leadership in schools (Klar, 2012). The science HODs, themselves, are mostly specialists in one or two domains of the natural sciences but are unlikely to be the experts in all five natural sciences domains.

HOD role and responsibility

Very little is known about how HODs go about doing their work and their perspectives on what their role should entail (Stephenson, 2010). Wise (2000), states that the legitimation of the HOD's role emanates from the acceptance by members of the subject department that the HOD is generally knowledgeable about the subject and the development of school-based assessment tasks in the South African context. Furthermore, HODs are expected to conduct class visits, model best practices, provide templates and guidelines and provide teachers with feedback on their teaching (Robinson & Timperley, 2007). As part of their role, HODs are also expected to set subject goals and direction, expectations for achievement (Lashway, 2002), monitor quality of instruction and achievement levels (for both teachers and learners), evaluate instructional practices and learning, maximise the effort of the instructional organisation, conduct appraisal (Smith, Mestry & Bambie, 2013) and participate in staff recruitment. However, in performing these duties, HODs face many challenges ranging from lack of time (Glickman, Gordon & Ross-Gordon 2011), role overload (Busher, 1988), role conflict and ambiguity (Zepeda & Kruskamp,

2007) and limited authority (Ho & Ng, 2012) to the multidisciplinarity of the subject. This situation is no different in South Africa.

The complexity of the role of HODs is influenced by contextual factors and is often compounded by conflicting expectations from principals and teachers (Collier, Dinham, Brennan, Deece & Mulford, 2002). Part of the challenge is that HODs have a dual role as both teachers and administrators, as both administrators and managers as well as both managers and leaders (Lai & Cheung, 2013). Siskin (1994) suggests that the HOD role is hermaphroditic because the HOD is neither fully a teacher nor fully an administrator. They are an interface between management and teachers, but they also represent teachers in the school management team (SMT) and they represent the SMT in the subject department meetings with teachers. At the same time, HODs work within a team, for the team and they lead the team (Stephenson, 2010, p. 19). Some of the literature suggests that the HODs' time is sometimes consumed by administrative work with many not afforded adequate release time (Glickman *et al*., 2011; Ng *et al*., 2015) to focus on instructional issues thus compromising their instructional leadership capacity. Anecdotal evidence reveals that some HODs do not even get time to lead and influence teachers in their departments.

For the NS, they are also an interface between the junior secondary or middle school and the high school science and take responsibility for aligning and ensuring conceptual progression and continuity of both human resource and key instructional goals (Lai & Cheung, 2013). At the same time, HODs work within a team to provide guidance, support and development which teachers need (interact on structural issues). They also work for the team (escalating teachers requests to the SMT, procuring and organising laboratory equipment, communicating urgent demands) and they lead the team (Stephenson, 2010, p19). The role demands that HODs become close to those they lead and where learning actually occurs (Aubrey-Hopkins & James, 2002).

The Personnel Administrative Measures (PAM) document (DoE, 1999) that guides HOD functions and mandates in South Africa expects them to teach 85% of the time and dedicate only 15% of their time to HOD functions. They tend to do work for teachers (escalating teachers' requests to SMT, procuring and organising laboratory equipment and communicating urgent

demands) rather than working with teachers, guiding them and providing the support and development that teachers need (interacting on instructional issues). There is very limited opportunity for the HOD to lead by example, identify and model good practice and share this with the teachers s/he leads. It is not far-fetched therefore to suggest that HODs could enhance their leadership practices by delegating some of the duties depending on the task at hand (Spillane *et al.*, 2004) and the agency of the teachers (Lai & Cheung, 2013; Timperley, 2005). HODs also have limited authority (Weller, 2001) to discipline and appraise teachers and experience strained relationships with teachers (Schmidt, 2000) especially those who are not teaching up to the expected quality of instruction and expected learning outcomes. In the next section, we discuss the structure and organisation of subjects departments that have a bearing on the work of the HoDs.

Subject departments

Literature describes a subject department as a school subsystem that is organised to 1) minimise the work load of especially secondary school principals (Aubrey-Hopkins & James, 2002); 2) focus on curriculum support (Harris *et al.*, 2011); and 3) improve performance of learners. The generalisation on what the department should be and what it should aim to achieve complicate the appointment of departmental leaders with the result that sometimes leaders without the appropriate credentials are appointed (Lai & Cheung, 2013). Unfortunately, appointment to the HOD position In South Africa is sometimes offered as a reward and anyone can apply sometimes with little preparation to lead on teaching and learning (Smith et al, 2013). There is relatively more research on the practices of HODs or department chairs where a department houses one school subject (Brown, Rutherford & Boyle, 2000; Harris, Busher & Wise, 2011) as opposed to a group of subjects.

In SA (DOE, 1999) HODs lead departments which usually comprise a group of subjects instead of one subject (Naicker, Chikoko & Mthiyane, 2013). There are exceptions for bigger and core subjects like mathematics, mathematical literacy and English which are done by most in the school, in which case it forms a department on its own. The opposite would be true for the science department, where the HOD would be responsible for all the different science disciplines offered in the school and each one then becomes an independent subject in high schools.

Anecdotal evidence suggests that some schools might even include mathematics, mathematical literacy and technology education as part of the science department. In South Africa there is no uniform grouping of subjects into departments and the demarcation of departments is school context specific (Naicker *et al.*, 2013). In other countries there seems to be a clear structure for the department to be subject-based except for conglomerate subjects like science (Ghavifekr & Ibrahim, 2014; Harris *et al.*, 2011; Ng *et al.*, 2015; Stephenson, 2010). Interestingly, very few countries organise science department to share with a non-science subjects or even mathematics.

The HODs are not likely to have professional capacity and expertise in all subjects offered in a federal department like the sciences. Professional credibility (Angelle & DeHart, 2011; Ghamrawi, 2010) is necessary for the HOD's self-esteem but also to the teachers who are being led or influenced. Member teachers need to have confidence and be convinced that the person who leads them has the professional expertise, skill and experience (Ghavifekr & Ibrahim, 2014) to provide the guidance and support that they need (Wanzare, 2013). It is expected that the HOD will have a proven track record and experience in the knowledge and teaching of a particular subject. Literature reports opportunities for distributed or shared leadership in schools at multiple layers (Spillane, Halverson & Diamond, 2001), depending on the task at hand (Spillane *et al.*, 2004) and the agency of the teachers (Sherer, 2008). This paper explores some of the credentials that are expected of the HOD by the department members and senior school leadership and how the capacity to allocate resources and lead the department was displayed.

Instructional leadership

Instructional leadership involves sharing the vision with followers, monitoring the instruction and assessment standards, allocating resources and reflecting on the outcome of the instruction (Lashway, 2002; Ritchie, Mackay & Rigano, 2005). Lashway (2002), however, sees instructional leadership as having shifted from having a vision and sharing it with the followers (coherence in improvement efforts), allocating resources both physical and human to instruction, managing the curriculum, monitoring lesson plans (not learning), evaluating teachers (focus clearly not on learning) to more recently inclusion of a focus on teaching and learning. This focus includes an alignment of curriculum instruction and assessment standards (Robinson, 2010) professional development, use of data to make decisions on professional development, resources and

instructional practice (Brown *et al.*, 2000), and creating a safe, secure and conducive environment for teachers using dialogue on key issues. Using classroom data the instructional leader can make decisions about professional development needs, interventions and grouping of learners where needed. The leadership process involves the leaders' capacity to involve their colleagues collaboratively in mutual development and learning, with the aim of improving teaching and learning. The HOD as an instructional leader influences many of the activities listed above and the type of leadership is also influenced by the followers (teachers). In the section below, we describe our conceptual framework for this paper.

Conceptual Framework

Researchers have reported on a number of factors that contribute to the HODs' ability to lead instruction. These ranged from HOD characteristics and behaviour (Harris, *Busher & Wise,* 2011; Bolam & Turner, 2003), contextual factors (York-Barr & Duke, 2004) and leadership practices such as facilitating collegiality and sharing decision-making (Printy, 2008). The role of the HOD is context dependent and there is no single hymn sheet for leading a department in different schools (Ritchie *et al.*, 2005). Harris *et al.*, 2011) assert that the HOD role is characterised by complexity and contingency and understanding this helps to explain how and why HODs practise (their role) instructional leadership in the ways they do. The actions of the HODs often depend on the leader him/herself, the task that needs to be performed, the departmental staff or followers and the situation (Timperley, 2005).

This paper proposes a conceptual framework based on the provisional model (Turner & Bolam, 1998) and the teacher leadership framework proposed by York-Barr and Duke (2004). The framework shows how the instructional leader's characteristics and his/her knowledge of the context and its problems can be integrated to provide leadership through effective interactions with the department's members and how it can influence the teaching choices (Robinson, 2010). Six (6) major components of instructional leadership by HODs have been identified in the literature and are discussed below.

The first component of the framework is the leader's characteristics such as subject proficiency, experience in the subject (Stein & Nelson, 2003), professional credibility, trustworthiness and

agency in resourcing the department. These contribute to how the departmental members perceive the leader (HOD). The second component is the leadership practices like vision setting, building collegiality, developing teachers, building relationships and the manner in which leadership is distributed among the department members (Hallinger, 2005).

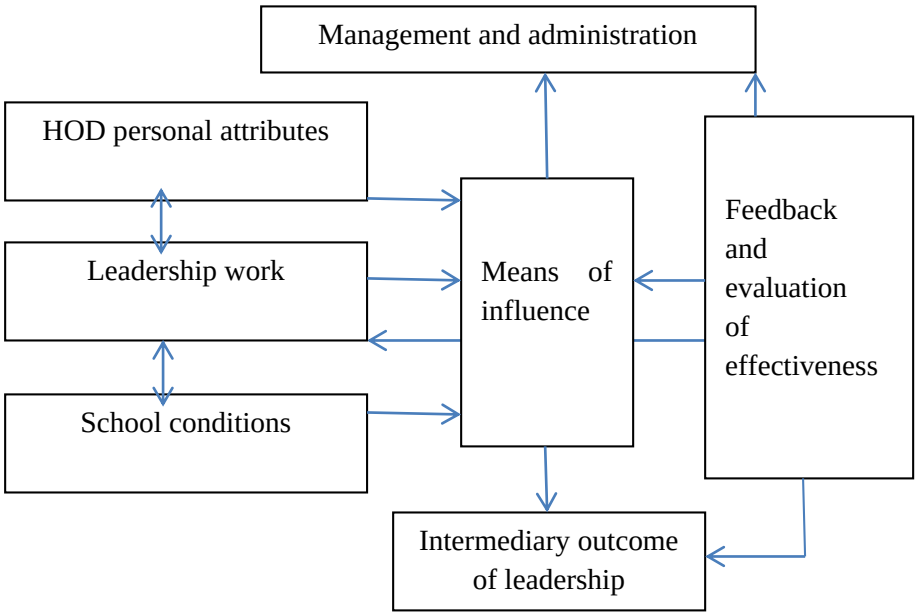


Fig 1: Abridged version of the conceptual framework for leading instruction (adapted from York-Barr & Duke, 2004)

The third component includes how the HOD negotiates his/her influence through the school's social, political, economic, cultural and other contextual problems (Robinson, 2010). This requires the HOD to be creative with his/her time and be able to balance his/her own administrative and instructional leadership duties. In some schools, as in Klar (2012), principals assist in fostering instructional leadership practices.

The fourth component looks at how the HOD influences teaching choices through setting instructional objectives, planning instruction and developing reflective practice using classroom observation and feedback sessions and action research (York-Barr & Duke, 2004). The fifth component is administration and management, which overarches with the role of managing people and resources (see figure 1). The subject department co-creates and uses routines and artefacts as a means of influencing the followers. The HOD is then expected to monitor the

interaction of departmental staff through the artefacts and routines. This is the one component where many HODs tend to spend most of their time and it is difficult to strike a balance between this component and all four of the other components.

The sixth and final component introduces the feedback loop and evaluation of the effectiveness of leadership. It involves critical reflection by individuals, teams and the organisation as well as follow-up, mentorship and dialogues about the effectiveness of instructional practices, learners' work (Lashway, 2002) and their own leadership practices. The HOD consistently monitors the alignment of curriculum, instruction and assessment standards using data and technology to ensure accountability for performance in the classroom (Busher *et al.*, 2000). This component provides the feedback to other components of the framework. To achieve the set goals the findings from the evaluation have to form the basis on which the other components are modified or enhanced. The main focus of the framework is to achieve improved and effective teaching and learning practices within a department and school. Using the conceptual framework developed above, we ask the key question of our study: viz. How is science HODs' instructional leadership capacity perceived by NS teachers?

METHODOLOGY

Data for our analysis were drawn from surveys collected over three months in four school districts in Gauteng, South Africa. Two different questionnaires were used in this study, one for science HODs and the other for the NS teachers from the same schools, to explore the instructional leadership capacities of science HODs in providing guidance and support to the teachers. Teachers provided a 360° evaluation of the HODs' practices. The questions about particular instructional practices were asked in different ways and different sections of the survey to elicit the capacities of HODs from different angles. The questionnaires were distributed to 243 secondary and intermediate schools from four districts in Gauteng, South Africa. Only 112 of the 400 distributed surveys were returned. The response rate was 142 (112 teachers and 30 HODs) questionnaires from 77 out of 243 schools in four districts (32.1% return rate). Since the questionnaire consisted of a Likert-type scale, some background questions concerning gender and teaching experience were also included in the survey. The HODs' involvement in instructional leadership activities were rated based on how frequent the activity was practised (1

indicated 'never' while 5 indicated 'always'). The HODs' general instructional leadership activities and skills were categorised and their means were taken to indicate the general trend in the subcategory. Inferential and descriptive statistics were used to analyse the data.

Sample

We collected data from 77 schools where more than one teacher responded to teacher questionnaires. The schools that we collected data from were 30 ex-model C[22] schools, 42 township schools and 5 independent or private schools all located in four districts in Gauteng. The schools' learner enrolment ranged from 429 to 1548 learners.

***Table 1**: Participating schools*

Schools	Race	School type
30	Mixed	Ex-Model C
42	African	Township
5	Mixed	Independent

The size of the science department ranged from two to 20 teachers. The subjects in the department that a science HOD was responsible for varied from life, physical and natural sciences to those that included, mathematics, mathematical literacy and technology education. Although 112 teachers from 77 schools responded, not all the schools' HODs necessarily responded. We only received 30 HOD responses.

***Table 2**: Participants in the study*

District	Number of HODs	Number of schools	Number of teachers
B	13	16	**31**
E	8	16	**26**
J	5	8	**13**
W	4	37	**42**
Total	**30**	**77**	**112**

Most HODs were middle-aged or older and the number of female HODs was slightly higher (16) than that of male (13) HODs. Most of them (20) had professionally qualified from Teachers'

[22] Ex-Model C schools are public state-owned schools that admitted predominantly white children before 1994. Post 1994 they changed their admission policy to include children from all races. Ex-model C schools tend to produce better academic results than state schools formerly reserved for other race groups.

Colleges rather than at universities. This could also explain the middle age or older age range. Most HODs qualified during the era of teacher colleges of education.

Table 3: Profile of HODs

Variable	Level	Frequency	Total (n)
Overall		**N (%)**	**30**
Gender	Male	13 (44.8)	
	Female	16 (55.2)	29
Age range	20-29 years	0	
	30-39 years	4 (13.33)	30
	40-49 years	13 (43.33)	
	50-59 years	13 (43.33)	
	>60 years	0	
Subject of Specialisation	Life or Biological Sciences	10 (33.33)	
	Physical Sciences	10 (33.33)	
	NS	7 (23.33)	30
	Other	3 (10.0)	
Type of Institution where qualification was obtained	Teachers' college	20 (66.7)	
	University	10 (33.3)	30
	Matric/unqualified	0	
Highest Qualification	PTD/PTC	1 (3.3)	
	STD	11 (36.7)	
	ACE	3 (10.0)	
	Bachelor's Degree	4 (13.3)	30
	Post Graduate	10 (33.4)	
	Other	1(3.3)	
Position held in school	HOD	26 (86.7)	30
	Master/Lead Teacher	4 (13.3)	
	Teacher	0	

In the next section, we present the findings for the data that were collected from both the NS teachers and the HODs.

FINDINGS

NS is a conglomerate of five science disciplines. This is not a new subject in South Africa nor is it any different in other countries although it might not be called NS but integrated science, as in USA and Japan. The subject curriculum is divided into four strands viz. 1) life and living, 2) matter and materials, 3) energy and change and 4) earth and beyond. With the introduction of the new curriculum CAPS there is a specification of when which strand is to be taught and there is

School-Based Common Assessment Task that the teachers must administer at the end of each strand. This assessment task needs to be standardised within the school and moderated before it is administered. This calls for the subject head to ensure the quality of the assessment and the learners' responses after writing the task. This requires the HOD, who knows the subject and who teaches the subject, to be able to understand the challenges in the subject from both the learners' and the teachers' perspective.

Below is an account of the practices that the HOD engages in to share the subject goals, develop a climate of high expectations and standards in the subject, monitor the instruction and assessment standards and model the desired teacher behaviours as well as promote school-based professional development.

Teaching of NS

In the 77 schools that responded, 18 HODs (60%) were actually teaching the subject (figure 2). These HODs would understand the subject challenges, would prove to have the needed subject expertise and be in a position to work with the teachers in the subject instead of working for them.

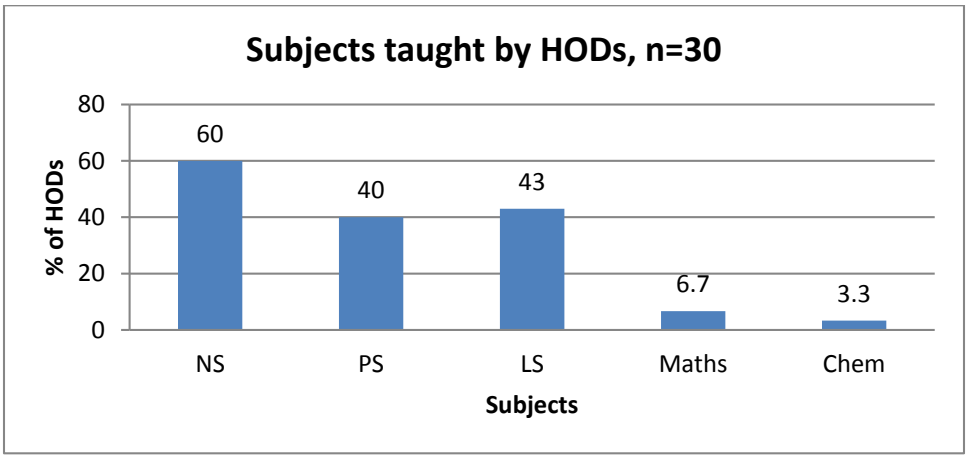


Figure 2: Subjects HODs teach

The HODs did not only teach NS, they also taught either physical or life sciences or mathematics. The number of HODs who taught physical sciences (12) was almost equal to the number of those who taught life sciences (13).

Qualifications/specialisation of HODs with regard to NS

Because of the interdisciplinary nature of NS, the HOD is expected to have the ability and knowledge to assist the teachers who might not have expertise in other science disciplines. The graph below shows the specialisation of the 30 HODs that participated in the study. The graph shows that almost half the number of HODs (12) does not have a physical or life sciences specialisation and almost a third have a mathematics specialisation. Those without a life sciences specialisation might not be comfortable teaching 25% of the NS syllabus and those without the physical sciences specialisation might not be confident teaching 50% of the syllabus. At the same time, HODs themselves cannot be specialists in all five or six science disciplines. They are likely to support teachers only in the area of their expertise.

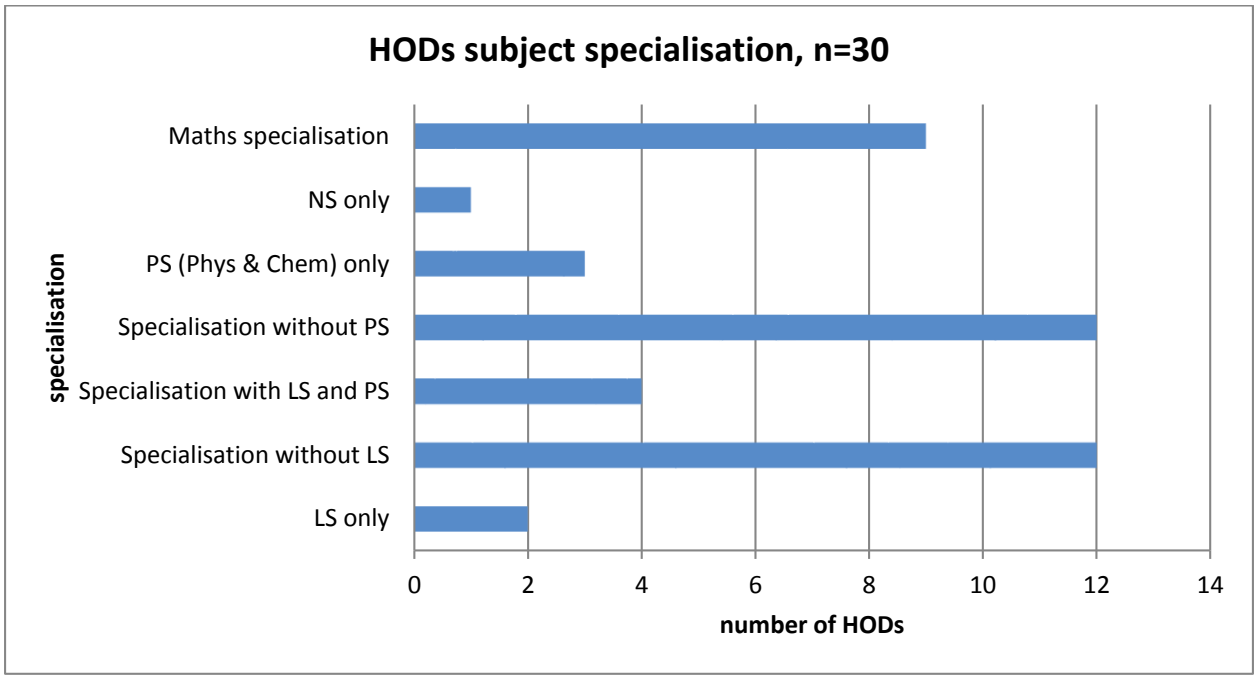


Figure 3: HODs' subject specialisation

HODs that did not specialise in the sciences are likely to use other teachers in the school, such as senior teachers in the subject, to assist them with monitoring the said subject. This provides an opportunity for shared or distributed leadership as advocated by Spillane *et al.* (2004).

Of the 112 teachers who teach NS in the study at least 58 (52 %) or a little more than half had not taught the physical sciences strand beyond grade 9. Even more teachers had not taught grades 11-12 (the number increases from 58 to 73 and 81 the higher the grade gets).

From the information in table six, the teachers of NS do not necessarily have experience in teaching grades 10-12 physical sciences. Therefore, they might not be in a position to lay the proper physical sciences foundation for grades 10-12. These teachers are more likely to need classroom support in 50% of the NS syllabus in order to teach it effectively and to the correct depth.

***Table 4**: Teaching experience of the teachers (NS: natural sciences; PS: physical sciences)*

Teaching experience	**NS grade 8**	**NS grade 9**	**PS grade 10**	**PS grade 11**	**PS grade 12**
1-2 years	17	13	12	11	4
3-5 years	18	17	12	7	5
6-10 years	20	18	4	4	4
>10years	14	18	10	6	3
No experience	27	31	58	73	81

They might be scared to do the experiments in science and set the prescribed common assessment tasks on their own. These teachers need the HOD to assist them more closely for 50% of the time. This study did not focus on the earth and beyond strand of NS and if these teachers are inexperienced in earth and beyond as well then they are only comfortable teaching 25% of the syllabus.

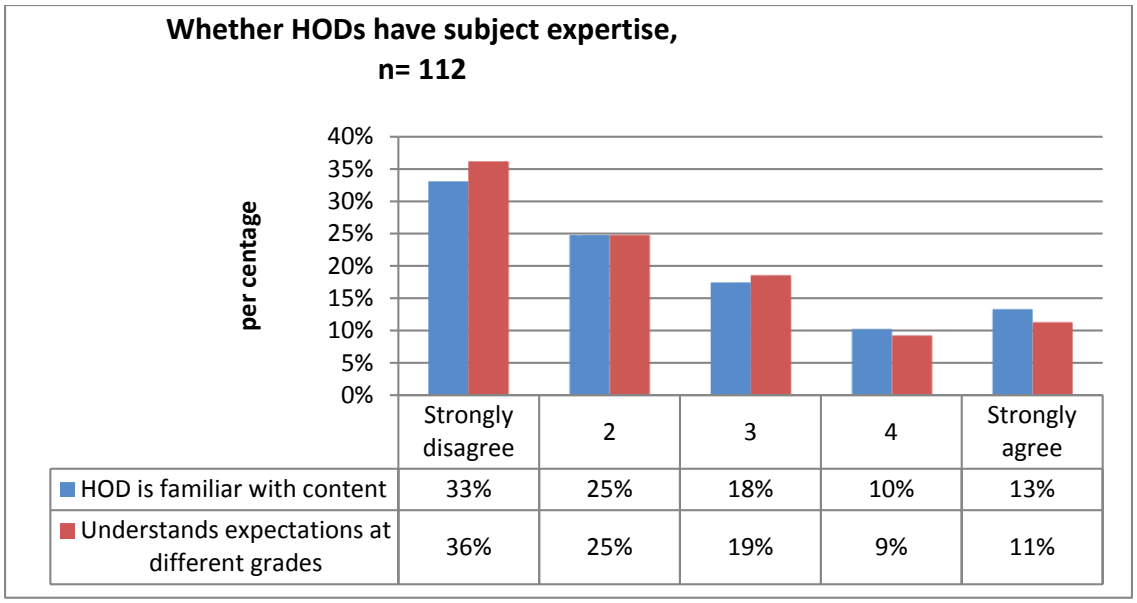


Figure 4: HODs' subject expertise according to teachers

The graph above shows that 58% (33% + 25%) of the teachers did not agree that their HOD was familiar with the subject content from their perspective and 61% (36% + 25%) believe that their HODs did not understand the subject expectations in the different grades. Familiarity with subject content means the HOD knows how deep and wide the teachers should present the subject. It involves understanding the subject progression, sequencing and coherence of topics so that the building blocks and anchors for the subject are formed. The teachers expect the HOD to know areas that are problematic and to prepare and caution teachers accordingly, giving them tips and transferring the necessary skills on how to tackle those problematic sections. With the new curriculum, there are assessment standards, expectations and demands that need to be met for NS.

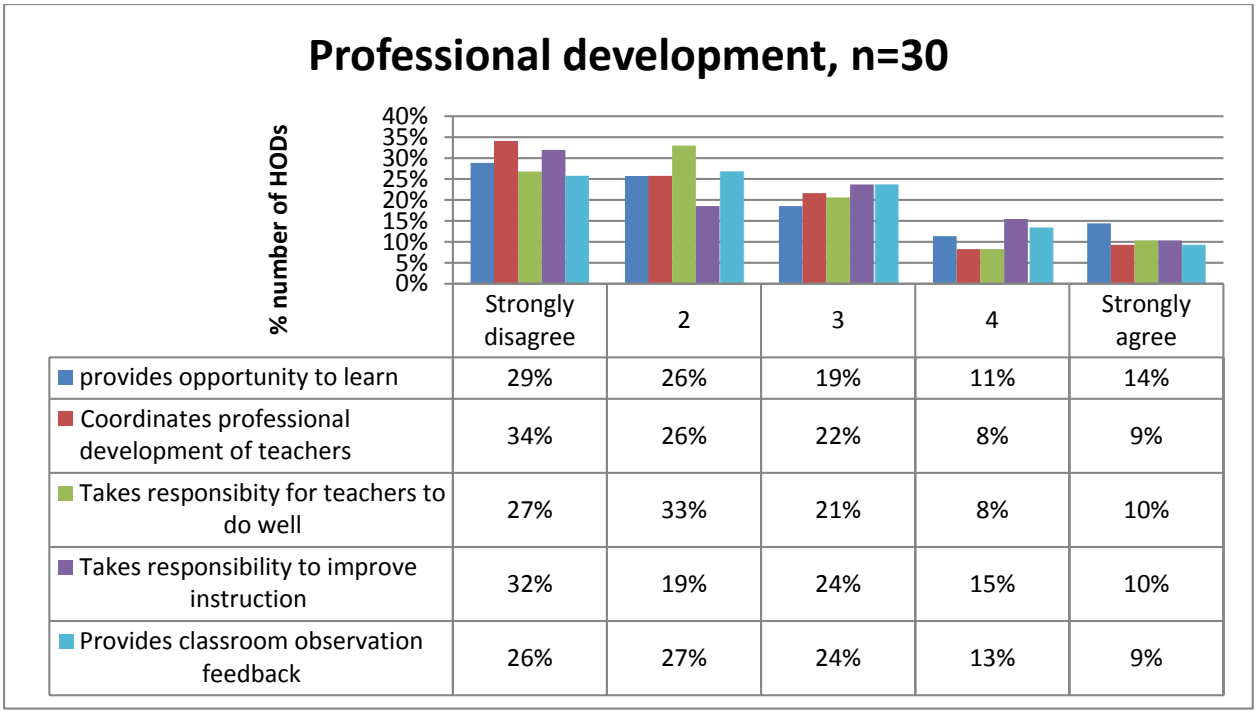
NS has a practical component and the new curriculum specifies that all leaners must do a common assessment task, which is based on the practical task. Practical work demands that the teacher prepares the experiment/investigation, ensures that the equipment is available and in working order and the teacher needs to understand the experiment and what could go wrong in order to assist the learners. The development, design and moderation of the task as well as the scheduling of the time and space for doing the common assessment tasks by all learners in the

grade on the same day requires the HOD's coordination. Once the task has been marked, the HOD can use the scores to analyse the level of understanding of the particular concept by learners and identify areas of support and for groups of learners.

About a quarter (23%) of the teachers agreed that their HODs were familiar with the NS content. Only 20% agreed that their HODs understood the subject expectations at different grades. The graph above (Figure 2) showed that almost two thirds of HODs were teaching NS. This meant that more than a third of the HODs were not teaching the subject that they were leading. The fact that they did not teach the subject contributes to their lack of understanding of the expectations of subjects per grade and their non-familiarity with the subject content.

How HODs spend their time

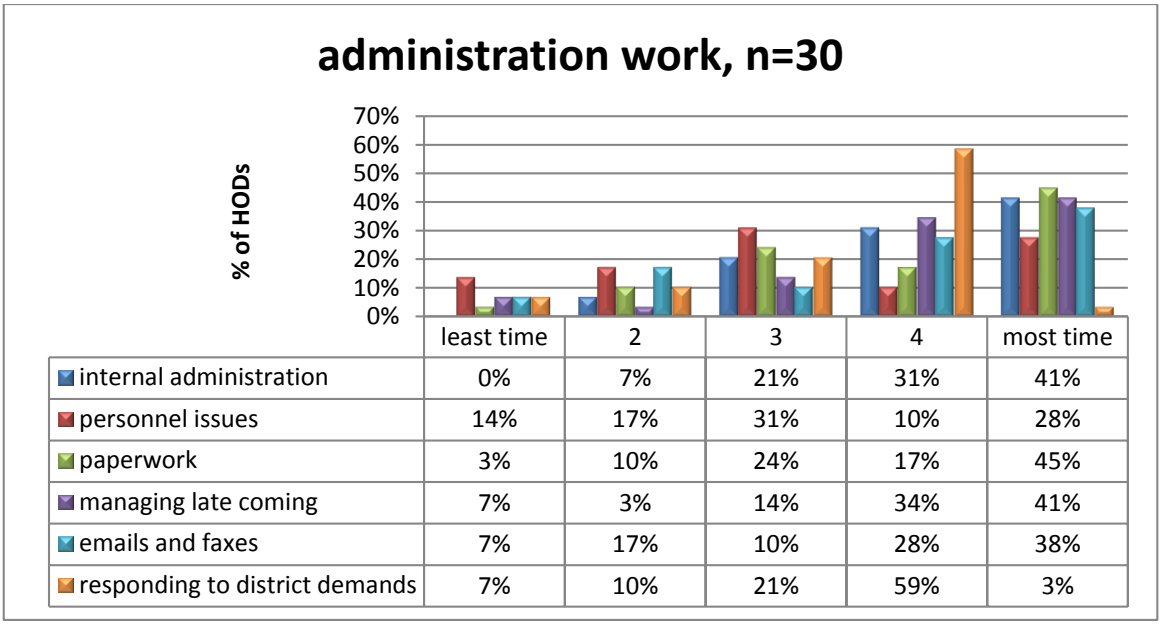
When asked how much time they spend on some leadership practices the HODs responded in the following way: On average, less than a quarter of the HODs agreed to provide any form of professional development to the teachers. Just over half (58%) of the HODs in the study did not agree to practicing any form of professional development activities. Fifty-four per cent (54%) did not provide opportunities to learn, 60% did not coordinate professional development nor did they take responsibility for teachers doing well, while 51% did not take responsibility for improving instruction and 53% did not provide classroom observation feedback. Predominantly over a third of HODs in this study did not coordinate professional development (34% strongly disagree), did not take responsibility for improving instruction (32%) or for teachers to teach well (33% agree). Only a quarter of the HODS agreed to providing opportunities for teachers to learn and taking responsibility to improve instruction.



	Strongly disagree	2	3	4	Strongly agree
provides opportunity to learn	29%	26%	19%	11%	14%
Coordinates professional development of teachers	34%	26%	22%	8%	9%
Takes responsibity for teachers to do well	27%	33%	21%	8%	10%
Takes responsibility to improve instruction	32%	19%	24%	15%	10%
Provides classroom observation feedback	26%	27%	24%	13%	9%

Figure 5: How HODs spend their time

The graph below (Figure 6) shows that HODs spend most of their time doing administrative work. Almost three quarter (72%) of the HODs indicated that they spent most of their time doing internal administration at the school. Almost two thirds spent their time on paperwork, two thirds spent most of their time responding to e-mail or fax correspondences, while three quarters spent most of their time managing late coming at the school and 62% spent time responding to local district office demands. On average 56.3% of the HODs spent their time doing administrative work.

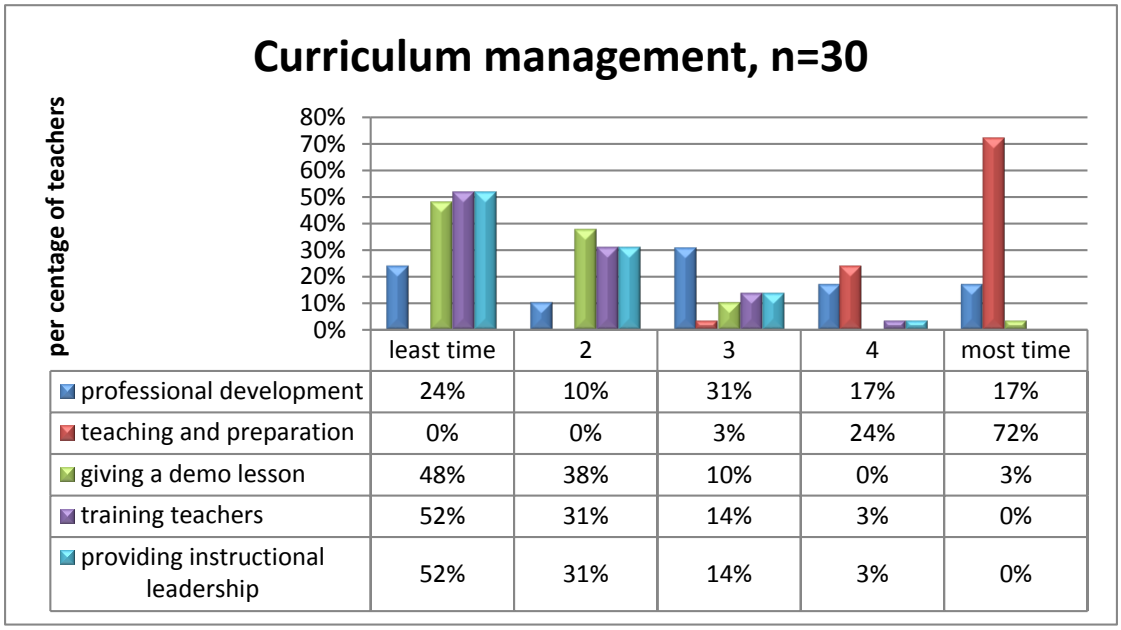


	least time	2	3	4	most time
internal administration	0%	7%	21%	31%	41%
personnel issues	14%	17%	31%	10%	28%
paperwork	3%	10%	24%	17%	45%
managing late coming	7%	3%	14%	34%	41%
emails and faxes	7%	17%	10%	28%	38%
responding to district demands	7%	10%	21%	59%	3%

Figure 6: Time spent on administrative work

Curriculum management

The graph below shows the amount of time HODs spend on managing the curriculum. Relating to the curriculum management issues, HODs indicated that they spent almost all their time (96%) preparing lessons and teaching. HODs spent a little over a third (34%) of their time developing teachers on issues around curriculum management and only 3% on providing demo lessons and training teachers or providing instructional leadership respectively. Teachers were also asked the frequency with which the HODs engage in curriculum management activities their responses are below.

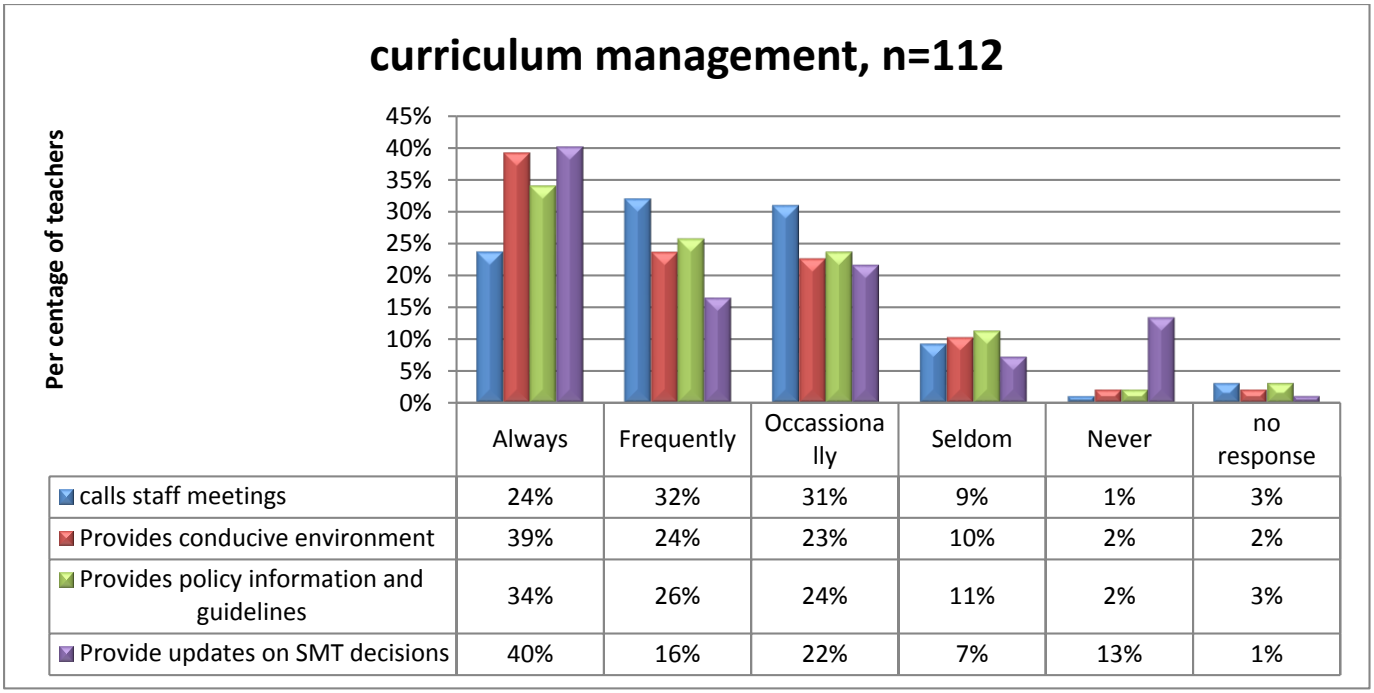


	least time	2	3	4	most time
professional development	24%	10%	31%	17%	17%
teaching and preparation	0%	0%	3%	24%	72%
giving a demo lesson	48%	38%	10%	0%	3%
training teachers	52%	31%	14%	3%	0%
providing instructional leadership	52%	31%	14%	3%	0%

Figure 7: Time HODs spend on curriculum management

More than half of the teachers (24%+ 32%) indicated that their HODs called subject staff meetings and provided feedback on SMT decisions more frequently. Almost two thirds of the teachers (63%) indicated that the HODs frequently provided an environment conducive for instruction. Sixty per cent (60%) of the time was spent providing policy information and guidelines.

The teachers' response showed that HODs provided curriculum management. Curriculum management in this context relates to all the activities that involve compliance to the demands of the SMT, district and provincial office for a particular subject offering. Most schools expect HODs to have subject meetings (56%) and they almost do this frequently although the meaning of frequent varies from school to school. The content of what is addressed at the subject meetings also varies from school to school. HODs are also responsible for ensuring that all teaching and learning resources and teaching spaces like adequately equipped laboratories are available (conducive).



	Always	Frequently	Occassionally	Seldom	Never	no response
calls staff meetings	24%	32%	31%	9%	1%	3%
Provides conducive environment	39%	24%	23%	10%	2%	2%
Provides policy information and guidelines	34%	26%	24%	11%	2%	3%
Provide updates on SMT decisions	40%	16%	22%	7%	13%	1%

Figure 8: Time HODs spend on curriculum management from the teachers' perspectives

The most helpful person

Teachers were asked to indicate which person they found most helpful regarding instructional matters. Fifty one (51%) per cent of the teachers indicated that the HOD was the helpful person whilst half the teachers found the senior teachers to be helpful whereas 12% of the teachers indicated that they did not have senior teachers for NS. Fifty-one per cent (51%) of the teachers found the subject advisor[23] helpful. Over a third (36%) of the teachers indicated that they received help from other teachers in the same schools whereas 13% indicated they received help from teachers in other schools.

[23] Subject advisors are local district based subject specialists who are charged with the task of providing subject-related curriculum and assessment support to teachers in the schools.

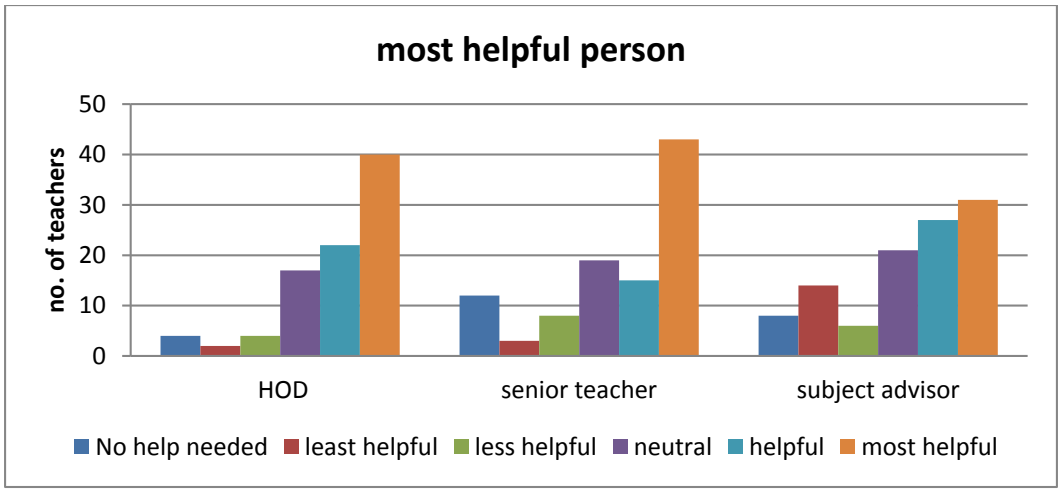
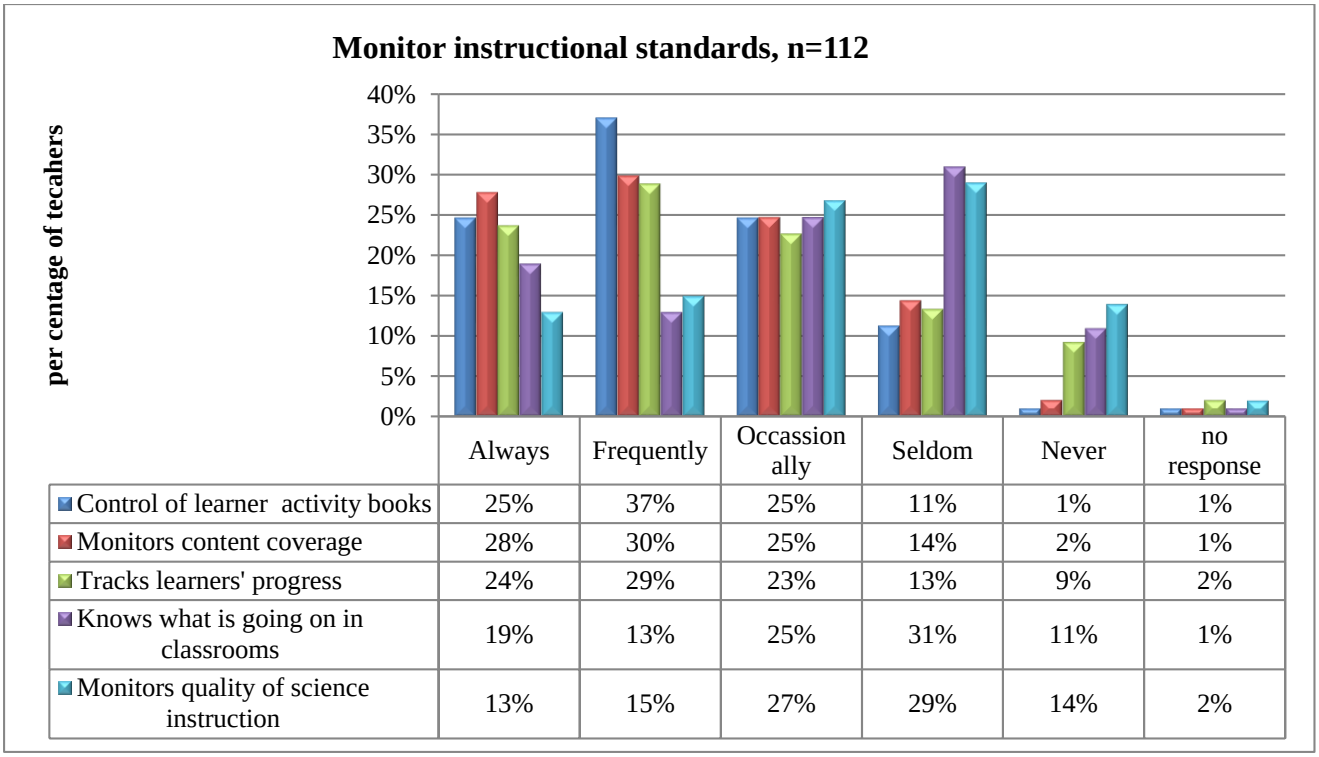


Figure 9: Teachers' perspectives on the most helpful person

Only 8% indicated that they received help from either universities or non-governmental organisations. The HOD and the subject advisor in the subject were identified as helpful but the teachers in the study identified the senior teacher as the most helpful person in the school.

Instructional leadership and in-classroom support

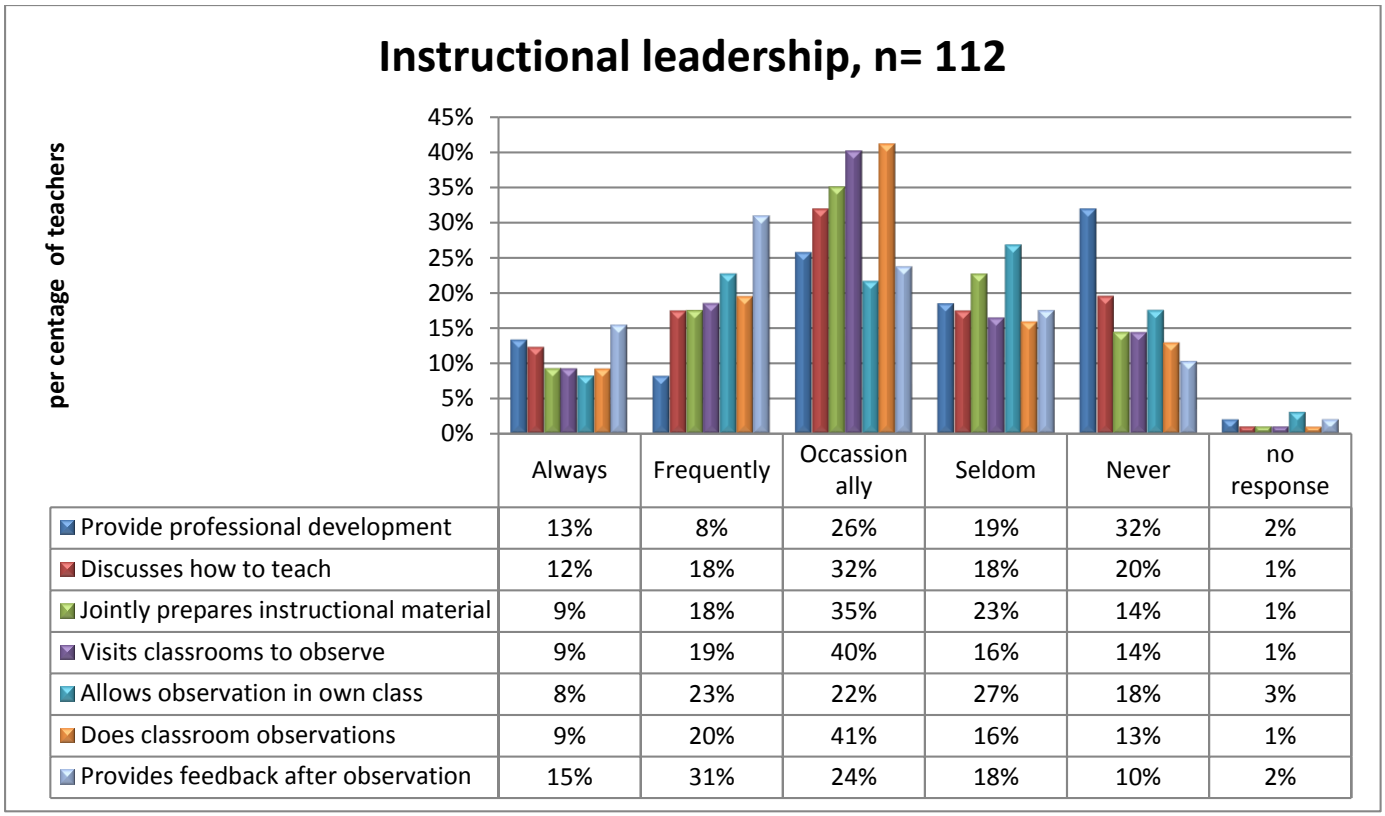
The HOD's key role other than teaching is providing instructional leadership. In class support is one of ways in which HOD provide leadership. Their capacity to provide in class support and leadership in general was explored. This section discusses how the teachers and HODs responded to the questions about instructional leadership. Regarding activities that HODs did to monitor instructional activities, 62% of the teachers indicated that their HODs more often than not controlled the learners' activity books and 58% agreed that HODs monitored the subject content coverage. Over half (53%) indicated that their HOD frequently tracked learners' progress. Thirty-one per cent (31%) indicated that HODs seldom or occasionally (25%) made time to understand what was going on in the science classrooms. 56% of the teachers indicated that HODs occasionally or seldom monitored the quality of the science instruction.



	Always	Frequently	Occassionally	Seldom	Never	no response
Control of learner activity books	25%	37%	25%	11%	1%	1%
Monitors content coverage	28%	30%	25%	14%	2%	1%
Tracks learners' progress	24%	29%	23%	13%	9%	2%
Knows what is going on in classrooms	19%	13%	25%	31%	11%	1%
Monitors quality of science instruction	13%	15%	27%	29%	14%	2%

Figure 10: Frequency of monitoring standards from teachers' perspective

Teachers were asked how frequently they interacted with the HOD regarding instruction and in-classroom support. The graph below shows the responses of the teachers in the study. Forty percent (40%) of the teachers indicated that their HODs occasionally did classroom observations. Over a third (35%) indicated that they occasionally developed instructional material jointly and 32% occasionally discussed how to teach NS. Almost half (46%) indicated that they frequently or always got feedback from the HOD after classroom observations. About a third indicated that their HODs never provided professional development while almost half (45%) indicated HODs seldom or never allowed teachers in their classroom for observations or demonstrative lessons.



	Always	Frequently	Occassionally	Seldom	Never	no response
Provide professional development	13%	8%	26%	19%	32%	2%
Discusses how to teach	12%	18%	32%	18%	20%	1%
Jointly prepares instructional material	9%	18%	35%	23%	14%	1%
Visits classrooms to observe	9%	19%	40%	16%	14%	1%
Allows observation in own class	8%	23%	22%	27%	18%	3%
Does classroom observations	9%	20%	41%	16%	13%	1%
Provides feedback after observation	15%	31%	24%	18%	10%	2%

Figure 11: Frequency of instructional leadership activities from teachers' perspective

Subject meetings

Subject meetings are formal organisational routines that are one of the aspects of organisational infrastructure that can enable or constraint leadership practice. HODs use these routines as monitoring tools to see if various components of the department are working as intended. Both teachers and HODs were asked about the content of the subject or departmental meetings. Below are their responses. Both HODs and NS teachers indicated that they discussed instructional assessment more (68%) than any other items ranked as the top item in the frequency of subject /department meeting agenda items. Instructional assessment included setting, moderation and administration of tests, examination question papers and school based assessment tasks. NS teachers ranked account of term's work as the next frequent agenda item while the HODs, on the other hand, identified learner assessment issues as next mostly discussed and the account of terms work third. NS teachers ranked development of lesson plans as 10th while HODs ranked the second least item to be discussed. HODs identified learner outcomes. Professional development, instructional evaluation and policy review were among the agenda items that were

least discussed. All participants corroborated that budgets were the least item to be discussed in subject of department meetings.

Table 6*:* Items discussed at department meeting

	Heads of departments		Teachers	
Agenda items at meetings	**Mean**	**Rank**	**Mean**	**Rank**
A. Question-paper monitoring	4.6	1	4.09	1
B. Account of the term's work or content coverage	4.4	3	3.82	2
C. Learner-assessment issues	4.5	2	3.73	3
D. Analysis of learner scores to inform instruction	3.5	12	3.71	4
E. Curriculum and learner outcomes	4.2	4	3.71	4
F. Start and end-of-term issues	4.2	5	3.61	6
G. Plan of next remedial or enrichment steps	4.0	6	3.61	6
H. Clarification of the department's direction	3.8	11	3.5	8
I. Textbook and course-material reviews	3.97	7	3.5	8
J. Development and sharing of lesson plans	2.67	15	3.42	10
K. Distribution of leadership activities	3.93	8	3.38	11
L. School improvement plan	3.9	9	3.37	12
M. Instructional evaluation	3.83	10	3.33	13
N. Professional development	2.83	14	3.32	14
O. Policy reviews	3.27	13	2.94	15
P. Budget	2.6	16	2.23	16

DISCUSSION

The capacity of the HODs in the study was limited in many ways. Firstly, the HODs could not differentiate between curriculum management and instructional leadership. For most of them, they could tick the checklist in terms of management issues like monitoring curriculum coverage from learner books, calling subject or departmental meetings, counting the number of assessment tasks given etc. Very few however, were able to influence the quality of what was happening in the classroom. Curriculum management does not need visible personal interaction with the teachers. Instructional leadership on the other hand involves constant interaction and professional dialogue in the form of one-on-one face-to-face meetings, or group meetings, classroom observation and feedback, lesson demonstrations of best practices and leading by example. This is the actual sphere and means of influence and this is how leadership works.

Any HOD can call the meeting and tick that output from the checklist, however, what is discussed at the meetings determines the difference between management and leadership. Schools have routines such as that on certain days all learner books are submitted to the HOD for moderation. If the HOD signed and stamped the learners' book, it can be ticked from the management checklist. However, an instructional leader will look at the content of the learner activity books and the quality of the science writing to pick up areas for development, or interventions in the classroom or work with the teacher(s) concerned depending on the trend that is picked up. In this study 62% of the teachers indicated that their HODs frequently monitor the learners' activity books but they occasionally or seldom monitor the quality of instruction.

These managerial duties are "simply clerical tasks that detract from their instructional duties" (Peacock, 2013, p. 186). They are often listed as official HOD responsibilities but are not instructional leadership activities. Peacock (2013) suggests that these managerial processes are those that support instruction, like budgeting, scheduling/routines and recruitment of teachers. Spillane and Hopkins (2013) also suggest that organisational infrastructures which includes routines, processes and structures are important for instructional delivery.

More than half (58%) of the teachers indicated that they occasionally or seldom spent time preparing instructional material as a group. Helterbran (2008) asserts that collaborative planning assists teachers to reflect carefully on what works and what does not in a particular school context and within a group of learners. These teachers can then work together to address challenges in the curriculum and with their teaching choices. The HODs in the study missed the opportunity to develop, facilitate, monitor and support common instructional material such as lesson plans and assessment tasks. The HOD did not have to develop this on his/her own but joint development is also an opportunity to distribute leadership and develop the teachers professionally. Most of the teachers prepare their own material, which can be appreciated but the quality of the material might be compromised.

Secondly, just over half of the HODs (57%) either teach NS in grade 8 or grade 9. This means that more than a third (43 %) do not teach the subject and will therefore find it difficult to know what goes on in NS classrooms (42% seldom or never know what is going on). Therefore they

would not be in a position to monitor the quality of NS instruction (43% seldom or never) apart from a self-report created by the teachers. More than half of the teachers strongly indicated that their HODs were neither familiar with the content nor understood the subject expectations at the different grades. The HODs that were not teaching the subject would normally pay more attention to the subjects that they teach and very little to NS. If 45% of the teachers indicated occasional classroom visits, how likely is it that HODs know what goes on in the classroom or where instructional practice is enacted and actualised? How can HODs possibly ascertain the quality of instruction at a distance, apart from the products of instruction evident in learner books and learner progress reports? How does the HOD know where to intervene and support the teacher in the classroom? They would not be in a position to know first-hand what learners are struggling with, how to approach such challenges and could not share it with the other teachers in the grade. Therefore, their capacity to provide instructional leadership is challenged. The minimum that they could do is to resort to curriculum management, which can be achieved through paperwork and does not involve physical presence of visible leadership in the subject (Southworth, 2002). Almost half (46%) of the teachers agreed that HODs provide feedback after observation (Aubrey-Hopkins & James, 2002). Providing feedback encourages the teachers to look back at their own instructional practice. The HOD uses this opportunity to identify areas on professional development and identify any other intervention in the classroom or even in the whole grade or school.

Almost another half of teachers (49 %) indicated that their HODs occasionally or seldom allowed teachers in their classrooms to demonstrate best practice (Benedict, 2009). HODs failed to position themselves as models of best professional and instructional practices. Partly because these HODs did not teach NS thus, it was difficult to go out of their way to plan and prepare the subject that they did not teach. In other schools, the agency of the teachers drives them to lead a subject even though s/he has not been appointed. There are schools where the HOD had specifically realised the need for the science specialisation and split the department such that another HOD was appointed to lead the NS department. Even in this arrangement, the HOD has a life sciences specialisation and a physical sciences senior teacher has been appointed to lead the two physical science strands, matter and materials and energy and change. This is where the

concept of senior/lead or master teacher plays a significant role. I discuss the role played by senior teachers later in this section.

Thirdly, the subject specialisations of the HODs could contribute to their capacity of providing effective instructional leadership. Subject specialisation provides the HOD with professional credibility as a specialist in a particular subject (Stein & Nelson, 2003). It boosts the professional esteem and confidence of the HOD as s/he professionally interacts and engages with the teachers that s/he is leading. In the study very few, about 15% of the HODs, had a qualification that enabled them to teach all subject strands of NS. Half of the HODs were only specialised enough to teach 50% (physical sciences – physics and chemistry specialisation) of the strands and another 46% were specialised to teach only 25% (life sciences- zoology and botany specialisation) of the subject strands. This affects the HOD's capacity to provide effective instructional leadership in the whole subject and all the subject strands. More than half of the teachers did not have the physical sciences teaching experience, which would have enabled them to teach 50% of the syllabus. This implied that the teachers needed plenty of support in teaching those strands. They are likely to rely on the senior teacher or the HOD in order to teach these strands effectively and confidently. This reliance might have resulted in the teachers rating senior teachers in the subject as being the most helpful person (38%).

A senior teacher is a specialist in the subject who might not be formally appointed to a particular position in the school and most of the time would lead the subject under the supervision of the HOD. The presence of senior teachers allows distributed leadership to be enacted where necessary. In some schools, the HOD allocates the subjects to the senior teachers and in some cases the teacher's own agency (Sherer, 2008) and professional credibility (Stein & Nelson, 2003) leads the teacher to practice as a senior teacher. The challenge of departments being a group of subjects could be addressed by recognising senior teachers and allocating them to provide instructional leadership in order to achieve learner outcomes.

The last capacity challenge is the availability of time in order to provide the much-needed instructional leadership. Most of the HOD's time is spent teaching and doing administrative work. Administrative duties outweigh curriculum management and instructional leadership

(Collier *et al.*, 2002). HODs are challenged by the urgency to balance the competing responsibilities of managing the department, teaching and enacting instructional leadership (Zepeda & Kruskamp, 2007; Feeney, 2009) without getting any release time for these responsibilities. They often have to find time outside working hours to fulfil some of the responsibilities. They spend 96% of the time teaching and there is no time to help other teachers teach better or observe what they do in class in order to support them. In the study, HODs reported spending 96% of their time on teaching and preparing to teach even though the department stipulated 85% of the time.

HODs would seem to know what is expected of them even if they do not practice it. The views of the teachers in terms of what the HODs say they do seem to differ. This is evident in the subject meeting agenda items; there is no alignment in terms of the frequency of what is discussed. This item would be followed up using observation of meetings and document analysis of meeting minutes. These capacity challenges are not necessarily unique to HOD research or to South Africa.

CONCLUSION

NS HODs have either a physical sciences qualification or a life sciences specialisation. When the HOD possesses a physical sciences qualification, this implies his expertise lie in 50% of the NS syllabus whereas the HOD with a life sciences specialisation might only be comfortable with 25% of the syllabus. This affects the support that the HOD can provide to the teachers. The survey showed that at least half of the teachers had not taught physical sciences at grade 10 or higher. This implies that these teachers might not know the subject demands and expectations beyond grade 9 and might not know the challenges in physical sciences that learners have, which could be addressed in grade 8 and 9. If the HODs, themselves, have capacity challenges and cannot leverage the senior teacher opportunity, the quality of instruction might be compromised. The HODs in this study were therefore only doing their curriculum managerial duties instead of providing instructional leadership. The specialisation shortcomings might have led to a lack of subject teacher professional development and a lack of willingness to model best practice in terms of demo lessons and common planning. The majority of the HODs have qualifications that limit their ability to support and develop teachers within NS. What is unique about these

findings, is the subject specific demands of NS and how schools have adapted their systems to accommodate the complex subject like NS in their own contexts. HODs' capacity is compromised because they do not teach the subject therefore they do not know what happens in NS classrooms. One of the reasons that they do not teach NS could be their involvement in senior secondary teaching. HODs rarely coordinate or provide professional development or even discuss it at meetings, which compromise their interaction with the teachers and being seen as professional leaders in the subject. Teachers were not convinced that HODs knew what was going on in the classroom in order for them to provide support. The HOD capacity is highly affected by the lack of release time because most of the HODs indicated that they spent the majority of their time teaching and doing administrative work.

It is recommended that HODs receive a more focused subject-specific training in the NS sub-disciplines, especially the physical sciences strand. It is envisaged that the HOD capacity can further be improved by allocating release time from teaching duties in order to attend to some instructional leadership activities. Where schools still have opportunities to appoint science HODs it is recommended that they consider an HOD for junior secondary science separate from the senior secondary science, so that senior secondary issues and urgency to provide matric results do not overshadow junior secondary issues. Furthermore, we recommend the need to re-examine the structures and functions within the science departments to enhance the potential for much stronger instructional leadership by the appointed HODs. Since HOD positions cannot be reversed, it is recommended that the senior/lead/master teacher concept be encouraged to address the instructional leadership deficit especially for NS teachers.

Limitations: In this paper, we only reported on the survey data that were collected in 77 schools as part of a bigger study on the middle management instructional leadership, but we have not reported on the follow up interviews and observational data that was collected from the schools.

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SECTION 3: DISCUSSION, CONCLUSION AND IMPLICATIONS

This section is a summary that reflects on the presentations from the preceding sections. It links the research questions to the findings from which I can draw conclusions. Initially it considers how science HODs influence instructional practice in the context of a multidisciplinary subject and lack of release time. This is followed by a discussion on the support that HODs receive from the principal and subject advisors. I further reflect on the perceptions of teachers about the quality of instructional leadership that they receive from HODs. The empirical findings on the capacity of science HODs to provide instructional leadership are examined and implications for school organisational infrastructure, with regards to NS are drawn. A presentation of recommendations with suggestions for further research is tabled.

3.1 DISCUSSION

The findings in this study were reported in five articles discussed above. The articles provided insight into the evidence of the challenging nature of the science HOD role. Below is an account of how the various articles answered the research questions. Each answer discusses major findings of the study that bring insight into understanding the instructional leadership practices of science HODs.

3.1.1 Research question 1: The means for instructional leadership

In what ways, if at all, do sciences HODs provide instructional leadership in NS or science departments?

To answer research question one, I draw from all the articles but especially from article 2 on the leadership capacity of HODs and article 3, which compared instructional leadership practices with organisational infrastructure in formerly segregated schools.

Focus on curriculum management

There was a strong compliance component at all levels in the schools. The teachers did some activities just to comply, even though they did not necessarily seem to benefit from it. The findings reveal that the monitoring of instruction by the HODs is more of a compliance activity

(Malinga & Jita, 2015d), with very little substantive engagement that focuses on assessing the effectiveness of teaching practice and the ways in which teaching could be improved. The teachers in the study were rather unconvinced about the extent to which HODs know what goes on in their classrooms even though the HODs had reported that they understood what goes on in the NS classrooms. The HODs' knowledge of the classrooms activities is rather superficial because they do not do classroom observations frequently. At a minimum, the HODs often resort to monitoring curriculum through desk-top reviews of teachers' and students' work rather than conducting meaningful classroom observations or spend time having subject instructional interactions with the NS teachers. Unlike in a study by Klar (2012), where principals fostered HOD leadership by attending meetings and on occasion attending professional development sessions with them, many of the science HODs in this study do not visit classrooms or observe teaching of the subject in their departments except for the IQMS purposes.

Curriculum management, as practiced in the schools, does not involve visible personal and professional interaction and dialogue with the teachers. HODs tend to resort to administrative approaches that do not require them to demonstrate as much of their subject expertise. For example, counting the number of activities in the learners' book and checking the teachers' subject files are not taxing in terms of the demand for subject expertise. It would appear that the HODs are content to acquire instructional information from monitoring the learners' activities and assessment books. The research findings suggest that these are the activities that dominated the agenda in subject meetings (Malinga & Jita, 2015c). This kind of information is secondary and only forms a small part of the instructional monitoring process. It only provides information on which sections of the curriculum the teachers chose to assess during class. The findings also suggest that the schools have routines such as submission of learners' books to the HOD on certain days, for moderation and stamping by the HODs. Once this is done, the HOD would then tick the activity off his/her management checklist. However, such routine monitoring work often fall short of engaging with the content of the learner activity books and the quality of the science assignments. It is not surprising that the HODs do not identify any areas for teacher development or initiate interventions to improve NS classroom instruction.

The findings regarding ticking the management checklist are consistent with the argument that these HODs' managerial duties were 'simply clerical tasks that detract from their instructional duties' (Peacock, 2013: 186). They are often listed as official HOD responsibilities but do not constitute substantive instructional leadership activities. Peacock (2013) asserts that these managerial responsibilities such as budgeting, scheduling routines and recruitment of teachers only provide the enabling conditions that support instruction. Instructional leadership on the other hand involves constant interaction and professional dialogue in the form of one-on-one, face-to-face or group meetings about instructional improvement, classroom observation and feedback about lesson activities, including lesson demonstrations of best practice and leading by exemplary teaching and professional practice. These activities would have had a greater effect on influencing instruction and increasing learner success (Hallinger, 2005) had they been practiced in this study.

Curriculum management is part of instructional leadership and is required in order to improve the teaching processes and learning outcomes. However, when curriculum management is done for compliance rather than as a developmental exercise then it is unlikely to result in instructional improvement of any kind. A number of factors seem to have contributed to the science HODs focusing more on curriculum management as a compliance exercise rather than seeing it as a means to improve NS instruction. These include: 1) a lack of release time for professional supervision of teachers' work; 2) pressure from the top leadership to submit departmental or other whole school leadership reports and 3) the HODs' own teaching in the FET band.

The HODs are fulltime teachers who do not get release time to focus on their instructional leadership duties. This is one of the challenges of 'managing from the middle'. They have to balance their roles which include taking instructions from the top, together with leading and managing other people in their departments. Given their other teaching assignments in the FET band, HODs are also expected to be followers. For example, a science HOD could be teaching English and would have to comply with the demands and expectations from the English HOD as well. The HODs could not provide effective support and leadership as described by Lashway (2002) in the form of professional development, classroom observation, mentoring and coaching.

Considering the profile of the teachers in their departments and the recent changes in the SA curriculum, the NS teachers seem to have missed out on the opportunities for visible and available instructional leadership from their HODs.

Faced with many challenges, some of which were organisational, it appears like the science HODs rarely involve teachers in professional dialogue, leading by example, demonstration of best practices or observing and providing feedback about lesson activities.

3.1.2 Research question 2: Support provided for HOD

What support, if any, is provided to science HODs by the principals and subject advisors in providing NS instructional leadership in secondary schools?

a. Principal support and leadership

The findings from article 2 show that the principals and their deputies never consider the impact of their decisions on NS instruction (especially on how it supported or detracted from it). They also never introspectively reflect on the outcomes of NS teaching beyond the fact that the assessment results in PS, for example, were not improving. The data shows that the principals provide inadequate support to the HODs or make little effort to make their jobs easier. This was evident in the ways described below.

Firstly, in many instances, less qualified teachers are allocated to teach NS. For example, in Fhutura School, a geography teacher who was allocated to teach PS in grade 12 (achieving only a 9% pass rate with his group of learners) was "demoted" to teach NS. This suggests that the school leadership does not care much about the NS foundation that this teacher would be laying at the grades 8 and 9 level. The findings also reveal that an Afrikaans teacher at Sheba School was allocated to teach NS when Afrikaans was phased out as a subject in the school. Similarly a life orientation teacher volunteered and was allowed to teach NS at Mooredale secondary. Evidently, the teachers cited in the foregoing examples had no science specialisation at all. This practice suggests that the school leadership in each of these cases does not see NS as an important subject that requires qualified and competent teachers. Inadequate teaching of NS is

likely to continue for a long time if there is no strong and effective monitoring of the grade 8 and 9 curricula and the alignment of instruction with assessment standards. The lack of monitoring does not only apply to the three schools discussed above but also to other schools in the study. The schools either have teachers who were partially qualified to teach NS because they had specialised in only some of the science disciplines or not qualified at all.

Secondly, the lack of principal support is evident in the appointment of the science HODs to lead NS departments. At least two out of the seven science HODs that were interviewed are actually mathematics specialists. If the principals were mindful of the specialisation of the science HODs and the NS teachers, it is more likely that they would have recruited leaders with specialisation in science or failing which they could institute the "senior teacher" structure (discussed further below) in the schools to support the science HODs and the teachers. The "senior teachers" would at least ensure that the NS teachers received subject specific support in each subject strand (science discipline) and the HODs could then support teachers in other areas that did not require subject specific expertise. As it turned out here, the principals appear to have left the HODs to sink or swim with whatever resources the teachers had.

Thirdly, the evidence in the study suggests that the school leadership do not prioritise subject or department meetings. Teachers have to sacrifice their own lunchtime or meet during the time for the school's extramural activities. This was also evident in the number of times that these meetings were postponed in some of the schools during the data collection cycle. The HOD at Fhutura School reported, for example, that there are more urgent issues that always come up which make them cancel the subject meetings (Malinga & Jita, 2015b). Similarly, in Sheba School the meeting that the researcher went to observe was cancelled three times because other urgent matters had to be attended to. This provides some evidence that the subject meetings are not formalised or prioritised by the school leadership to the extent of allocating times for the meetings. The findings suggest that these subject meetings are considered even less important than extramural activities, which have specific times allocated every week.

Fourthly, the findings show that although the principals were supposed to be supportive, they do not in the main, assist in providing a safe (free from chemical spills and fumes) and adequate

space in which the HODs can do their work. The researcher witnessed the shortage of space for HODs, first hand, when there was no room for meetings or spaces for professional development sessions or use as storage space for equipment and filing records. I conducted many of the interviews in crammed spaces, which were originally designed to be the laboratory storerooms. These rooms are packed with textbooks, some old laboratory equipment, learners' books, teachers' files, etc. In other schools, interviews were conducted in the deputy principals' offices because the HODs do not have any office space in which to have such meetings. The only spaces to do any work with teachers are the classrooms that they shared with the learners. Even then, these classrooms are used for the learners' feeding schemes during the lunch breaks.

b. Subject advisor support

Subject advisors are potentially rich resources that the department of education has provided to support subject instruction. In Gauteng, the subject advisors were appointed according to the four schooling phases: Foundation phase (grades R-3), Intermediate phase (grades 4-6), Senior phase (grades 7-9) and the FET band (grades 10-12). However, the study revealed that in the secondary schools the arrangement of subject departments, unlike with subject advisors, is such that the HODs are responsible for senior phase and FET subjects. The exploration of the support provided by subject advisory services reveal that some schools do benefit a great deal from the services while other schools do not. Subject advisors arrange cluster meetings at least once a term. At these meetings, they meet with teachers to discuss areas of difficulty or to plan for the term ahead. In some schools, such as Mooredale, only one teacher per subject attends cluster meetings, with the expectation that they would come back and share what had been discussed at the meeting with the rest of the subject teachers at the school. In certain districts, the subject advisors provide the necessary individual support to teachers, especially in schools where the HOD has not specialised in any of the science disciplines.

Subject advisors tended to work directly with teachers and not the HODs, except in instances where the HOD is also a teacher of that particular subject. They invite teachers to workshops and cluster meetings but do not have any specific interactions with the HOD for NS. Clearly, the district approach of working directly with the teachers misses the very important link to instructional improvement in the subject – the HOD, (Melville, Wallace and Bartley, 2007).

HODs are better placed to support the teachers because they spend more time with them (Highfield, 2010). Subject advisors are responsible for a group of at least twenty schools and it is thus not possible to be available every time a teacher needs their assistance.

However, the HODs were never prepared for the job or developed in order to do their work. To be appointed as the HOD, one has to apply for the position and if appointed, they attend a day-long induction that orientated them on the forms that needed to be filled in when monitoring teaching. Unlike the teachers who were supported by HODs and subject advisors, no one provided the support for the HODs in the schools, district or provincial offices. An advanced certificate programme for principal development had been introduced as a requirement for appointment but nothing similar for the HODs. HODs are expected to learn on the job or as Stephenson (2010) posits, they define their own roles based on their experiences or what they have seen other HODs do. Evidently, in this study there is no structure or forum where science HODs from different schools meet to share best teaching practices and/or systems for instructional support and supervision of NS.

Science HODs could be better and more explicitly supported by perhaps establishing a forum such as a professional learning community where they could voice their concerns, learn from peers and subject advisors and network with each other. If the districts and circuits could revisit the operations of this layer of leadership, not only would subject advisor meetings be better organised and more effective but school-based subject instructional leadership could be enhanced.

c. Senior/master teacher support

Considering the multidisciplinary nature of NS, HODs are likely to feel inadequate and doubt whether they are valuable to the teachers that they lead if they are not teaching NS or are not science specialists. They could also be conscious that some of the teachers they supervise know more than they do about some areas of the subject (Malinga & Jita, 2015b). In this study, the need to institutionalise the concept of senior teachers at the schools was identified. Senior teachers are usually experienced teachers with a good knowledge of the subject. These senior teachers could provide guidance and counselling and act as mentors and coaches to less

experienced teachers. They could facilitate professional development activities (in the role of a master teacher), assist the HOD in identifying aspects that require special attention and assist in addressing them and when required, act as head of a subject, phase or grade in support of the relevant HOD (ELRC, 2003). Even better, the HODs could allocate the leadership of some subjects or sub-disciplines to the senior teachers and in some cases leave this to particular teachers' own agency (Lai & Cheung, 2013) and professional credibility (Angelle & DeHart, 2011). Science HODs in this study may have unintentionally promoted teacher agency because of their unavailability to NS teachers.

The findings in article 4 suggest that the NS teachers in the study identified teachers who could assist them, whether they are designated officially as senior teachers or not (Malinga & Jita. 2015c). They reverted to these colleagues for assistance. The teachers showed agency, took responsibility for their own development and approached other teachers, whom they trusted to assist them. This act of agency shows that teachers learn best through interaction with other teachers and with experts acting as 'critical friends', provided there is mutual trust (Rollnick & Brodie, 2011). The teachers who are approached to provide assistance also demonstrate agency, as defined by Sherer (2008), when they see the need or the gap and provide leadership. They also show a strong sense of collegiality and provid professional support and guidance without the formal title of HOD or senior teacher as advocated by De Lima (2008).

The challenge of conglomerate departments with many subjects could be addressed by recognising these senior teachers in all subjects and allocating them to provide some of the required instructional leadership. Sharing leadership would also afford HODs time to attend to their other leadership duties.

3.1.3 Research question 3: Discussion of teachers' perceptions

What are the NS teachers' perceptions of the quality of instructional leadership that they receive?

Articles 1 and 4 provided insights into the perceptions of the NS teachers concerning the quality of leadership enacted by science HODs. The findings from article 1 suggest that NS teachers feel

marginalised and overshadowed by senior secondary subject teachers whose subjects receive more attention because of their prominence in the grade 12 national examination. Most science HODs teach senior secondary subjects and do not have enough time for NS. NS teachers reported that their department meetings tend to focus on urgent FET issues and reports that need to be submitted and they feel discriminated against in such meetings (Malinga & Jita, 2015a). NS teachers have to sit in these meetings while only FET issues are discussed. The current school organisational structure of departments appears to neglect NS as a key foundational subject and the NS teachers as key people in laying the foundation for the two or three related senior secondary school subjects.

Firstly, NS teachers' feelings of neglect stems from the fact that the HODs in this study do not even teach the NS that they are supposed to be supporting, monitoring and improving. They do not seem to know what is going on in the NS classrooms and do not do classroom observations except for Integrated Quality Management Systems (IQMS). Even when they do IQMS, some HODs do not provide feedback to the teachers and thus cannot identify areas for professional development or provide that support to them (Malinga & Jita, 2015c; e). To the teachers, the HODs are out of touch with the subject and lack an understanding of its dynamics and challenges. Secondly, NS, a junior secondary subject, is grouped in the same department with subjects that are in the FET band. These FET subjects are assessed externally by the National Department of Basic Education and enjoy an elevated status at schools. Thus, NS has a lower status compared to these subjects. This finding supports Spillane *et al*. (2001) who argue that resources are unequally distributed across subject areas. It is ironic though that in this context, NS suffers from a lower status yet it is required to lay the foundation for these 'elevated' science FET subjects.

Being appointed to a leadership position should not only be based on seniority or position (De Lima, 2008) but on the expertise and experience of the teachers (Ghamrawi, 2010; Guthrie & Schuermann, 2010). Most of the teachers in this study, like all other followers in a leader–follower relationship, expect to have instructional leaders who would be available when the need arises for guidance and support. The teachers expect their instructional leaders to have sufficient expertise, experience and subject knowledge to meet their needs. They also expect the leader or

HOD to be available to provide support, in the form of demonstrations, mentoring and coaching as often as possible (Koh, Gurr, Drysdale & Ang 2011). The findings suggest that the HODs are 'too busy' and do not have release time to perform the expected support duties. HODs are also allocated subjects to teach and ae class (register) teachers.

The findings reported above clearly reveal the challenges involved in leading NS instruction in the current context of South African schools. The new curriculum specifies one experiment per term for each science discipline. This requirement has created a number of challenges for NS teachers. In the past, school visits by district officials focused on grade 12 subjects but recently the Department of Education monitored the implementation of the SBATs for grades 8 and 9. From the data presented, it is evident that NS teachers need different types of support and instructional leadership from what they received previously during the old curriculum. In cases where teachers do not have access to more formal kinds of support, they created their own support systems by identifying teacher leaders who could provide them with the support they need (Spillane *et al*, 2003). In general, the findings suggest that there are many reasons why teachers who require assistance could not get it from the HODs thereby leading to poor perceptions of HODs as instructional leaders.

3.1.4 Research question 4: Enhancing HODs' capacity

How can the capacity of science HODs be enhanced to provide effective leadership?

The fifth article explores the findings on the capacity of science HODs to provide NS instructional leadership. The capacity of the HODs is found to be limited in many ways. Looking at the HODs' personal and professional attributes as the first component of the conceptual framework (such as qualifications, teaching experience, specialisation and to a certain extent, the institution of qualification, which was linked to age), affects their capacity to provide subject specific instructional leadership. Although most HODs have degrees and postgraduate qualifications obtained after they had qualified as teachers, these are in subjects other than NS. In most cases, the data shows that HODs had specialised in either LS or PS with less than a quarter having a specialisation in NS. Naturally, as argued by Stein and Nelson (2003), HODs felt inadequate in providing leadership in a subject where they lacked particular subject content

knowledge. Similar to teachers, they tend to provide support only in subjects that they have expertise in and are comfortable in teaching (Ng, Nguyen, Dong & Choy, 2015). The findings show that even though some HODs have postgraduate degrees, their initial teacher training was attained at teachers' colleges (with 3-year diplomas), whereas most teachers under their leadership have qualified at universities (with 4-year degrees). This qualification difference poses a challenge to the HODs' professional credibility and esteem, especially in the subjects they did not specialise in, making them feel inadequate compared to the people they lead (who have degrees). This feeling of inadequacy could have compromised their HODs' capacity to lead NS instruction as discussed below.

a. Capacity to provide professional development

The inadequate subject specialisations of the HODs could have affected their capacity to provide effective instructional leadership. Angelle and DeHart (2011) argue that subject specialisation provides the HOD with professional credibility as a specialist in a particular subject. It boosts the professional esteem and confidence of the HOD as s/he professionally interacts and engages with the teachers that s/he is leading. As the findings reveal, some HODs had specialised in certain strands of NS, while some have no science specialisation at all. This could have contributed to them feeling inadequate and thinking that teachers know more than they do. It may have affected their capacity to provide effective instructional leadership in the whole subject and all the subject strands. More than half of the NS teachers in the study do not have the PS qualification and teaching experience required for them to teach more than half of the NS syllabus. This implies that the teachers need plenty of support from the HODs in teaching those strands (half the syllabus) that they (the HODs) also have not specialised in and in which they lack confidence.

The capacity of the HODs to provide professional development could be enhanced by the school allocating time and resources for such development for the teachers and for the HOD. The subject advisory services could be better structured to support subject HODs more in addition to the teachers.

b. School conditions

The second capacity challenge for science HODs is the availability of time in order to provide the much-needed instructional leadership. Most of the HODs' time is spent teaching and doing administrative work. This finding is consistent with that of Brown, Rutherford and Boyle (2000), who argue that HODs have no release time and often hide behind administrative work instead of providing instructional leadership. The HODs are in a daunting position of balancing the role of being managers and administrators with that of being teachers. They belong to various school committees, which take a lot of their time and add to their responsibilities. As members of the school management teams, they are expected to lead those committees as well. Some of the committees they serve in do not have any bearing to the subject department's work. In line with the study by Barnett, Shoho & Oleszewski (2012), HODs are also expected to provide whole school leadership, such as leading grade or phase teachers instead of concentrating on the subjects in which they are specialists. The capacity to perform HOD duties could be enhanced by allocating time for such duties.

Some of the administrative work does not require subject specialisation. Administrative duties seem to outweigh curriculum management and instructional leadership as is indicated in the study by Collier, Dinham, Brennan, Deece & Mulford (2002). Similar to HODs in other countries, science HODs in this study are challenged by the need and urgency to balance the competing responsibilities of managing the department, teaching and enacting instructional leadership (Bush & Glover, 2014; Zepeda & Kruskamp, 2007) without getting any release time for these responsibilities. In this study, the HODs reported spending 96% of their time on teaching and preparing to teach, even though the department's policy stipulates 85% of the time (ELRC, 2003). They often had to find time outside of working hours to fulfil some of the responsibilities such as convening subject meetings. There is simply no time to help other teachers or observe what they do in class. The capacity of science HODs could be enhanced by relooking at the organisational infrastructures of the school and allocating administrative duties that do not require specialisation to other teachers. Identifying, developing and allocating senior teachers to complement the HODs especially in subject areas within the departments where they lack expertise would also be helpful.

c. Physical resourcing of department

Teachers reported that HODs always tried to provide a climate that is conducive for teaching and learning. Some of the HODs' capacity challenges are institutional and result from the schools' context and conditions. The school conditions are an important component of the conceptual framework and are likely to impact on the ways in which the HODs provide leadership. In this study, the lack of laboratory equipment for example was identified as one of the more serious of the many challenges that arose from the school context. It becomes the responsibility of the HOD to borrow equipment from other schools. The shortage of equipment has a negative effect on how practical assessment tasks are conducted and limits the HODs' capacity to provide an environment that is conducive to teaching and learning. The schools do not address this important condition for learning NS thus leaving the HODs to provide for their departments on their own (Malinga & Jita, 2015c). The HODs ranked managing the departments without resources as one of the most difficult tasks they had to perform (Malinga & Jita, 2015d). The school leaders could enhance the capacity of science HODs by allocating a budget for subject resources and providing financial support.

d. Arrangement of departments

Subject departments in most South African schools comprise a group of subjects rather than one subject. The arrangement of subject departments is contextually based and related to the former segregated schooling system in South Africa. Although the desegregation of schools happened more than twenty years ago, the playing fields has not yet been levelled, as former Model C schools are still better resourced and organised to support NS instruction. Schools with better finances are at liberty to recruit more HODs or even senior teachers to assist with instructional support, and are able to provide adequate and high quality facilities and sufficient materials to ensure learner success.

The arrangements in the majority of South African public schools though are such that subjects like mathematics, mathematical literacy, technology, natural, physical, life and agricultural (where applicable) sciences all belong to one department. Thus, it is unlikely to have HODs who are specialists in all of these subjects. This arrangement makes it impossible for the HODs to

address subject specific issues in one departmental meeting. In schools with better organisational infrastructure such as Mooredale and Knowledge, meetings were dedicated to NS and its instruction. The HOD at Knowledge School (one subject department), was the only one who reported having done some classroom visits and provided in-class support. In Mooredale School, senior teachers took on the role of supporting NS teachers in various subject strands.

Some HODs found a way around this. They only discuss administrative issues and address urgent information that was required to produce the departmental reports whenever they meet with teachers at departmental or subject meetings. They do not discuss subject specific issues at these meetings. This was confirmed during the departmental meeting observations, where the largest amount of the subject meeting time was dedicated to assessment issues of senior secondary school subjects such as PS and LS. The findings show that even though the meetings do not seem to be supported by the senior leadership in many schools, HODs manage to at least hold departmental meetings rather than subject meetings. A number of things could be done to enhance the capacity of science HODs to lead effectively. For example the school leaders could involve the HOD in the allocation of teachers in the departments especially NS teachers, they could allocate a budget and time to train teachers who need help and group subjects in the departments such that HODs are able to support them. Furthermore, they could identify and allocate senior teachers for subject specific support, allocate and protect subject meeting times and meet more as subjects rather than as departments.

e. Means of influencing instructional practice

The HODs can use various means to influence instructional practice. Some of the ways in which the capacity of the HODs could be enhanced to influence instruction are discussed in this section. Helterbran (2008) asserts that collaborative planning assists teachers in carefully reflecting on what does and does not work in a particular school context and group of learners. More than half of the teachers in this study indicated that they occasionally or seldom spent time jointly preparing instructional material. The HODs in this study missed the opportunity to develop, facilitate, monitor and support common instructional material development such as lesson plans and assessment tasks. This would have provided an opportunity to distribute leadership and

develop the teachers professionally. Most of the teachers prepare their own materials but the quality of these materials could have been enhanced had they been developed collaboratively.

Although HODs reported that they took responsibility for teachers to do well, this is neither evident in their involvement to prepare instructional material nor in their observations of classroom practice. The HODs are not in a position to tell how instructional practice is enacted and actualised. They do not know first-hand what the learners are struggling with and how to address such challenges in terms of supporting the teachers. They always miss the opportunity for professional development to build their capacity to influence instruction right from the planning phase to the implementation and assessment phases.

One of the reasons for not engaging in these activities lies in the fact that HODs do not teach NS themselves. They do not seem to understand what is expected in grade 8 and 9. The fact that they do not teach NS compromises their NS instructional leadership capacity and reduces them to administrators who would just tick off the list of administrative requirements that included checking to see how much content was covered, how many activities the learners had completed in their books and the number of tests that had been written.

f. Summary

In summary, the major findings in the study reveal that most science HODs do not teach NS and/or do not have the instructional experience needed for all the sub-disciplines under their leadership. As a result, they often resorted to monitoring instruction through desk-top reviews of teachers' and students' work rather than conduct any classroom observations or spend time discussing the curriculum in any organised professional development sessions or meetings.

Secondly, the findings suggest that some of the science HODs are not adequately qualified to teach NS at all and/or did not possess the subject matter competency, the Pedagogical Content Knowledge (PCK) or the professional credibility to lead NS instruction. This limited their capacity to provide effective instructional leadership.

The third major finding for the study has to do with the structure and organisation of science departments in schools, which makes it difficult for science HODs to focus attention on NS relative to other subjects in the mix. The departments are mostly organised as conglomerate departments comprising of at least four different subjects including NS, PS, LS and mathematics. This composite arrangement of departments makes it difficult for science HODs to provide the much-needed attention to NS teachers and its teaching (relative to PS and/or mathematics for example). As a result, the NS teachers feel marginalised and overpowered by the senior secondary subject teachers within the science departments.

In the fourth instance, the findings uncover the rather weak position of the science HODs, as middle managers, within the overall leadership hierarchy of the school. That is, by virtue of their position within the school leadership hierarchy, the science HODs did not have much of a say on who gets allocated to teach NS, how the subjects are grouped within the science departments and how time is allocated and/or protected for subject meetings and professional development of teachers. They often find themselves caught between the senior leadership of the school and the teachers. Similarly, the subject advisors, who are the district officials responsible for providing support on the science curriculum and its implementation in schools. They often choose to work directly with the teachers in providing professional development and/or curriculum support on the new CAPS curriculum. In such instances, once again the HODs found themselves caught somewhere between the subject advisors and the subject teachers.

The last major finding of the study has to do with the rather carefree attitude of the school leadership hierarchy in allocating teachers for the NS. Most of the school leaders do not seem to pay sufficient attention to the careful allocation of NS teachers so as to ensure that the appointed teachers have the necessary content knowledge and PCK to teach the subject. The result is that some teachers, who cannot be placed anywhere, end up teaching NS, in order to fill up the quota of the workload. This practice puts further strain on the level and extent of instructional support required from the science HODs.

In addition to the five major findings outlined above, it was interesting to note the level of understanding and interpretation of instructional leadership that the HODs, principals and subject

advisors seem to have in this context. Although the HODs consider themselves to be specialists, their subject leadership is rather limited, mostly to curriculum monitoring only. Instructional leadership appears to be reduced to only three major activities, viz. managing the department's human resources, filling in the subject administration checklist and chairing the various school committee meetings. The instructional leadership activities that involve discourse and practice on the subject matter and content and/or the classroom pedagogy are mostly 'outsourced' to the district officials (specifically, the subject advisors). Most principals, who prefer the HODs to focus more on management of the grade or phase, are supportive of this approach to leadership. Although the HODs seem to know what their roles entail they are often limited by their own teaching responsibilities, and the management and administrative duties of their positions. They struggle to find the right balance between these competing responsibilities of their position (Malinga & Jita, 2015a).

Overall, the findings in this study suggest that neither the school leadership teams nor the district offices engage in any periodic reviews of the school-based subject leadership structures and practices to determine their effectiveness. The extent to which the HODs, their practices and the structures are fit for the purpose of meeting the teachers' needs with respect to instructional guidance and support thus remain unclear to the officials and school leaders. As a result, the possibilities for enhancing the capacities of the HODs to lead instruction and manage subject departments remain untapped. The NS teachers, on the other hand, continue to feel neglected especially as the system often prioritised the grades 10-12 teachers who are responsible for either PS or LS and sometimes mathematics offered by the same department. Instructional leadership for NS in SA is therefore not well understood and continues to be poorly structured and practiced in most schools. .

3.2 CONCLUSION

Clearly, the science HODs displayed various ways of leading instruction, depending on the schools' conditions and contexts. When the contingent variables of the school context were considered, they resorted to managing the curriculum by focusing more on compliance activities like monitoring content coverage and moderating question papers, which only enabled instruction but did not necessarily influence or improve instruction. The majority of the HODs

do not provide instructional leadership in the form of jointly preparing instructional materials, conducting classroom observations and giving feedback, discussing learner performance, mentoring and coaching teachers or providing any other forms of professional development. As a result, the HODs in the study do not appear to positively influence the instructional practices in the classrooms. NS teachers often approach their colleagues, not necessarily the HODs, for help with challenges on subject matter or pedagogical content knowledge.

The allocation of less qualified teachers, who possess partial expertise in the subject, creates an urgent need for HODs to intervene and provide some kind of professional development, whether it was self-initiated by teachers, school-based or an external opportunity for teachers to acquire the appropriate expertise, knowledge and skills to teach the subject. The HODs in this study could not provide the kind of support NS teachers needed at crucial times during the implementation of the new CAPS curriculum. At times, NS seem to compete with other subjects that are accorded better status in the secondary school curriculum, including their placement as exit and/or gateway subjects at grade 12. This finding is consistent with the argument that HODs often lack the time (Zepeda & Kruskamp, 2007) and highlights the inequalities in the treatment of subjects within the subject departments (Spillane *et al.*, 2001). The NS teachers have no confidence in the capacity of the science HODs to provide instructional leadership, in part because the HODs are not teaching NS but teach other FET subjects. Given that the HODs do not conduct classroom observations; they were mostly unaware of what happens in NS classrooms or what the expectations of the learners' are per grade. The HODs' capacity is compromised by not teaching the subject; hence, they could not provide meaningful support to the NS teachers.

The study concludes that leading NS instruction in the context of a new curriculum is complex and requires leadership by an effective science HOD who has the relevant expertise, professional credibility, deep subject matter and pedagogical knowledge together with unquestionable teaching competency in the subject. These attributes are crucial in providing effective NS instructional leadership if the teachers' needs are to be met within the context of a multidisciplinary subject such as NS. Science HODs in this study possess personal attributes that are insufficient for providing effective instructional leadership. They are expected to lead a group

of subjects, some of which they have not specialised in. In these instances, they find themselves leading teachers who knew more than they did in the subjects. The capacity of the science HODs as instructional leaders is also compromised by occupying a middle management position. The HODs occupied the middle position between the senior leadership of the school and the teachers and between the district subject advisors and the teachers. This posed a challenge and made their roles more complex. A review of the current structures and practices for instructional leadership of NS at both the school and district levels is thus called for.

The findings further reveal that the way the school leadership currently allocates NS teachers and science HODs in SA is likely to have contributed to the poor performance of learners in senior secondary science (PS). The allocation of NS teachers does not carefully consider their specialisation and that of the science HODs who are expected to provide support for improved instruction. As long as the qualifications of science HODs and NS teachers and the organisational structure of the science departments continue to be trivialised as evidenced in this study, learners' performance is unlikely to improve significantly.

The success of the science HODs in supporting instruction depends on how the school arranges its systems and infrastructure to support instruction. The instructional leadership practices of the HODs are shaped by these school organisational structures and systems and are also contingent to the contexts of the school. This finding suggests that the school organisational infrastructures either constrain or enable subject instructional leadership. Evidence suggests that departments comprising of one subject are likely to be better managed than the composite ones made up of a group of subjects.

Science HODs receive minimal support from their principals and subject advisors. The HODs did not receive subject specific support (in terms of time, space, apparatus, qualified teachers, etc.) from the school leadership team or from the district's subject advisors. The subject advisors worked directly with the teachers in schools and almost independently from the HODs. The science HODs thus has very little capacity to influence decisions that could affect their departments. A review of the instructional leadership structures and practices would go a long

way to assist the HODs in providing the instructional leadership that is required for improved instruction.

3.3 IMPLICATIONS

Firstly, the analysis and findings suggest that the school leadership teams and the districts should review the organisational infrastructure such as the subject departments and subject groupings within departments so that junior secondary subjects are not marginalised by the senior secondary subjects. This would enhance the potential for much stronger NS instructional leadership by the appointed HODs.

Secondly, because current HOD positions cannot be reversed even while the specialisation of some science HODs are inadequate for the task of NS instruction and leadership, it is recommended that the position and role of the "senior teachers" as subject leaders be encouraged in order to address the instructional leadership deficit, especially for NS teaching. The findings of this study support the recommendation that these senior teachers could help to ease the overload of the HODs and provide subject specific instructional support for the NS teachers. Where schools still have opportunities to appoint science HODs, it is recommended that they consider appointing an HOD for junior secondary science separately from the senior secondary appointment so that urgent senior secondary issues do not overshadow junior secondary issues. HODs who teach the subject, understand the grade expectations and do not have senior secondary pressures should be considered for appointment to the junior secondary phase.

Thirdly, the leadership challenges posed by the multidisciplinary nature of NS lead to the recommendation that the school leadership team and the local district officials need to reconsider how they allocate staff for NS teaching and for leading the science department, if this subject is to succeed in laying a strong foundation for a gateway subject such as PS.

Fourthly, the study recommends that science HODs receive more focused subject specific training in the NS sub-disciplines, especially the PS strands. It further recommends that subject advisors work more closely with the HODs and build their capacity for institutionalised

instructional support. The relationship between the HODs and subject advisors needs to be strengthened by forming professional learning communities so that the capacity of the HODs is enhanced to be able to provide instructional leadership because they are, after all, closer to the teachers than the subject advisors.

Lastly, this study has shown that for the most part, school principals and deputy principals do not monitor the work of the HODs or listen to the views of teachers regarding instructional support. Principals are thus not able to plan interventions and/or provide effective curriculum leadership themselves. The study uncovered some of the weak practices of science HODs and thereby highlights areas for professional development and intervention. It also provides the Gauteng Department of Education with well-researched guidance on the way school subject departments could be structured and constituted with regard to the specialisation of HODs. The study has contributed to the understanding of the growing field of instructional leadership in SA schools and has highlighted the importance of subject specific leadership, locally and globally. It has also contributed insights into the challenges of teaching, learning and leadership at the junior secondary levels in general.

3.4 LIMITATIONS

This empirical data only begins to identify the practices of science HODs as far as NS is concerned in the South African context. The study worked with a small but representative sample of schools and the limitations of the small sample size means that the results cannot be generalised to all the schools in the country. However, an interpretation of the findings can contribute to a deeper understanding of the role of instructional leadership in NS in South Africa and the practices of NS HODs. Further research on the school contexts and other school types, such as farm, mine, ex-Model C, and private or independent schools, might provide additional insights that can enhance this understanding.

The study also focused on a small sample of NS teachers' perspectives (two per school) of the support they receive from each science HOD. A future case study could assist in examining the degree to which perceptions of instructional leadership are aligned to actual practices. This work was limited in that it did not include on-the-job HOD observations on a day-to-day basis.

However, minutes of subject meeting provided insights on some activities that the HODs engaged in on a daily basis. The researcher, however, believes that school principals and district officials, especially subject advisors, will find the study useful in understanding the challenges faced by NS teachers and science HODs regarding NS teaching processes and improving learners' outcomes.

There is room for improving the design of the study. Further research could be done on the extent to which schools have employed senior teachers for NS and the role they play in South African schools as an emerging area of subject leadership. Such research could also explore the overlaps, if any, between the senior teachers and the HODs.

Future research might also systematically explore case studies of the different school types to examine the various instructional leadership practices and the differences therein. Further research is also suggested to find out if HODs with specific NS specialisation, as opposed to PS, LS and/or mathematics are more likely provide better instructional leadership and the effects of such leadership in improving NS learner outcomes.

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APPENDIX 1: PERMISSION LETTER FROM GDE

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

For administrative use:
Reference no: D2014 / 401

GDE RESEARCH APPROVAL LETTER

Date:	**31 March 2014**
Validity of Research Approval:	**31 March to 3 October 2014**
Name of Researcher:	**Malinga C.B.B.**
Address of Researcher:	**173 Hartbees Avenue**
	Germiston
	1401
Telephone Number:	**011 344 2614 / 082 801 1456**
Email address:	**cynthia.malinga@sasol.com**
Research Topic:	**Middle Management and Instructional Leadership: Case studies on Natural Science Heads of Department (HoDs) in the Gauteng Province of South Africa**
Number and type of schools:	**THREE HUNDRED AND SEVENTY-THREE Secondary Schools**
District/s/HO	**Ekurhuleni North; Ekurhuleni South; Gauteng East; Gauteng West; Johannesburg Central; Johannesburg South; Johannesburg West and Sedibeng East.**

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

Makhado
2014 / 03 / 31

1

Making education a societal priority

Office of the Director: Knowledge Management and Research
9th Floor, 111 Commissioner Street, Johannesburg, 2001
P.O. Box 7710, Johannesburg, 2000 Tel: (011) 355 0506
Email: David.Makhado@gauteng.gov.za
Website: www.education.gpg.gov.za

APPENDIX 2: LETTER OF CLEARANCE FROM UNIVERSITY

Room 12

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

Faculty of Education

Ethics Office

Winkie Direko Building

Faculty of Education
University of the Free State
P.O. Box 339
Bloemfontein 9300
South Africa
T: +27(0)51 401 9922
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BarclayA@ufs.ac.za

14 April 2014

ETHICAL CLEARANCE APPLICATION:

MIDDLE MANAGEMENT AND INSTRUCTIONAL LEADERSHIP: CASE STUDIES OF NATURAL SCIENCES HEADS OF DEPARTMENT (HODS) IN THE GAUTENG PROVINCE OF SOUTH AFRICA

Dear Ms Malinga
With reference to your application for ethical clearance with the Faculty of Education, I am pleased to inform you on behalf of the Ethics Board of the faculty that you have been granted ethical clearance for your research with the following stipulations (comments by reviewers):

- The consent letters need to have the following:
- The contact details of the supervisor
- A reply slip which allows the participant to state that he/she has understood the nature of the project and gives permission to participate.

- This sentence should be clarified for participants:
"Your answers will be strictly confidential and the names of people you may mention will also be kept confidential. However, information from the study and the consent form signed by you may be reviewed for research or legal purposes".

- The authorization of the Gauteng Department of Education should be provided as soon as this is obtained.

Your ethical clearance number, to be used in all correspondence, is: **UFS-EDU-2014-011**
This ethical clearance number is valid for research conducted for one year from issuance. Should you require more time to complete this research, please apply for an extension in writing.

We request that any changes that may take place during the course of your research project be submitted in writing to the ethics office to ensure we are kept up to date with your progress and any ethical implications that may arise.

Thank you for submitting this proposal for ethical clearance and we wish you every success with your research.

Yours sincerely,
Andrew Barclay
Faculty Ethics Officer

APPENDIX 3: LETTER TO PRINCIPAL

173 Hartebees Avenue
Leondale
23 March 2014

Dear Principal

PARTICIPATION IN RESEARCH STUDY ON INSTRUCTIONAL LEADERSHIP OF SCIENCE HODS

I am currently doing a research dissertation towards my PhD degree in Curriculum Studies, specialising in Instructional Leadership. I am exploring the instructional leadership practices of science heads of department that is what they do, how they do it and with what consequences to the quality of teaching and learning of natural sciences.

The participation of your school involves filling in of questionnaires by HODs and natural science teachers. They will also be requested to participate in 45 minute in-depth semi-structured interviews. Your participation involves participating in in-depth semi-structured interviews about instructional leadership.

You may not benefit directly from this study; however your participation may provide a long-term benefit by identifying gaps in the continuous professional development of teachers and improvement of teaching and learning of natural sciences. There are no costs for participating in this study other than the time you will spend completing the survey questionnaire and interview. You will be asked to provide subject files, and some learner progression schedules, learner work, note books and test exercise books. The aim is to do a document analysis of the science instruction and subject meetings. The interviews will happen outside the teaching time at times pre-arranged with you and your staff. The discussion during the interviews will be recorded and transcribed for analysis.

Your answers will be strictly confidential and the people you may mention will also be kept confidential. However, information from the study and the consent form signed by you may be reviewed for research or legal purposes. Findings may be presented at meetings or conferences but your name and school will never be used in these presentations or papers. Only summary results of the study will be reported, not at the school or classroom level. You will also have access to the research findings once published.

You do not have to participate in this study. You may decide to stop at anytime for any reason without any penalty. If you have any questions about your participation in this study, please do not hesitate to contact me and/or my supervisor (jitalc@ufs.ac.za or 051 401 7522).

Yours sincerely

Ms Cynthia Malinga (researcher)
082 801 1456 cynthia.malinga@sasol.com

APPENDIX 4: CONSENT FORM

I understand the nature and purpose of the study. I also understand that I have the opportunity to withdraw from the study at any time and that the information I give will be confidential and will not be disclosed for any other purposes other than the research for the present study.
I therefore give my consent to participate.

Name: _____ Date:_____

Signature: _____

Yours Faithfully

Cynthia B. B. Malinga
082 801 1456
cynthia.malinga@sasol.com

Supervisor
Professor Loyiso Jita
051401722
JitaLC@ufs.ac.za

APPENDIX 5: TEACHER QUESTIONNAIRE

School_____ **Date_____**

INSTRUCTIONS

- **Please respond to each of the following questions.**
- **For each question, please read all the answers first, and then indicate your answer by placing an X in *ONE* box only (unless specified otherwise).**
- **Answer *ALL* the questions.**
- **Your responses are confidential, and no one in the school will see your answers, so please be as honest as possible**

1. **What is your position at this school/ subject department? Mark with X where applicable.**

A. HOD	B. Senior Teacher specify subject:_____	C. Teacher specify subject _____

2. **ADMINISTRATION. Mark each applicable answer with an X.**

Statement	**Yes**	**No**
A. Do you have a job description?	1	2
B. Do you have/ have you seen a subject/departmental policy?	1	2
C. Are you encouraged to share and discuss instructional ideas and materials?	1	2
D. Do you meet regularly to discuss instructional goals and issues?	1	2
E. Does the HOD lead and chair subject meetings?	1	2
F. Does the HOD keep minutes of subject meetings?	1	2
G. Do you keep a subject file?	1	2
H. Do you have a laboratory in your school?	1	2
I. Is the laboratory also used as a classroom?	1	2
J. Is your laboratory adequately equipped?	1	2
K. Do you teach all the subject strands e.g. Life and Living, Matter and Materials etc?	1	2
L. Do you only teach particular strands e.g. Life and Living and not Matter and Materials	1	2

3. **Rank the following sources to monitor learners' progress in natural sciences as a school, where 1 indicates you place no emphasis and 5 indicates major emphasis.**

Monitoring learners' progress	**1**	**2**	**3**	**4**	**5**
A. Classroom tests					
B. District common exam					
C. Your professional judgment					

4. **Who has the primary responsibility for each of the following activities in the science department at your school? Mark ALL the people responsible for each item with an X.**

Role	SGB	Principal	Deputy Principal	HOD	Teachers	n/a
A. Interviewing science teachers for posts						
B. Establishing science learner grading policies						
C. Purchasing science supplies						
D. Selecting textbooks and resources for the subject department						
E. Allocating science learners to classes						
F. Planning the timetable for science teachers						
G. Developing relief timetable						
H. Developing the roster for laboratory use						
I. Assigning science teachers to classes						
J. Allocating subject teachers to grades						
K. Facilitating development of lesson plans and work schedules						
L. Promoting of Grade 9 learners to Grade 10 physical sciences						
M. Moderating examination papers						
N. Organising science excursions and competitions						
O. Coordinating projects or science fairs						
P. Determining the budget for the subject department						
Q. Monitoring attendance procedures						
R. Doing campus duty						
S. Communicating with parents						

5. **To what extent has each of the following people helped you to improve your instructional leadership activities or solve instructional problems? Rank from 1 to 5, where 1 is least helpful and 5 most helpful or 0 if you did not need any help from them.**

School Community personnel	0	1	2	3	4	5
A. Principal of this school						
B. Deputy principal						
C. Head of Department						
D. Science Senior teacher						
E. District curriculum specialist/Subjects advisor						
F. Laboratory technician/assistant						
G. Other teachers at this school						
H. Other teachers in the district						
I. University professor or researchers						
J. Other (please specify _____						

6. **To what extent do you agree or disagree that each of the following statements describe a characteristic of your department, where 1 indicates your strong disagreement and 5 your strong agreement. Mark with an X the applicable statement.**

Statements	**1**	**2**	**3**	**4**	**5**
A. There is a great cooperative effort among my department's members					
B. The HOD is familiar with the content and specific goals of the subjects taught by teachers in our department					
C. The teachers in my department work together to develop common exams/tests for particular subjects					
D. The HOD makes a conscious effort to coordinate the content of my subjects with teachers in my department					
E. Teachers' subjects and other departmental assignments are frequently rotated					
F. Goals and priorities for this department are clear					
G. The HOD sets priorities, makes plans, and sees that they are carried out					
H. The HOD usually consults with staff members before making decisions that affect us					
I. The HOD provides opportunity for staff to learn and try out new ideas					
J. The HOD coordinates professional development sessions for department staff					
K. The HOD takes responsibility for helping teachers do well					
L. The HOD takes responsibility for improving the overall quality of teaching in the school					
M. The responsibility for the quality of science teaching and learning lies with the principal.					
N. The responsibility for the quality of science teaching and learning lies with teachers.					
O. The HOD sets high standards for teaching and learning					
P. The HOD understands what learners at different grade levels are expected to know and be able to do.					
Q. The HOD provides feedback to the department on classroom observations that occur in my school					
R. The HOD arranges for support when I need it (such as access to coaches, outside consultants, district curriculum staff).					

7. **How often does your HOD practice the following? A – Always; F – Frequently; O – Occasionally; S – Seldom; N – Never. Mark the most appropriate answer with an X**

	Statement	**A**	**F**	**O**	**S**	**N**
A	Calls meetings of department staff members					
B	Makes every effort to provide favourable environment for departmental meetings					
C	Provides information regarding policies and regulations governing services of staff members					
D	Keeps us aware about decisions taken at the SMT meeting					
E	Allows department staff to meet and discuss their problems					
F	Invites staff members to participate in framing school plans					
G	Conveys suggestions of my department staff to the principal and the SMT					
H	Arranges for us to meet with other teachers in my district					
I	Arranges for us to meet with our subject advisor					
J	Provides professional development to my department staff					
K	Discusses teaching of a particular concept with the staff					
L	Works with my department to prepare teaching material					
M	Visits other teachers' classrooms to observe their teaching					
N	Allows informal observations in his/her own classroom					

	Statement	A	F	O	S	N
O	Does classroom observations					
P	Provides regular and useful feedback/suggestions on my teaching					
Q	Monitors and controls learners' activity and assessment books					
R	Monitors subject content coverage					
S	Carefully tracks learners' academic progress					
T	Knows what is going on in science classrooms					
U	Actively monitors quality of science instruction					
V	Works directly with teachers who are struggling to improve instruction					
W	Leads professional development sessions in which you participate in					
X	Attends professional development sessions alongside the staff					

8. **What do you discuss in department or subject meetings? Rank the statements in terms of frequency at meetings where 1 is the least frequent and 5 is the most frequent. Mark with an X the applicable statement.**

Topics of discussion at subject meetings	1	2	3	4	5
A. Reviewing policies					
B. Clarifying direction of the department					
C. Reviewing textbook and other subject materials					
D. School improvement plan					
E. Instructional evaluation					
F. Professional development					
G. Curriculum and leaners' outcome					
H. Learner assessment issues					
I. Moderation of question papers					
J. Analysis of learner scores to inform instruction					
K. Start and end of term issues					
L. Budget					
M. Developing and share lesson plans					
N. Account of terms work/ content coverage					
O. Distributing leadership activities					
P. Planning what to do next					

9. **What informs the promotion of learners from Grade 9 to the Grade 10 physical sciences class? Rank with 1 indicating top priority and 5 the low priority.**

Basis of promotion of learners	
A. Average performance in Grade 9	
B. Performance in mathematics	
C. Performance in natural sciences	
D. Performance in both mathematics and science	
E. Career choice of the learner	
F. Performance on a standardised test	
G. Other (specify)_____	

10. **Which of the following shortages that you face affect your capacity to provide instruction? Rank on a scale from 1 to 5, where 1 affects capacity the least and 5 affects it the most.**

Shortages that affect instruction	1	2	3	4	5
A. Instructional materials (e.g. textbooks)					
B. Budget for stationery					

C. School buildings and grounds					
D. Heating/cooling and lighting systems					
E. Instructional space (e.g. classrooms)					
F. Library material relevant to science instruction					
G. Audio-visual resources for science instruction					
H. Science laboratory equipment and materials					
I. Computers for science instruction					
J. Computer software for science instruction					
K. Some teachers are inadequately qualified to teach Natural Sciences					
L. Lack of teachers planning time					
M. Class sizes are too large					
N. Too little coordination between classes in the science curriculum					

11. How well prepared do you feel to teach the following topics. Rate in terms of a scale 0 to 4 where 0 represents the topic that does not apply to your subject, 1 represents not well prepared and 4 represents well prepared.

	0	1	2	3	4
Life Science					
Plant physiology					
Cell biology					
Ecology					
Anatomy and physiology					
Genetics and evolution					
Microbiology					
Zoology and animal behaviour					
Earth Science					
Astronomy					
Geology and Meteorology					
Oceanography					
Physical geography					
Environmental science					
Agricultural science					
Chemistry					
Matter and materials					
Analytical chemistry					
Organic chemistry					
Inorganic chemistry					
Biochemistry					
Physics					
Mechanics- Force and motion					
Work, energy and power					
Electricity and magnetism					
Heat and thermodynamics					
Optics, Sound and waves					
Solid state physics					

12. About how many hours of science–specific staff training or development have you received in the past twelve months? Mark with an X where applicable.

A. None	B. less than 6hrs	C. 6-15 hours	D. More than 15 hours

13. In the past 12 months, have you participated in professional development in any of the following? Mark with an X where applicable.

Professional development topic	Yes	No
A. Science content	**1**	**2**
B. Science pedagogy/ instruction	**1**	**2**
C. Integrating IT into science	**1**	**2**
D. Doing practical work	**1**	**2**
E. Improving critical thinking or problem solving skills	**1**	**2**
F. Science assessment	**1**	**2**

BIOGRAPHICAL DATA

14. What is your gender? Mark with an X where applicable.

A. Male	B. Female

15. What is your age range? Mark with an X where applicable.

A. Under 25	B. 25-29	C. 30-39	D. 40-49	E. 50-59	F. 60+

16. What is your subject/s specialisation? Please mark with an X all applicable.

A	Life/Biological Sciences	F	Physics
B	Physical Sciences	G	Technology Education
C	Natural Sciences	H	Geography
D	General Sciences	I	Mathematics
E	Chemistry	J	Other (specify)

17. Where did you professionally qualify as a science teacher? Mark with an X where applicable.

A. Teachers' College	B. University

18. What is your <u>highest</u> qualification? Mark with X where applicable.

A. Matric	D. ACE (specify specialisation) _____	G. Honours degree in _____
B. PTD/PTC	E. Bachelor's Degree (specify majors) _____	H. Master's degree
C. STD (specify subject specialisation) _____	F. Post Graduate Diploma (FDE, HDE,UED- specify specialisation) _____	I. Doctoral degree

19. TEACHING EXPERIENCE: Which grades do you teach? For how long have you taught each grade? Please mark with X all applicable.

A. Grade 4-7 Natural Sciences □1-2 years □3-5 years □6-10 years □>10 years

B. Grade 8 Natural Sciences □1-2 years □3-5 years □6-10 years □>10 years

C. Grade 9 Natural Sciences □1-2 years □3-5 years □6-10 years □>10 years

D. Grade 10 Physical Sciences □1-2 years □3-5 years □6-10 years □>10 years

E. Grade 11 Physical Sciences □1-2 years □3-5 years □6-10 years □>10 years

F. Grade 12 Physical Sciences □1-2 years □3-5 years □6-10 years □>10 years

20. QUALIFICATIONS IN THE SUBJECT/S YOU TEACH. Fill in ALL applicable

Subject taught	**Grade**	**Number of classes**	**Class sizes**	**Qualification in the subject e.g. Chemistry 2 or Mathematics 1 or diploma major**
A. Natural Sciences				
B. Physical Sciences				
C. Life sciences				
D. Geography				
E. Physics				
F. Chemistry				
G. Agricultural Sciences				
H. Earth Sciences				
I. Technology Education				
J. Mathematics				
K. Geography				

21. To which professional science teacher organisation/association do you currently belong?

A.SAASTE	B.TEASA	C.AMESA	D.NO MEMBERSHIP

Thank you for participating in this study!

APPENDIX 6: HOD QUESTIONNAIRE

School_____ Date_____

INSTRUCTIONS

- **Please respond to each of the following questions.**
- **For each question, please read all the answers first, and then indicate your answer by placing an X in *ONE* box only (unless specified otherwise).**
- **Answer *ALL* the questions.**
- **Your responses are confidential, and no one in the school will see your answers, so please be as honest as possible.**

1. Which subjects constitute your department? Select *ALL* applicable.

A. Natural Sciences	B. Physical Sciences	C. Life Sciences	D. Geography
E. Mathematics	F. Mathematical Literacy	G. Agricultural Sciences	H. Technology Education

2. How big is your school, in other words, how many people are in the school? Please fill in these numbers as accurately as possible.

A. School enrolment (Number of learners)		F. Number of natural-science teachers	
B. Number of teachers in the department (excluding you)		G. Number of Grade 8 classes	
C. Number of science teachers (excluding Technology Education)		H. Number of Grade 9 classes	
D. Number of science teachers with a degree in science or science education in your department		I. Number of science teachers without relevant science qualifications	
E. Number of lead or senior teachers in your department		J. Number of laboratory-assistant teachers	

3. ADMINISTRATION. Mark each applicable answer with an X.

Statement	**Yes**	**No**
A. Do you have a job description?	1	2
B. Have you drawn up your own subject or departmental policy?	1	2
C. Do you keep a subject or departmental file?	1	2
D. Do teachers in your school meet regularly to discuss instructional goals and issues?	1	2
E. Do you, as the HOD, lead and chair subject meetings?	1	2
F. Are teachers in your school encouraged to share and discuss instructional ideas and materials?	1	2
G. Do you keep minutes of the subject meetings?	1	2
H. Do you have a laboratory in your school?	1	2
I. Is the laboratory also used as a classroom?	1	2
J. Is your laboratory adequately equipped?	1	2
K. Do Natural-Sciences teachers teach all sections in the syllabus? This means that they do not split the subject and share teaching of subject strands.	1	2

4. As an HOD, senior or lead teacher, rank the aspects of your job in order of importance on a scale of 1 to 5, where 1 is the least important and 5 is the most important.

Job Aspect	**1**	**2**	**3**	**4**	**5**
A. Representing the school in the community					
B. Representing the school at official meetings					
C. Internal administrative tasks, e.g. regulations, school budget and time table					
D. Teaching, including preparation					
E. Giving a demonstration lesson					
F. Training teachers					
G. Professional development activities					
H. Providing a conducive academic environment					
I. Discussing educational objectives with teachers					
J. Initiating phase, grade or lesson planning among teachers					
K. Talking to parents					
L. Counselling or disciplining learners					
M. Responding to requests from district, provincial and/or national offices					
N. Dealing with e-mails, faxes and circulars from district offices					
O. Working with the science department					
P. Convening subject meetings					
Q. Doing HOD instruction leadership					
R. Doing action research and analysing results					
S. Collaboration with other units of the school					
T. Working with staff other than science teachers					
U. Other school duties like managing late coming					
V. Paperwork and bureaucracy					
W. Personnel issues					
X. Professional networking					
Y. Other (Please specify)					

5. Who has the primary responsibility for each of the following activities in the science department at your school? Mark *ALL* the people responsible for each item with an X.

Role	**SGB**	**Principal**	**Deputy Principal**	**HOD**	**Teachers**	**n/a**
A. Interviewing science teachers for posts						
B. Establishing science-learner grading policies						
C. Purchasing science supplies						
D. Selecting textbooks and resources for the subject department						
E. Allocating science learners to classes						
F. Planning the timetable for science teachers						
G. Developing relief timetable						
H. Developing the roster for laboratory use						
I. Assigning science teachers to classes						
J. Allocating subject teachers to Grades						
K. Facilitating development of lesson plans and work schedules						
L. Promoting of Grade 9 learners to Grade 10 physical sciences						
M. Examination-paper moderation						

Role	SGB	Principal	Deputy Principal	HOD	Teachers	n/a
N. Organising science excursions and competitions						
O. Coordinating projects or science fairs						
P. Determining the budget for the subject department						
Q. Monitoring attendance procedures						
R. Doing campus duty						
S. Communicating with parents						

6. Rate each of the following Management, Leadership, and Personal Abilities as important for your role as an HOD, where 1 is least important and 5 most important.
ALSO INDICATE IF YOU ENGAGE IN THE PRACTICE OR NOT.

Abilities	1	2	3	4	5	Yes	No
A. Management Abilities							
1. Conducting effective meetings							
2. Monitoring department and staff workloads and productivity							
3. Creating or updating the department's strategic plan							
4. Understanding operations and policies of the school							
5. Understanding financial policies and procedures							
6. Determining or recommending salary progression							
7. Buffering teachers from distraction to instruction							
8. Writing reports on departmental work							
B. Instructional management							
1. Using data to inform instruction							
2. Developing a coherent educational programme across							
3. Reviewing learner classwork, data and testing							
4. Reviewing lesson plans and instructional material							
5. Formally evaluating teachers and providing feedback							
6. Observing classroom instruction							
7. Planning and implementing professional development							
8. Suggesting how to improve classroom management							
9. Supervising subject-curriculum delivery							
10. Discussing teaching and the curriculum							
11. Coaching teachers							
12. Modelling excellent classroom teaching and learning practice							
13. Identifying examiners and moderators							
14. Managing common tests and examinations							
15. Developing the departmental improvement plan							
C. Facilitating meetings							
Meeting with other department or grade-level heads, teachers, specialists, and administrators to:							
1. exchange suggestions for curriculum materials							
2. discuss curriculum change							
3. discuss managing classroom behaviour							
4. discuss what helps student learn							
5. schedule and conduct regular grade-level or subject-area meetings and arrange for the distribution of the minutes							
6. enforce the school's goals and vision.							
D. Staff matters							

Abilities	1	2	3	4	5	Yes	No
1. Inducting new members							
2. Developing relationships with the teachers							
3. Achieving cultural diversity							
4. Encouraging collaboration							
5. Interacting socially with teachers							
6. Counselling teachers							
7. Dealing with concerns from the staff							
8. Managing and resolving conflict							
9. Allocating staff duties							
10. Managing non-instructional staff							
11. Managing staff paperwork like leave and IQMS.							
12. Interacting with other HODs							
E. Administration							
1. Managing the departmental timetable, including relief duty							
2. Managing resources and materials							
3. Managing personal and school-related schedules							
4. Managing learner discipline							
5. Fulfilling administrative requirements and paperwork							
6. Managing all departmental examinations, documentation and procedures							
7. Managing and keeping learner reports and departmental records							
8. Supervising campus duty, e.g. late coming and cleaning							
9. Monitoring the attendance, appearance and behaviour of learners and teachers							
10. Taking and controlling stock							
11. Arranging all permissions and logistics for excursions							
12. Keeping up with technology in the classroom and office							
F. External relations							
1. Communicating with the district to obtain resources							
2. Working with the community on science activities							
3. Fundraising							
4. Planning excursions, Olympiads and competitions							
G. Leadership Abilities							
1. Understanding the roles and responsibilities of the HOD							
2. Cultivating positive working relationships with the principal and other administrators							
3. Managing change							
4. Giving and receiving feedback							
5. Negotiating for additional resources							
6. Recruiting, retaining and developing staff							
7. Developing and nurturing relationships with professional organisations, associations, and/or alumni							
H. Personal Abilities							
1. Managing time effectively							
2. Managing work-life balance							
3. Evaluating own success as HOD							

7. **What other school and/or district committees do you belong to? Mark *ALL* the applicable committees with an X.**

Committee	
A. Fundraising	
B. Condolence	
C. Social	
D. Cluster Leaders	
E. Other (Please specify) _____	

8. **What do you discuss during in department or subject meetings? Rank the statements in terms of frequency at meetings where 1 is the least frequent and 5 is the most frequent. Mark with an X the applicable statement.**

Topics of discussion at subject meetings	**1**	**2**	**3**	**4**	**5**
A. Policy reviews					
B. Clarification of the department's direction					
C. Textbook and course-material reviews					
D. School improvement plan					
E. Instructional evaluation					
F. Professional development					
G. Curriculum and learner outcomes					
H. Learner-assessment issues					
I. Question-paper monitoring					
J. Analysis of learner scores to inform instruction					
K. Start- and end-of-term issues					
L. Budget					
M. Development and sharing of lesson plans					
N. Account of the term's work or content coverage					
O. Distribution of leadership activities					
P. Plan of next remedial or enrichment steps					

9. **Rank each of the following skills in terms of what needs to be developed *most in yourself* on a scale of 1 to 5, where 1 is most and 5 least urgent. Mark with an X the applicable skill**.

Skills	**1**	**2**	**3**	**4**	**5**
A. Management and planning skills					
B. Leadership skills					
C. Communication skills					
D. Relationship-building skills					
E. Ability to enforce discipline					
F. Focus on teaching and learning content					
G. I don't feel I have any skills that need development right now					

10. To what extent do you agree or disagree that each of the following statements describe a characteristic of your department, where 1 indicates your strong disagreement and 5 your strong agreement. Mark with an X the applicable statement.

Statement	1	2	3	4	5
A. There is a great cooperative effort among my department's members.					
B. I am familiar with the content and specific goals of the subjects taught by teachers in my department.					
C. The teachers in my department work together to develop common examinations and tests.					
D. I make a conscious effort to coordinate the contents of my subjects with teachers in my department.					
E. Teachers' subjects and other departmental assignments are frequently rotated.					
F. Goals and priorities for this department are clear.					
G. I set priorities, make plans, and see to it that they are carried out.					
H. I usually consult with staff members before I make decisions that affect us all.					
I. I provide opportunities for staff to learn and experiment with new ideas.					
J. I coordinate professional development sessions for department staff.					
K. I take responsibility for helping teachers do well.					
L. I take responsibility for improving the overall quality of teaching in the school.					
M. The responsibility for the quality of science teaching and learning lies with the principal.					
N. The responsibility for the quality of science teaching and learning lies with teachers.					
O. I set high standards for teaching and learning.					
P. I understand what learners at different grade levels are expected to know and what they should be able to do.					
Q. I provide feedback to the department on classroom observations in our school.					
R. I arrange for support when my teachers need it, such as access to coaches, outside consultants and district curriculum staff.					

11. How often do you practice the following? A – Always; F – Frequently; O – Occasionally; S – Seldom; N – Never. Mark the most appropriate answer with an X.

	Statement	A	F	O	S	N
A	I call meetings of department staff members.					
B	I make every effort to provide a favourable environment for departmental meetings.					
C	I provide information regarding policies and regulations governing the services of staff members.					
D	I keep my colleagues aware of decisions taken at the SMT meetings.					
E	I convey suggestions of my department staff to the principal and the SMT.					
F	I allow department staff to meet and discuss their problems with me.					
G	I invite staff members to participate in framing school plans.					
H	I meet with other HODs in our school.					
I	I meet with other HODs in our district.					
J	I meet with my subject advisor.					
K	I provide professional development to my department staff.					
L	I discuss the teaching of particular concepts with the staff					
M	I work with my department on preparing instructional material.					
N	I visit other teachers' classrooms to observe their teaching.					
O	I allow informal observations by other teachers in my classroom.					
P	I provide regular and useful feedback or suggestions about teaching.					
Q	I monitor and control learners' activity and assessment books.					
R	I monitor subject content coverage.					

S	I carefully track learners' academic progress.					
T	I know what is going on in science classrooms.					
U	I actively monitor the quality of science instruction.					
V	I work directly with teachers who are struggling to improve their methods of instruction.					
W	I attend professional development sessions alongside the teachers.					

12. To what extent has each of the following people helped you to improve your instructional leadership activities or solve instructional problems? Rank from 1 to 5, where 1 is least helpful and 5 most helpful or 0 if you did not need any help from them.

School community personnel	**0**	**1**	**2**	**3**	**4**	**5**
A. Principal of the school						
B. Deputy principal						
C. Science senior teacher						
D. District curriculum specialist/subject advisor						
E. Laboratory technician or assistant						
F. Other teachers at the school						
G. Other teachers in the district						
H. University professors or researchers						
I. Other (Please specify) _____						

13. Please indicate how strongly you agree or disagree with each of the following statements about your school. Rank on a scale of 1 to 5 where 1 indicates strong disagreement and 5 strong agreement.

Statements	**1**	**2**	**3**	**4**	**5**
A. The teachers support me and get involved when I try out new ides					
B. The SMT is supportive and encouraging towards teachers.					
C. The principal frequently talks to me about my instructional practice					
D. I am encouraged by the principal to try out new ideas when teaching natural sciences.					
E. The principal encourages me to observe natural-science teachers					
F. The principal enhances the natural-science programme by providing me with the materials and equipment that my department needs.					
G. The principal provides space for departmental activities.					
H. The principal provides time for departmental meetings.					
I. The principal sometimes attends departmental meetings.					
J. The principal deals effectively with pressure from outside the school that might interfere with teaching.					
K. I have the full support of my subject advisor.					

14. About how many hours of science-specific staff training or development has the average teacher received in the past twelve months?

A. None	B. less than 6hrs	C. 6-15 hours	D. More than 15 hours

15. How do you develop members of your department? Indicate by choosing Yes or No for each item.

I facilitate the development of department staff by:	**Yes**	**No**
A. creating opportunities for teachers to work together	1	2
B. creating networks for conversation	1	2
C. making resources available to support individual development	1	2
D. building bridges by linking with other structures outside of our school	1	2
E. reviewing instruction	1	2
F. encouraging affiliation with professional science-teacher organisations	1	2
G. providing regular feedback on e.g. classroom observation or lesson plans.	1	2
H. discussing learners' scores with teachers to identify successes, challenges and interventions	1	2
I. using school-based activities	1	2
J. participating in NGO activities	1	2
K. participating in district-office activities	1	2
L. using an internal and external mentoring system	1	2

16. Rank the factors that you consider when deploying teachers to science classrooms on a scale of 1 to 3 where 1 is the least important and 3 the most important.

Factors considered when deploying teachers to science classes	**1**	**2**	**3**
B. Teachers' subjects and PCK			
C. Need for fairness to all staff			
D. Teachers' expertise in engaging learners			
E. Teachers' experience of teaching that grade			
F. Teachers' preference			
G. Teachers' professional ability to teach all disciplines			
H. Other (specify)_____			

17. What strategies do you employ to alleviate staff shortages? Please indicate by placing an X on the frequency of the strategy.

Strategy to alleviate staff shortages	**Frequency**			
	Frequently	Sometimes	Rarely	Never
	1	2	3	4
A. Increase science teachers' timetables				
B. Use teachers of other subjects				
C. Increase science class sizes				
D. Use student teachers to teach sciences				
E. Use support or lab assistant to teach science				
F. Reduce number of timetabled lessons				

18. Which of the following shortages that you face affect your capacity to provide instruction? Rank on a scale from 1 to 5, where 1 affects capacity the least and 5 affects capacity the most.

Shortages that affect instruction	**1**	**2**	**3**	**4**	**5**
A. Instructional materials, e.g. textbooks					
B. Budget for stationery					
C. School buildings and grounds					
D. Heating or cooling, and lighting systems					
E. Instructional space, e.g. classrooms					
F. Library material relevant to science instruction					
G. Audiovisual resources for science instruction					

H. Science-laboratory equipment and materials					
I. Computers for science instruction					
J. Computer software for science instruction					
K. Teachers qualified to teach Natural Sciences					
L. Teachers qualified to teach Biology or Life Sciences					
M. Teachers qualified to teach Chemistry					
N. Teachers qualified to teach Earth Sciences					
O. Teachers qualified to teach Physics					
P. Teachers qualified to teach Physical Sciences					

19. Rank the basis on which learners are promoted to the Grade 10 physical sciences class, where 1 indicates top priority and 5 indicates the least priority.

Promotional Basis	**1**	**2**	**3**	**4**	**5**
A. Average performance in Grade 9					
B. Performance in mathematics					
C. Performance in natural sciences					
D. Performance in both mathematics and science					
E. Career choice of the learner					
F. Performance on a standardised test					
G. Other (specify)_____					

20. Rank the following sources to monitor learners' progress in natural sciences as a school, where 1 indicates you place no emphasis and 5 indicates major emphasis.

Monitoring learners	**1**	**2**	**3**	**4**	**5**
A. Classroom tests					
B. District common exam					
C. Your professional judgment					

21. Rank the following statements from 1 to 5, where 1 indicates the least difficult issue you have had to deal with, and 5 the most difficult.

Difficult issues	**1**	**2**	**3**	**4**	**5**
A. Staffing issues					
B. Bureaucracy/dealing with school management and administration					
C. Managing subject finances					
D. Finding time for action research					
E. Analysing learner's scores					
F. Managing with inadequate resources					
G. Time management					

22. In terms of your own stress levels, please rank the following statements in terms of main causes of stress, where 1 indicates the least important cause, and 5 the most important cause of stress.

Cause of stress	**1**	**2**	**3**	**4**	**5**
A. Dealing with staff					
B. Volume of work					
C. Meeting deadlines or dealing with pressures from above					
D. Managing finances					
E. Administration or paperwork					

F. Lack of time for research					
G. Role overload					
H. Lack of administrative support					
I. Long working hours					
J. Too much change					
K. Insufficient powers					
L. Working with difficult teachers					
M. Issues relating to the assessment and promotion of learners					
N. Issues relating to curriculum change					
O. Learning about new content and instruction					

BIOGRAPHICAL DATA

23. What is your gender? Please mark the applicable answer with an X.

A. Male	B. Female

24. What is your age range? Please mark the applicable answer with an X.

A. Under 25	B. 25-29	C. 30-39	D. 40-49	E. 50-59	F. 60+

25. What is your position at this school or in the subject department? Please mark the applicable answer with an X.

A. HOD	B. Senior, Master or Lead Teacher Specify subject:_____

26. What is your subject(s) of specialisation? Please mark *ALL* the applicable answers with an X.

A	Life or Biological Sciences	F	Physics
B	Physical Sciences	G	Technology Education
C	Natural Sciences	H	Geography
D	General Sciences	I	Mathematics
E	Chemistry	J	Other (Please specify)

27. Where did you professionally qualify as a science teacher? Please mark the applicable answer with an X.

A. Teachers' College	B. University

28. What is your highest qualification? Please mark *ALL* the applicable answers with an X.

A. Matric	D. ACE (specify specialisation) _____	G. Honours degree
B. PTD/PTC	E. Bachelor's Degree (specify majors) _____	H. Master's degree

C. STD (specify subject specialisation) _____	F. Post Graduate Diploma (FDE, HDE,UED- specify specialisation) _____	I. Doctoral degree

29. TEACHING EXPERIENCE: **Which grades do you teach? For how long have you been teaching each grade? Please mark *ALL* the applicable answers with an X.**

□Grade 4-7 Natural Sciences □1-2 years □3-5 years □6-10 years □>10 years

□Grade 8 Natural Sciences □1-2 years □3-5 years □6-10 years □>10 years

□Grade 9 Natural Sciences □1-2 years □3-5 years □6-10 years □>10 years

□Grade 10 Physical Sciences □1-2 years □3-5 years □6-10 years □>10 years

□Grade 11 Physical Sciences □1-2 years □3-5 years □6-10 years □>10 years

□Grade 12 Physical Sciences □1-2 years □3-5 years □6-10 years □>10 years

30. QUALIFICATIONS IN THE SUBJECT(S) YOU TEACH. Fill in *ALL* the applicable answers.

Subject taught	**Grade**	**Number of classes**	**Class sizes**	**Qualification in the subject e.g. Diploma major or minor Degree major or minor No qualification**
A. Natural sciences				
B. Physical sciences				
C. Life sciences				
D. Geography				
E. Physics				
F. Chemistry				
G. Agricultural Sciences				
H. Earth Sciences				
I. Technology Education				
J. Mathematics				
K. Geography				

31. To which professional science-teacher organisations do you currently belong? Please mark ALL the applicable associations with an X.

A. SAASTE	B. TEASA	C. AMESA	D. OTHER	E. NO MEMBERSHIP

Thank you for participating in this study.

APPENDIX 7: INTERVIEW PROTOCOL- TEACHER

School_____ Date_____

Thank the participant for agreeing to participate. Introduce myself and the purpose of the interview. Request permission to record the interview.

1. How long have you taught science in this school? (*Probe for specialisation, teaching science beyond grade 10*).
2. How would you describe your own education in science and science education?
3. Let's talk about the materials you use for teaching: How easy is it to get the materials you need for teaching? To whom do you go to get those materials? How helpful is that person? *(Probe for existence of HOD or senior teacher, and what they do specifically to assist etc.)*
4. How easy is it to get time for common planning? How do you use that time? What do you discuss?
5. How easy is it to get time to meet with other teachers? *(Probe how often they meet)* Are there any other times that you get together to talk about teaching? Besides these formal professional development events, how often do you talk with other people in this school about improving teaching? With whom? In what setting (lunch)? How easy and frequently do you hold subject meetings? (*Probe for who chairs, what is discussed at these departmental meeting, etc.)* What do you talk about?
6. What professional development have you received in the last 12 months (*Probe for who initiated it, who provides it, duration, access to these, and role of HOD)*
7. What were the most helpful events/sessions in science in the past year?
8. Have you or your school received any help from the subject advisor? Can you tell me about that event? How helpful was that intervention?
9. What kind of support do you expect to receive from your HOD (*Probe for qualifications and challenges faced by teachers, support provided by HOD if adequate or what else)*
10. How often have you participated in district- or school-sponsored professional development on specific topics/involving specific types of activities? (*Probe for value of topics discussed or type of professional development received for the teacher's professional growth*)
11. What informs promotion of learners to next level of physical sciences? (*Probe for criteria and influence in the promotion requirements)*
12. What are the areas of conflict in the department, if any, and how is the conflict handled?
13. What formal and informal actions do HOD/principal /Subject advisor (*Ask about each separately*) take to support your teaching? What support do you receive from the principal?
14. What professional development activity was most useful/ helpful to you? What did you learn from the experience? What about the activity made it helpful? What activities that you're not getting now would be most useful for your professional development? (*Probe specifically for activities on Classroom practices, bridging the theory–practice gap, Support within the department/school, Emotional support. Recognition of your efforts (whether successful or not), Provision of constructive feedback).*
15. What are the big issues your department faces*? (Probe for perceived challenges to improving teaching and learning in the classroom. Why? Why do you think that? What gives you that impression?)*
16. How long have you taught in all? How many years at this school? What certifications or degrees do you have? Are you working on any other degrees or new certifications?