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

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Abstract. With the increase in demand for school-based tasks, teachers, especially natural sciences (NS) teachers, are increasingly in need of professional support and leadership that will improve their subject instruction. This paper investigates NS teachers' perspectives on the type and quality of instructional leadership provided for NS teaching and how this leadership is adapted to implement the curriculum successfully. This study adopted a mixed methods research approach to investigate the quality of instructional leadership for NS teaching. We used a dataset of NS teachers from 243 schools. Of these, 112 teachers completed the questionnaire and 10 were interviewed and observed from six schools in the Gauteng province of South Africa. The data obtained were analyzed using descriptive statistics for the quantitative strands, while the qualitative strands were coded and interpreted into themes. The findings revealed that some of the participants were novices in the teaching of some sections of NS and thus tended to seek help from their peers because of the less than expected and inaccessible leadership provided by heads of department (HODs). This paper argues for the distribution of leadership by recognizing the contributions made by senior, leader, or master teachers to the professional development of NS teachers in general and the differential allocation of science HODs along junior and senior secondary school subjects. This paper contributes to an understanding of the function of subject leadership beyond formal positions in the South African context.

Keywords: Head of department; instructional leadership; natural sciences; senior teachers

I. INTRODUCTION

Natural Sciences (NS) is a junior secondary subject that belongs to a group of science subjects (Ng et al., 2015) constituting the science department in secondary schools. In the South African context, NS lays the foundation for at least four high school subjects, namely 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 reorganized. One of the key prescriptions of the new curriculum in South Africa is the need for school-based assessment tasks (SBATs) for each science discipline of NS (Department of Basic Education [DBE], 2011). This is because the importance and adequate teaching and learning of NS cannot be overemphasized in the development of any nation (Bantwini & Feze, 2017; Christensen & Rasmussen, 2017).

Teachers and other stakeholders, such as heads of department (HODs), can play a major role in achieving set goals and objectives and the multi-disciplinary and complex roles played by the HOD can make or mar the achievement of these goals. Since most NS teachers and HODs specialize in a maximum of two subjects, it might be difficult to have an HOD who can successfully provide leadership for teachers in all the subjects. The kind of support provided for teaching NS in the context of it being a junior secondary school subject competes with the main gateway subjects such as mathematics and PS within the structural arrangement of science departments in schools (Naicker et al., 2013). This support might be quite different from the support given in the senior phase. Spillane and Hopkins (2013) called this structural arrangement of departments in schools "a system and organizational infrastructure" (p. 2). This arrangement of departments in most secondary schools brings together a group of subjects, such as mathematics, mathematical literacy and 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, and 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.

Instructional leadership refers to actions that are related to teaching and learning, such as conducting classroom observations (Ng, 2019). Instructional leadership implies all the activities that should be done in order to guarantee the realization of classroom goals and objectives. Ng (2019) opined that instructional leadership includes all leadership activities that indirectly affect student learning, such as school culture and timetabling procedures. Most of these activities are usually carried out by the principal or the HOD (Vogel, 2018). Even though the activities might not be officially documented, they are strong enough to guarantee the realization of school goals and objectives.

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 et al., 2013). Most studies have focused on principals as instructional leaders (Bush, 2013; Ismail, Don et al., 2018; Ismail, Mansor et al., 2018; Winn, 2016; Vogel, 2018) and, more recently, on deputy principals (Chitamba, 2019). 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 et al., 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 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 et al., 2011). York-Barr and Duke (2004), however, explained 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 et al., 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 requires the leaders to have the ability to involve their

colleagues collaboratively in mutual development and learning, with the aim of improving teaching and learning. Lai and Cheung (2013) defined 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 organizational and institutional evaluation. In this paper, instructional leadership will refer to all processes and practices by anyone in the school and the education district that positively influence professional matters relating to the teaching and learning of NS.

The South African Department of Education (DoE, 2000) identified specific areas of instructional leadership as related to whole-school evaluation. These are: setting up staff development programs, conducting classroom and follow-up visits, monitoring learners' work, assisting teachers with lesson plans, discussing learner progress, moderating tests and examinations, and inducting new teachers. 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).

The South African DBE introduced a new Curriculum and Assessment Policy Statement (CAPS) with the aim of raising the standards of education outcomes in the country (DBE, 2011). In addition to CAPS, SBATs 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, 2008). Umalusi evaluators suggested that teachers lack resources to prepare for practical work; subject expertise, knowledge, and skills to develop SBATs; and time to plan and reflect on the curriculum (Umalusi, 2008). In the same context, Kriek and Basson (2008) argued that the challenges identified 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 specialization.

The HOD, as a formal instructional leader, is identified and appointed from among experienced teachers who are either lead or master teachers, or consultants who have been brought in as mentors or action research facilitators (Melville et al., 2014). In South Africa, the HOD position has a statutory delegated authority because it is officially recognized in the school setting (Mbatha et al., 2006). As part of the role, HODs are expected to set subject goals and expectations for achievement, monitor achievement levels (for both teachers and learners), evaluate instructional practices and learning, maximize the effort of the instructional organization, and conduct staff recruitment and appraisal (DoE, 1999). The HOD's role is characterized by complexity and contingency (Hallinger & Heck, 2011) and this is compounded by conflicting expectations of principals and teachers. HODs have a dual role – they are expected to be teachers and administrators (Siskin, 1994) and managers and leaders. Wise (2000) maintained 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 has revealed that HODs' time is consumed by administrative work and that they do not often receive release time (Brown et al., 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. HODs have extremely limited opportunity 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.

Leadership need not be located in the principal only, as some studies have reported (Hallinger, 2005; Leithwood & Jantzi, 2000; Vogel, 2018), but can be “stretched” over multiple leaders (Bendikson et al., 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 in HODs only 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) warned 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) concurred that the distribution of leadership among both positional and informal leaders and the actual division of labor in the workplace strengthen the effectiveness thereof.

The conceptual framework used in this paper 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 leadership 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 school's social, political, economic, cultural, and other contextual problems (Robinson, 2010).

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 overarch the role of managing people and resources (see Fig. 1). The sixth and final component introduces the feedback loop and evaluation of the effectiveness of leadership. This paper focuses on only one component (4th 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 in this study, we examine the kind of instructional support that teachers receive and identify 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?

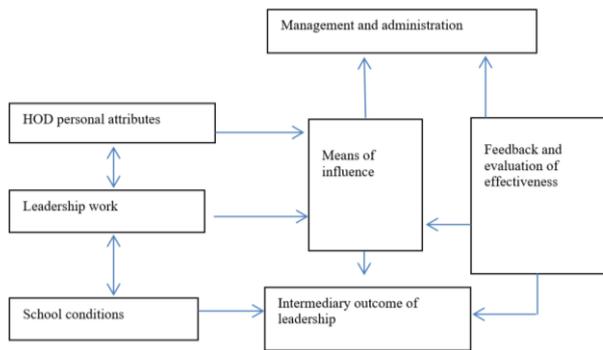


Fig. 1 Abridged version of the conceptual framework for leading instruction (adapted from York-Barr & Duke, 2004)

II. METHODS

This paper adopted a mixed methods research approach to investigate NS teachers' perspectives on the quality of instructional leadership provided by HODs. The justification for adopting a mixed methods approach is because it allows for the collection of both quantitative and qualitative data. Creswell (2014) opined that a mixed methods approach allows the integration of numerical and qualitative information gathered in several ways. This will allow the achievement of a deeper and broader understanding of the research questions. We adopted the mixed methods approach because it was important to match the research methodology with the objectives and content 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 et al., 2011).

A. Mixed Methods Sampling

A total number of 243 schools from the Gauteng provincial districts were invited to participate in this study. Only 112 of these schools accepted invitation to participate in the study, which comprised a subset of the sample. Another subset was further selected for in-depth investigation. The quantitative strands of the data were collected from 112 NS teachers who responded to the questionnaire and the qualitative strands of the data were collected from 10 NS teachers who were interviewed and observed. Creswell (2014) opined that the use of semi-structured interviews, meeting observation, and documentary analysis allows for a deeper understanding of facts.

B. Description of Instruments

Data were collected using self-report techniques (questionnaire and semi-structured interview), observational methods (participant observation), and secondary data analysis from artefacts and school documents (Teddlie & Tashakkori, 2012). The quantitative study used full-group data from 112 secondary schools (all the schools with Grades 8 and 9) in four of the fifteen districts in the Gauteng province. The questionnaire targeted respondents and

explored their perspective on science HODs' instructional leadership practices and the frequency thereof, and who else they found useful in meeting their professional needs. The last section of the questionnaire collected biographic data of the respondents.

C. Procedure for Data Collection

In this paper, we first focused on the biographic data of the respondents from all the schools participating in the study, because this informed the needs and expectations of the respondents regarding HODs' professional capacities. Teachers' needs are likely to challenge the HODs' ability to build relationships and collegiality (Ghamrawi, 2010) and develop teachers, as well as the agency of the HODs or other teachers regarding equipping and resourcing their department (Angelle & DeHart, 2011; York-Barr & Duke, 2004). The biographic data include profiles of the respondents, 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 their department was also investigated. Second, we investigated the means of influence that HODs used to maintain focus on the core of the curriculum, namely 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 was 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 et al., 2011; Naicker et al., 2013) and demonstrations, which some teachers prefer because they would rather learn from one another's classroom practice than from formal programs offered at universities. Such professional development support should be based on the teachers' own contexts, goals, and knowledge and learner needs (Vercio et al., 2008) as well as reflective and collaborative work expected at the schools (Glickman et al., 2011; Wanzare, 2013).

We also observed five cluster meetings that had been arranged by the two district subject advisors. The teachers who attended the 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 talk" 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.

This is a mixed methods 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) argued for distributed leadership, and we explore whether the distribution is formalized or whether teachers use their agency, as suggested by Sherer (2008), to take up leadership opportunities.

D. Mixed Methods Analysis

Mixed methods data analysis involves the use of both quantitative and qualitative approaches to analyze data. It also involves the combining of the two forms of data. The quantitative strands of data were analyzed using descriptive

statistics such as frequency counts and percentages, while the qualitative strands derived from the investigation were recorded and transcribed. The data were coded and interpreted into themes using literature on instructional leadership and the conceptual framework. We ensured the anonymity and confidentiality of the participants by adopting the use of codes for the 10 participants who were interviewed and observed, such as Teacher 1, Teacher 2, ... Teacher 10.

III. FINDINGS

As part of the results for this investigation, we present the profiles of the NS teachers involved in the study. In addition, the findings emanating from this investigation are reported according to the themes that were highlighted in literature.

A. Profile of the Respondents in the Study

Participating teachers were asked to indicate their qualifications and specify the areas of their specialization. Although most respondents were qualified as teachers with either secondary education diplomas or degrees, 9.7% of them 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 I. Table I shows that the majority of the respondents in this study were female (59.2%), while the male respondents who took part in the study made up 40.8% of the sample.

TABLE I
 QUALIFICATIONS AND GENDER OF RESPONDENTS

Qualification	Number	%	Male	%	Female	%
Matric	5	4.9	1	2.3	4	6.6
Primary teachers’ certificate or diploma	5	4.9	3	7.1	2	3.3
Secondary teachers’ diploma	17	16.5	7	16.7	10	16.4
Advanced certificate in education	20	19.4	7	16.7	13	21.3
B degree	24	23.3	11	26.2	13	21.3
Postgraduate qualification	32	31.0	13	31.0	19	31.1
Total	103	100.0	42	100.0	61	100.0

TABLE II
 INSTITUTIONS OF PROFESSIONAL QUALIFICATION AND AGE RANGE OF RESPONDENTS

Institution	<25 years		25–29 years		30–39 years		40–49 years		50–59 years		60+	
	years	%	years	%	years	%	years	%	years	%	years	%
College	0	0	0	0	8	30.8	31	67.4	8	66.7	1	50.0
University	8	100	4	100	18	69.2	14	30.4	4	33.3	0	0
Unqualified	0	0	0	0	0	0	1	2.2	0	0	1	50.0
Total	8	100	4	100	26	100	46	100	12	100	2	100

Table II displays the ages of respondents and the types of institutions where they 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.

Most of the respondents (66.7%) were 40 years and older and 66.7% of those older than 40 years had qualified from

teacher colleges and not from universities. This meant that they had three-year qualifications, as opposed to those who had qualified at universities with four-year qualifications. About 13.3% of the respondents were younger than 30 years and all of these respondents had qualified from universities.

There were no unqualified respondents younger than 40 years of age. Table III shows that 52.4% and 49.4% of the respondents had less than five years of experience teaching

Grades 8 and 9 NS, respectively. Approximately half (47.6% of Grade 8 and 50.6% of Grade 9) of the respondents had more than five years NS teaching experience. More than a third of the respondents (41.9%) taught Grade 10 PS, over a quarter (26.8%) taught Grade 11 PS and 16.1% taught Grade 12 PS, irrespective of experience.

Fig. 2 indicates the areas in which respondents had specialized. Just over half of the respondents in the study (53.6%) had specialized in LS, which covers a quarter of the NS syllabus (life and living).

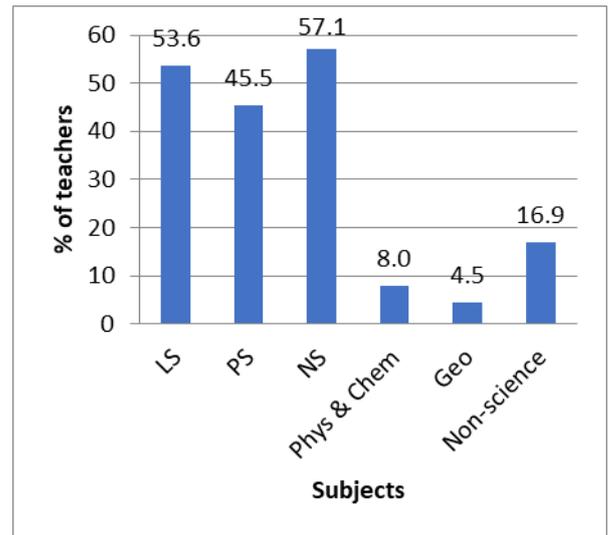


Fig. 2 Respondent specialization

About 45.5% of the respondents had specialized in PS, which covers half the syllabus (matter, materials, and energy). Almost two thirds (57%) of the respondents had specialization that enabled them to teach all the NS disciplines. A small percentage of the respondents (16.9%) were not qualified to teach any of the NS disciplines.

TABLE III
 TEACHING EXPERIENCE OF RESPONDENTS

Experience teaching subject	Grade 8 natural sciences		Grade 9 natural sciences		Grade 10 physical science (%)		Grade 11 physical science (%)		Grade 12 physical science (%)	
	N	%	N	%	N	%	N	%	N	%
1–2 years	23	28.1	18	23.4	15	32.0	9	30.0	5	27.8
3–5 years	20	24.4	20	26.0	14	30.3	10	33.3	5	27.8
6–10 years	22	26.8	22	28.6	6	13.0	4	13.3	4	22.2
>10 years	17	20.7	17	22.0	12	25.0	7	23.4	4	22.2
Total	82	100	77	100	47	100	30	100	18	100

TABLE IV
 BIOGRAPHICAL DATA OF TEACHERS INTERVIEWED

Participant	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	Advanced certificate in education (Afrikaans)	Fhutura	2
Teacher 6	F	40–49	University	Advanced 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

We interviewed 10 of the 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 us in terms of travelling distance. Table IV 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 four 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)

B. Main Research Findings

We present the findings of the study according to the six themes that were significant in the literature.

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

1. Help with Practical Work and Resources/Apparatus:

The participants were asked about the kind of support that they needed urgently and how they were being supported. Some of their top priorities were assistance with experiments, developing assessment tasks, and securing apparatus for experiments and other consumables and resources such as textbooks. We collected data during the third term at one school and one participant had not even had the NS textbook at the time:

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

A participant 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 participants 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 participant 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 (ticker timer), I have never used it, 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 in most South African schools have to manage and address and provide effective leadership in to improve the teaching and learning of NS.

2. Specialization Effect: Because NS is a multidisciplinary subject, some teachers struggle with certain topics within the subject. Both participants from Sheba School 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)

The other participant 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, Teacher 4, 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 specialization]. (Teacher 4, Knowledge)

Teacher 6, a senior teacher, 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)

A participant 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 this.

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)

Participants struggled with different sections of the four strands of NS, depending on their area of specialization. The

effects of specialization were not impacting only teachers, but the HODs as well because they have to develop the content and pedagogical knowledge of the teachers. We wanted to find out which colleagues or other individuals provided subject leadership to teachers if the HOD could not, as was the case at Alpha.

3. Role Players Providing Instructional Support:

Responses from all the respondents in the study showed that HODs were taking responsibility for the quality of science teaching and learning. We asked respondents to rank the HODs' responsibilities in order of importance using a scale of 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 (Table V). 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 V.

Other responsibilities involved standards and goal setting, and these were not necessarily contributing to improving instruction directly, except setting the goalpost. The last four responsibilities, however, provided a better picture of the instructional leadership practices of the HODs. HODs took moderate responsibility in familiarizing 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. Providing classroom observation feedback received a mean score of 3.51. These ratings were at the border of agreeing and being neutral. These responsibilities were ranked very low, 8th and 9th out of ten activities, respectively. It can be concluded that the HODs did not consider these instructional leadership practices very important in improving instruction.

TABLE V
 RANKING OF HODS' RESPONSIBILITIES (N = 112)

HOD responsibility	Mean	Ranking
The 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
The HOD sets high standards of science teaching and learning	3.82	5
The 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
The HOD provides opportunity to learn, coordinates professional development, and helps teachers do well	3.55	8
The HOD provides classroom observation feedback	3.51	9
The HOD understands what learners do and are expected to do in each grade	2.69	10

Though the HODs were taking responsibility for the quality of teaching and learning, it was not evident from the questionnaire data how they 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 participants. The participants were asked how their HODs supported them. One of them 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 participant 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 NS.

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

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

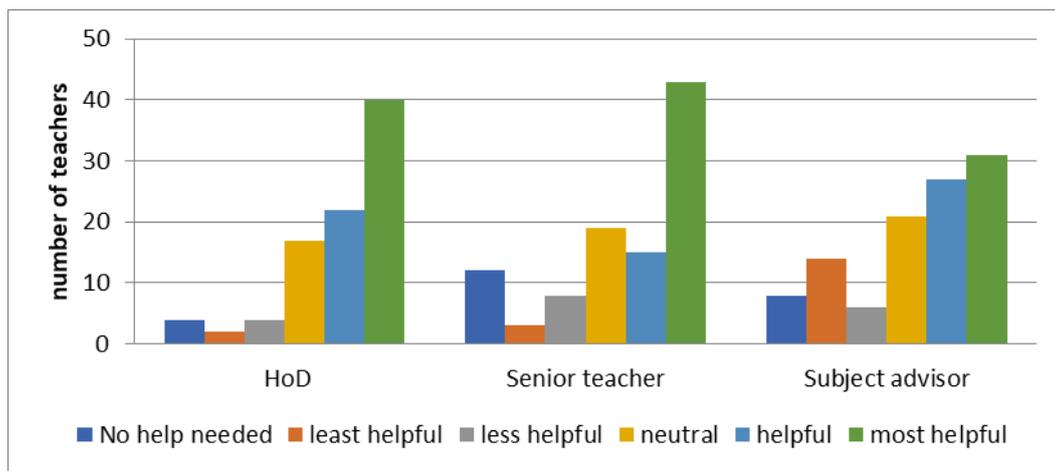


Fig. 3 The most helpful person according to respondents' view

In high-performing schools (Naicker et al., 2013), the principal ensures that experienced teachers assist novice teachers in the classroom. For the schools in the study, it was not a matter of teaching experience of NS teachers. Rather, what mattered was expertise and insufficient content and pedagogical knowledge to teach certain sections of the subject for which these teachers would seek help from other teachers or the HOD. In these schools, support was not planned by school leaders, but happened sporadically. The participants 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)

One participant 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 participant received help from her colleagues in the section of the syllabus in which she was not specialized.

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

The participant 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 the participants 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)

4. *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 organized by the subject advisors, regarding which participants 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)

Participants from other schools 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 participant 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). (Teacher 8, 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. (Teacher 8, Alpha)

A participant 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 participants, however, saw the need for support from district officials. The participant 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 only, took place once a term, and each was attended by the teachers of more than 50 schools. Almost all schools in the study demonstrated the need for organized professional development of most NS teachers. This is 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.

5. *Professional Development at School:* Table VI shows that less than half of the respondents (43.75%) had received either less than six hours or no professional development at all. Approximately 20% of the respondents indicated that they had received more than 15 hours of professional development in the last 12 months, which was about two days of training or development.

TABLE VI
 NUMBER OF HOURS OF PROFESSIONAL DEVELOPMENT

No. of hours	No. of respondents	%
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

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

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

A participant from Sheba School was very frank, saying that there was no organized professional development at her school.

No informal teacher development. (Teacher 10, Sheba)

Another participant 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)

A participant from Knowledge School concurred:

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

Participants 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 VII shows the mean frequencies of the instructional leadership practices from the respondents’ 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 equal or above 3.00, 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 was on track.

The responses of respondents 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 respondents indicated frequent provision of professional development, despite receiving less than 15 hours of professional development, as indicated in Table VI. Evidently, HODs did not lead the professional development (ranked last in Table VII). This correlated with the qualitative data, that the professional development the participating teachers reported on was mostly CAPS training.

TABLE VII
 FREQUENCY OF INSTRUCTIONAL LEADERSHIP PRACTICES

Instructional leadership practices	Frequency of IL practices	
	Mean	Ranking
Monitors and controls learners’ activity and assessment books	3.22	1
Carefully tracks learners’ academic progress	3.00	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

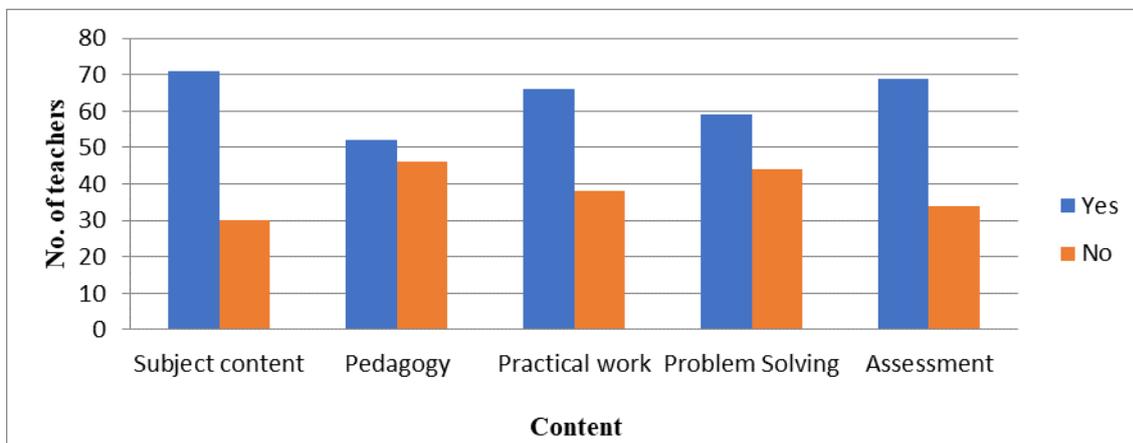


Fig. 4 Content of professional development sessions

However, the questionnaire responses painted a positive picture regarding teachers receiving professional development. Fig. 4 shows the areas in which respondents had received training in their schools. The questionnaire did not specify who provided development and what type of development was provided. Most respondents indicated that they were professionally developed on subject content (71%), assessment (69%), problem-solving (59%), and practical work (66%). A little more than half of the respondents (52%) indicated that they were developed in pedagogy.

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 participant 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 respondents indicated 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 participants 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 the integrated quality measurement system (IQMS), which is a compliance activity.

It was confirmed that only the HOD from Knowledge School did classroom observations that were outside the 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 participant 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)

The participant from Fhutura confirmed that classroom observations were done at her school and she had 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, curriculum management meetings were conducted 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 meeting's 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 to 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 a few cases, such as in Alpha School, where the HOD frequently referred NS teachers to the subject advisor.

6. Focus on Compliance: In a study by Brown et al. (2000), HODs did not receive 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 where we followed up with semi-structured interviews.

One of the participants 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)

The other participant 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 participant 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 job description of HODs (DoE, 1999). In one study, 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 respondents about the frequency of certain topics or activities being raised at the meetings (Fig. 5).

Some respondents (59.3%) agreed that HODs always or frequently called meetings and discussed staff problems in meetings (50.5%) (Fig. 5). Other respondents (39.8%) confirmed that their HODs occasionally or seldom called meetings.

We analyzed the subject meetings to determine if any instructional support and leadership were provided at these meetings to teachers as a group. The participants 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).

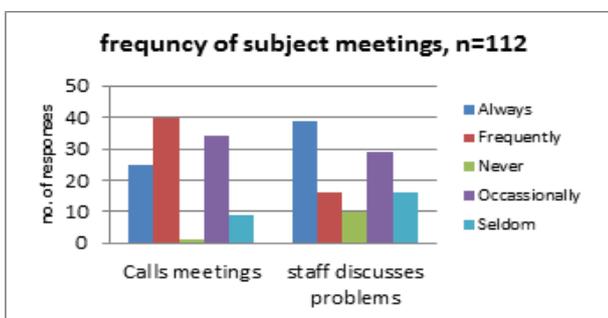


Fig. 5 The frequency of subject meetings

A participant 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.

Fig. 6 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 respondents (38.5%) expressed neutrality about discussions on professional development in subject meetings. It has been gathered that professional development was rarely done in schools, as discussed earlier. Almost two thirds of the respondents (63.9%) rated content coverage as a frequently discussed item. This was also ranked as one of the most frequent practices of HODs, in Table VII, namely monitoring content coverage through checking learners' books. Teacher 9 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 setup 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)

Approximately half (47.7%) of the respondents 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 participant transcripts confirmed this. The participant 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 participant 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 participant 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)

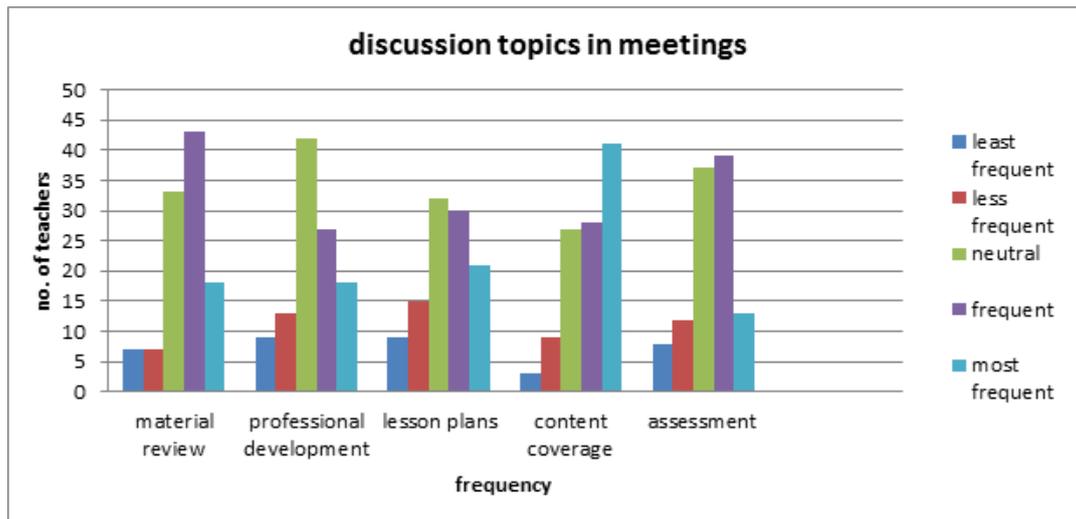


Fig. 6 Topics discussed in meetings

IV. DISCUSSION

The findings from this study clearly revealed the challenges involved in leading NS instruction in the current context of South African schools. Even 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 DoE has increased the monitoring of the implementation of SBATs. From the data presented, it is evident that participants needed different types of support and instructional leadership. In cases where participants did not have access to this support formally, they identified their own leaders (support system) who could provide them with the support they needed. This finding is consistent with the argument by Spillane et al. (2003) that teachers construct their own leadership.

Being appointed to a leadership position 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. Participants expected their instructional leaders to have sufficient expertise, experience, and subject knowledge 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 participants reported needing their HODs for assistance, but the HODs were “too busy” and did not have release time to do HOD duties. The findings showed many reasons why participants required assistance.

The new CAPS curriculum, among other educational 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 have had to set a practical assessment task for each science discipline, even the science disciplines in which they had no expertise. Consequently, they were likely to need assistance in this regard. Science education in South Africa has been characterized 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 revealed 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 prioritized for experiments because of the national focus on these senior grades. NS teachers need guidance and support from HODs to, firstly, source apparatus so that they could do the experiments – which could sometimes involve borrowing from other schools. Secondly, NS teachers require assistance to schedule NS classes for experiments at the existing laboratories, ensuring that laboratories are available for the teachers to prepare and conduct experiments.

The challenge that participants had to design experiments for learners and assess these practical tasks was compounded by their lack of specialization in some science disciplines. Some schools allocated the development of these tasks to either senior teachers or teachers who possessed the necessary specialization. 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. 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 utilize schedules, routines, and artefacts for designing a timetable for sharing the laboratories.

Secondly, more than a third of the participants in the study were either teaching NS for the first time or it was their second year of teaching. Rivkin et al. (2005) argued 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 participants 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 participants stated that they could teach NS with confidence. These findings were made from self-reported data and were not tested in this study.

Some of the participants 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 organized 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. In their allocation of subjects every year, the school leadership did not consider 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 recognize 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 in this regard cannot be overemphasized.

The fourth reason why teachers would need strong instructional leadership relates to the teachers' area of specialization, across all ranks. Secondary school teaching requires teachers to specialize in certain subjects. The level of specialization of participants informed the kind of

professional leadership and support that they would require and expect their institutions to provide. HODs might have specialized in one subject, but they had to supervise others in subjects they themselves were not specialized in. Some participants in the study had not specialized in any of the sciences at all. Those that had specialized in one discipline needed help in the other disciplines. Very few participants had specialized in both LS and PS and a few (often older) participants 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 school's responsibility to ensure that the teachers they allocate to teach this subject are adequately qualified, or to put systems in place, such as appointing senior teachers, to be available to provide much-needed assistance to NS teachers.

A. Professional Development

To implement the changes in the curriculum, the DoE had been providing piecemeal, workshop-type professional development that was not effective (Kriek & Basson, 2008). Lai and Cheung (2013) argued 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 but not limited to short meetings, half-day sessions, a few days training, weeklong conferences, seminars, and continuous professional 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) maintained that professional development fosters pedagogical, emotional, social, ethical, and cognitive development.

According to the findings, the biggest need seems to relate to practical work, especially designing experiments for the SBAT in areas in which teachers were not specialized. 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 neighboring schools in order to do the experiments. In Promise School, the interviewed participant, although a qualified PS teacher, had never used a certain piece of equipment and confessed to having 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 specialized in the area in which the participant 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.

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. In the context of the HOD who was not trained on the new curriculum, his/her duty became more of coordination than actual facilitation of training. In the study, 39% of participants indicated 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 revealed that most participants did 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 revealed this, despite the fact that in the quantitative responses, participants indicated an average of 15 hours of professional development over the last 12 months. This happened to be CAPS training that was provided by the provincial office and not necessarily by the school. It was evident that participants needed professional development that focused on both subject matter and pedagogical content knowledge. It is clear that providing continuous teacher professional development is an important area and one in which HODs could make a difference to the quality of NS instruction.

B. Subject Advisor Support

In exploring the support provided by subject advisory services, we realized that some schools were benefitting from the services but others 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 did 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 minimize the number of teachers who attended cluster meetings and improve the content and effectiveness of the meetings. At the time of study, 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 organized and

more effective, but school-based subject instructional leadership would also be enhanced. The HODs who are not specialists in the particular subjects that they lead 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 specialized 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.

C. Senior/Master Teacher Support

Considering the multidisciplinary nature of NS, HODs are likely to feel inadequate and doubt whether they add value for the teachers that they lead. They could also be conscious that some of the teachers they supervise know more than they do about some subjects or areas of the subject. There is a great need to institutionalize 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 organizing extra and co-curricular activities to ensure that education of learners is promoted in a proper manner. They also provide guidance and counselling, act as mentors and coaches to less experienced teachers, and participate in and facilitate professional development activities (master teacher). Furthermore, senior teachers 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 (Education Labour Relations Council [ELRC], 2008). The senior teacher resource would ensure that the expertise of different teachers is recognized and deserving teachers are given the opportunity and support to lead in their subjects. In this way, leadership would be 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 require and they will only have 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 participants in the study indicated that they were senior teachers. The challenge is finding a way to identify these teachers in schools (Lai & Cheung, 2013). The findings suggested that the participants 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 (whom 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 approached to provide assistance demonstrated agency, as defined by Sherer (2008), as they saw the need or the gap and provided leadership. These teachers in these schools showed a strong sense of collegiality and provided professional support and guidance without the need to have a formal title of HOD or senior teacher.

D. 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. Most participants (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 are not beneficial and could therefore be interpreted as being done for compliance reasons only. There was a strong compliance component at all levels of the instructional hierarchy in the schools of this study. The participants did some activities simply to comply, even though they did not benefit from it. Participants also prepared and presented lessons for the IQMS purely for compliance reasons, but they did not see it as beneficial. They mentioned that some members of the SBATs who conducted the 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” and not the “how” of the job; therefore, they found it difficult to supervise. They only stamped and signed the learners’ books or teachers’ files as evidence that monitoring had been done, but no follow-up was done to raise concerns or acknowledge the teachers’ good work.

V. CONCLUSION

Participants in the study had very clear views about the extent and quality of instructional leadership that were provided at their schools. The findings revealed that the way school leadership currently allocates NS teachers and science HODs in South Africa is rather shortsighted and likely to have contributed to the poor performance of learners in senior secondary school science. The findings also revealed 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 that which is organized by the provincial or district offices. 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 HOD-teacher interaction. Subject advisors provided limited instructional support, which could be improved with better organization.

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 reorganized to optimize the quality of instructional leadership. HODs who 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 recognize 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 NS teachers. 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 generalized 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 HODs be explored further with a view to clarifying their respective roles and to avoid duplication and overlapping.

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