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Characterised Instructional Leadership Practices for Life Sciences: An Exploration of Two South African Schools

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ABSTRACT
This study investigates instructional leadership practices specific to Life Sciences in South African high schools, with a focus on how principals and departmental heads monitor, support, and evaluate teaching and learning. Using an exploratory qualitative case study design, data was collected from two schools, notably, one well-resourced and one under-resourced, through semi-structured interviews, observations, and document analysis involving eight participants (principals, departmental heads, and teachers of Life Sciences). The findings reveal that the well-resourced school employed structured monitoring tools such as the Curriculum Management Framework, systematic file checks, and regular classroom visits, coupled with professional development opportunities and adequate resource provision. In contrast, the under-resourced school relied on less formal monitoring practices, offered limited subject-specific support, and faced challenges linked to resource deficits and leaders' lack of expertise in Life Sciences. The study highlights the importance of subject-specific instructional leadership, contextual resource capacity, and professional development in shaping effective instruction of Life Sciences. It concludes that strengthening leaders' science-specific knowledge and establishing structured support mechanisms are essential for improving teacher development and learner outcomes in Life Sciences.

KEYWORDS
Instructional leadership; life sciences; monitoring; teacher support; departmental heads.

INTRODUCTION

The role of school leaders in supporting science instruction and their understanding of science practices remains a subject of debate among scholars (Ismail et al., 2018; Lowenhaupt & McNeill, 2019; McNeil et al., 2018). Instructional leaders have been identified as key drivers of instructional reforms and classroom improvement (Ntuli & Mahlangu, 2023; Ralebese et al., 2025a, 2025b; Taole et al., 2024). However, little is known about principals' and departmental heads' capacities to support teacher learning in science, particularly regarding science practices emphasised in the Next Generation Science Standards (NGSS), Curriculum and Assessment Policy Statement (CAPS), and similar curricula (Lochmiller & Cunningham, 2019; Malinga & Jita, 2016; McNeil et al., 2018). The limited science background of many principals and departmental heads, combined with competing administrative demands, constrain their ability to provide meaningful guidance. For any science subject, a sound understanding of the discipline is essential for effective instructional leadership and tailored feedback (Malinga & Jita, 2016; Tsakeni et al., 2020). Supporting teachers to develop competence in science practices and appropriate strategies remains critical for improving learning outcomes.

Teachers may differ in view on what makes good science instruction, with some prioritizing content knowledge over the integration of science practices, namely experimenting, simulating, inquiring, argumentation, and more. However, the need to develop the capacity of principals and departmental heads to effectively supervise science instruction that reflects recent reform efforts and supports systemic change in science education is germane (Bellibaş et al., 2021; Lowenhaupt & McNeill, 2019; Malinga & Jita, 2016). The literature has recognised the limitations in the capacity of instructional leaders, with reports of them lacking a background or expertise in science, which raises questions not only about their knowledge of, but also their understanding of high-quality science instruction (Ismail et al., 2018; Onuma, 2016). Similarly, reports of teachers not being adequately supported to integrate science practices into their instruction can influence learning outcome and achievement (McNeill et al., 2018; Osman & Mukuna, 2013; Yow et al., 2021), as schools and districts may not be prepared for the necessary instructional reforms. When instructional leaders focus on general pedagogy when observing science instruction, it may negatively impact science teaching and learning. According to the literature, these impacts may include limited attention to science practices, missed opportunities for feedback and improvement, limited understanding of the quality of science practices, and misalignment between the intended goals of the curriculum and instructional practices (McNeill et al., 2018; Peacock & Melville, 2019).

Research on instructional leadership (IL) has focused on mathematics and science broadly (Yow & Lotter, 2016; Yow et al., 2021), IL and content knowledge (Lochmiller & Cunningham, 2019; Stein & Nelson, 2003), science-specific IL (Cherbow et al., 2020; Hallinger et al., 2020; Peacock, 2014; Peacock & Melville, 2019), and IL capacity-building (McNeill et al., 2022; Onuma, 2016; Osman & Mukuna, 2013). However, these studies are limited in scope and context. At senior secondary level, science is divided into distinct subjects such as physics, chemistry, and biology, each with unique curriculum demands, content, and instructional practices. In South Africa, science is further divided into Physical Sciences and Life Sciences, each requiring differentiated instructional leadership support. Life Sciences, in particular, has its own curriculum and teaching practices, which necessitate tailored IL strategies. Global assessments such as PISA highlight the need for improvement in science education worldwide (OECD, 2019a, 2019b, 2021). In South Africa, student performance in Life Sciences has remained unsatisfactory for over a decade, especially at 50% achievement, with recent DBE diagnostic reports reaffirming this challenge.

Table 1.

Students' performance in the Life Sciences in the NSC examinations (2019–2024)

Year	% Achieving ≥ 30%	% Achieving ≥ 40%
2019	72.3 %	49.0 %
2020	71.0 %	47.9 %
2021	71.5 %	51.3 %
2022	71.5 %	49.0 %
2023	75.6 %	52.3 %
2024	80.8 %	61.2 %

Source: Department of Basic Education (DBE, 2023, 2024).

Table 1 illustrates students' performance in Life Sciences in the National Senior Certificate (NSC) examinations from 2019 to 2024, reported at the 30% and 40% achievement thresholds. The results indicate prolonged stagnation between 2019 and 2022, with pass rates at the 30% level remaining between 71% and 72%, while those at the 40% level fluctuated between 48% and 51%. A modest improvement was recorded in 2023, with 75.6% of candidates achieving 30% and above, and 52.3% achieving 40% and above. A more notable increase occurred in 2024, when 80.8% of learners achieved at least 30% and 61.2% achieved at least 40%. These figures highlight persistent challenges in achievement in Life Sciences despite recent gains, underscoring the importance of strengthening instructional leadership practices, particularly subject-specific support from principals and departmental heads, to enhance teaching quality and students' outcomes. In this context, this study explores characterised instructional leadership practices for Life Sciences in two South African high schools. By examining monitoring, support, and evaluation practices in both well-resourced and under-resourced settings, this study aims to provide insight into the contextual and disciplinary dynamics that shape instructional leadership in Life Sciences.

Research Questions

1. How do principals monitor, support, and evaluate the teaching and learning of Life Sciences?
2. How do departmental heads (DHs) monitor, support, and evaluate the teaching and learning of Life Sciences?
3. How do teachers of Life Sciences experience and perceive the instructional leadership practices of principals and departmental heads?

LITERATURE REVIEW

Instructional leadership (IL) is central to planning and provisioning for curriculum delivery. IL requires leaders to mobilise resources, set expectations, and leverage instructional supervision to enhance teaching and learning (Abdullahi et al., 2018; Plaatjies, 2025). In science departments, heads are responsible for organising and overseeing science-related activities across classrooms and the broader school. The goal of IL is to sustain a coherent vision that informs instructional decisions and classroom practices, thereby improving learners' outcomes (Malinga & Jita, 2016). To this end, instructional leaders deploy managerial and pedagogical strategies to support teachers' practice (Cherbow et al., 2020; McNeill et al., 2018; McNeill et al., 2022). A key task is to remove barriers to effective science teaching by ensuring access to appropriate resources and tools (Lowenhaupt et al., 2021). Given that part of the core aims of science education is emphasis on intellectual development, creative problem-solving, and enquiry (DBE, 2011), IL's attention to the specific demands of science classrooms is warranted.

A deep understanding of science education should therefore be a priority for instructional leaders if they are to influence classroom practice and continuous improvement (Lochmiller & Cunningham, 2019). Yet many school leaders possess limited preparation in science education (Spillane & Hopkins, 2013) and have a weak grasp of science practices (McNeill et al., 2022), which complicate supervision and guidance in science subjects (Sandholtz & Ringstaff, 2014). While elementary science IL has attracted attention in some contexts (e.g., Winn, 2016), South African public schools face distinctive challenges. Departmental heads (DHs) for Natural Sciences often struggle with day-to-day responsibilities and lack the requisite qualifications and competence to lead science effectively (Malinga & Jita, 2020; Ngema, 2016).

Compounding this, staffing constraints result in inexperienced teachers being assigned to teach science without targeted training or growth opportunities, resulting in adverse consequences for learners' later success in Physical Sciences (Malinga & Jita, 2020). Unqualified or inexperienced teachers may lack adequate science understanding, and together with the absence of instructional support from school leaders, these exacerbate underachievement (Ngema, 2016). Studies also underscore the need for sustained IL support that covers both experienced and novice teachers for science instruction, which depends on laboratory work and specialised apparatus (Adeniran, 2020). DHs and principals hold the prerogative to secure and allocate such support; as such, understanding the skill set required for these responsibilities motivates the present study. Beyond textbooks, learners benefit when teachers engage in laboratory experiences that strengthen conceptualisation and interest in science (Du Plessis & Mestry, 2019; Siphukhanyo & Olawale, 2024). Without subject-appropriate guidance and support, teachers are less likely to utilise diverse instructional strategies and available resources to implement the science curriculum effectively.

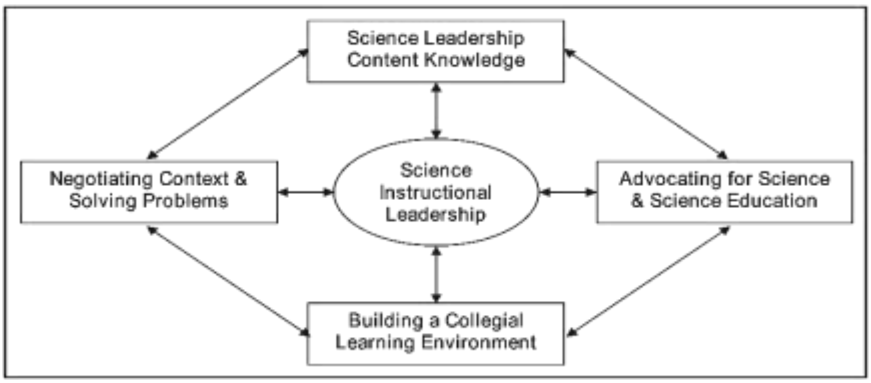
Persistent underperformance in Life Sciences has been linked to a shortage of trained teachers, the presence of unqualified teachers, and limitations in IL capacity to support these staff members (Dhurumraj & Broadhurst, 2023; Maduna, 2022). Teachers reasonably expect DHs to conduct lesson observations, model lessons, provide templates and guidance, and use observation data to strengthen instruction (Ralebese et al., 2025b). In policy and practice, likewise, it is expected that science DHs possess subject knowledge and strong teaching expertise to supervise instruction (Angelle & DeHart, 2011; Malinga & Jita, 2016). Because some competencies are not fully mastered during initial preparation, on-the-job support is essential (Stein & Nelson, 2003). Cycles of observation, feedback, and learning new approaches to science teaching can help both leaders and teachers to improve practice (Akram et al., 2017; Lowenhaupt et al., 2021). Whether and how these responsibilities are enacted in Life Sciences departments remains an important gap that this study addresses.

CONCEPTUAL FRAMEWORK

This study is grounded in Peacock's (2014) framework of leadership capabilities that contribute to effective science instructional leadership. The framework identifies four interrelated components (Figure 1), each of which is necessary for leaders to influence the quality of science teaching and learning.

Figure 1.

A conceptual model of leadership capabilities contributing to science instructional leadership



(Peacock, 2014).

Instructional leaders require an in-depth understanding of science content, as limited subject expertise constrains their ability to provide discipline-specific supervision, offer constructive feedback, or model appropriate instructional strategies (Stein & Nelson, 2003). Beyond content expertise, they must act as advocates for science and science education imperatives by prioritising the former in school development plans, ensuring curriculum alignment, and championing instructional practices that reflect contemporary reforms (National Research Council, 2015). Effective science instructional leadership also depends on building and sustaining collegial learning environments in which professional communities of teachers collaborate, share resources, and engage in continuous learning (Hallinger et al., 2020). In addition, leaders must be able to negotiate contextual realities and solve problems, particularly as science instruction is highly resource-dependent; this requires addressing constraints such as non-functional laboratories, inadequate teaching materials, and underqualified teachers, with strategic problem-solving being central to supporting effective science teaching (Bybee, 2010). In this study, Peacock's (2014) framework informed both the research design and the thematic analysis of data, with its four components guiding the coding of interview transcripts, observational evidence, and documents to interpret the practices that characterise instructional leadership for Life Sciences in the two participating schools.

METHODOLOGY

Study Context

Two high schools from Standerton in the Gert Sibande District were purposively selected because they offered Life Sciences and represented diverse contexts relevant to the study. The first school, located in town, falls within the quintile 4–5 category, is fee-paying, and is well-resourced with a functioning science laboratory, computer centre, library, and reliable infrastructure. It has a consistent record of strong Life Sciences results. The second school, located in a township, is a quintile 3 no-fee school. Although its infrastructure is adequately maintained, its science laboratory is non-functional, requiring fundraising to supplement resources. Despite such challenges, its Life Sciences results have steadily improved. Selecting these two schools created the opportunity to explore how instructional leadership is constructed and enacted across different resource contexts, thereby responding directly to the study's first and second research questions on principals' perceptions and the enactment of instructional leadership.

Approach

A qualitative case study design was adopted to investigate instructional leadership within a real-life context. This design enabled an in-depth exploration of the ways in which instructional leadership is practised, understood, and experienced by principals, departmental heads, and teachers. Case studies were considered suitable because they support rich descriptions and explanations of practices aligned with the study's research questions, namely: (i) principals' perceptions of instructional leadership; (ii) how these perceptions translate into enacted practices; and (iii) the alignment or misalignment between perception and enactment (Pearson et al., 2015; Yin, 2018).

Sampling

Purposive sampling was employed to select participants who were the most knowledgeable about the phenomenon under investigation. Principals were selected as the key instructional leaders, departmental heads as intermediaries responsible for the enactment of practice, and Life Sciences teachers as frontline implementers whose experiences reflect how leadership practices shape classroom instruction. This sampling strategy ensured triangulation of perspectives, supporting the study's aim of capturing instructional leadership as both perceived and enacted.

Data Collection

Three complementary methods were used to ensure data triangulation, namely semi-structured interviews, observations, and document analysis.

- Semi-structured interviews served as the primary tool for exploring participants' perceptions (RQ1) and lived experiences of instructional leadership. Open-ended questions elicited descriptive accounts while allowing for probing and clarification. Audio recordings were transcribed verbatim to preserve accuracy.
- Observations were conducted during school visits, staff meetings, departmental meetings, and in-service workshops. These observations provided direct evidence of enacted practices (RQ2), enabling comparison between principals' espoused perceptions and their actions (RQ3). Observations also captured tacit behaviours and dynamics that might not surface in interviews (Nieuwenhuis, 2016; Creswell & Baez, 2020).
- Document analysis included reviewing meeting minutes, workshop manuals, monitoring records, and subject performance improvement plans. These documents were analysed to validate claims from interviews and observations and to offer institutional evidence of leadership practices. Document analysis enriched an understanding of how instructional leadership is embedded in policy and practice, thereby supporting all three research questions (Patton, 2015).

Instrumentation

The semi-structured interview schedule was designed around the study's conceptual framework, with open-ended questions linked to the three research questions. For example, questions about principals' understanding of their roles aligned with RQ1, while questions on monitoring and support of teachers targeted RQ2. This structure ensured that data collection tools were conceptually anchored and empirically relevant.

Data Analysis

Thematic analysis, as outlined by Braun and Clarke (2006), was used to analyse interview transcripts, observational notes, and documents. The six-phase process (familiarisation, coding, theme development, review, definition, and reporting) was guided by the conceptual framework. Codes were generated to reflect participants' perceptions, practices, and areas of alignment or divergence. Themes were then reviewed against the three research questions to ensure consistency and relevance. The framework thus provided both a deductive lens for theme generation and an inductive space for emerging insights.

Ethical Considerations

Ethical approval was granted by the University of the Free State Research Committee (Ref. UFS-HSD 2022/1933123). Permission to access the schools was obtained from the Department of Education and the school principals. Informed consent was sought from all the participants, who were assured of anonymity, confidentiality, and voluntary participation (De Vos et al., 2011). Pseudonyms were used in all transcripts and reporting.

FINDINGS AND DISCUSSION

The study investigated practices that characterise instructional leadership for Life Sciences in two high schools with contrasting contexts. Given the volume of data generated from the semi-structured interviews, observations, and document analysis, the findings are presented according to the three research questions: (1) principals' monitoring, support, and evaluation; (2) departmental heads' monitoring, support, and evaluation; and (3) Life Sciences teachers' experiences and perceptions of instructional leadership practices.

RQ1: How do principals monitor, support, and evaluate the teaching and learning of Life Sciences?

Monitoring of teaching and learning for principals

Mrs Tracy, the principal of school A, advocated for science teaching and learning by monitoring teaching-learning processes, by checking teachers' files every Friday. Teachers' files, among others, should follow the annual teaching plan to structure daily lessons, consist of copies of informal and formal assessments, and include mark sheets pertaining to continuous assessments.

While Mr Frank, the principal from school B, monitored teachers' portfolios, made brief comments, and periodically engaged in informal classroom visits, as these were important to ensure that teachers were actually doing what they were guided to do. Also, he did formal class visits on a term basis and made suggestions based on what he knew as an experienced teacher. The feedback had positive effects on motivation, self-esteem, and the efficacy of teachers.

Instructional leaders use a variety of strategies and management abilities to support their teaching staff for the improvement of their students' teaching and learning outcomes (McNeill et al., 2018; McNeill et al., 2022). Evidence from the principals interviewed shows that the kind of leadership support provided is general, and not characterised for improved science instruction, as set out in this study. The studies of Lowenhaupt & McNeill (2019) and Hallinger et al. (2020) provide a road map for expected instructional leadership for science teachers. However, the principals only provided general leadership support to all teachers and not specifically for science instructors, with the assumption that teachers are instructional experts needing no particular monitoring and support.

Support for teaching and learning of science by principals

This is what the principals had to say regarding the support they provide for science teaching and learning:

> *Mrs Tracy, the principal of school A, supports the teaching and learning of Life Sciences by creating a positive environment. This included the provision of support, on-going professional development opportunities for teachers, and appreciation for teachers. The priority has always been to create and sustain a learning community for all, where teachers believed in their capabilities, respected colleagues, and care about learners.*
>
> *Mr Frank, the principal of school B, mentioned that since he did not have a science background, he supported his teachers by ensuring that the DHs hold meetings and submit minutes. Furthermore, sometimes he attends grade and subject meetings to solve challenges that DHs and teachers were facing.*

According to Adeniran (2020), there is a need for instructional support for both experienced and inexperienced teachers of science to guide science teaching. This support remains the responsibility of the principal and DH. School A's principal provides professional development support, a positive environment, and appreciation to teachers unlike in school B. It remains unclear whether the resources available to school A were responsible for the support provided or whether it was the caring nature of the instructional leader who is female. While science practice is an expected rudiment of IL, the context of this study is yet to establish whether such training exists for instructional leaders.

Evaluation of teaching and learning

Both principals evaluated Life Sciences outcomes through performance reviews and meetings. Mrs Tracy highlighted the systematic evaluation of learner results, while Mr Frank focused on quarterly performance checks tied to departmental reports. Bybee (2010) stresses that evaluation is integral to effective science instruction, but in this study, evaluation at School B was less formal and more reactive to results than in School A, where appraisal was integrated into school routines.

RQ2: How do departmental heads (DHs) monitor, support, and evaluate the teaching and learning of Life Sciences?

Monitoring of teaching and learning for DH

Mr Luke, the DH of school A, promoted science teaching and learning through monitoring the work of teachers by applying the Curriculum Management Framework (CMF) tool, which indicates whether everything is proceeding according to plan. Also, he utilised the monitoring tool to check learners' activity books to ascertain if learners were being taught the prescribed content. Lastly, Mr Luke conducted formal and informal class visits.

Similarly, Mrs Steve, the DH of school B, walked along the school corridors to ensure that learners were busy in their classrooms during teaching time. She also conducted classroom visits to check if teachers were following the ATP. Mrs Steve conducted term appraisals by recording notes after which she gave feedback to teachers. She also conducted random class visits to ascertain whether teachers were thoroughly prepared to deliver interesting lessons, not just to please her when she was on formal visits.

It is the duty of instructional leaders to engage in a cycle of observation, sharing feedback on teaching science, which in turn can help both teachers and leaders learn how to improve science instruction (Akram et al., 2017). School A appeared to be rudimentary with the use of the CMF and the close monitoring of teachers, unlike school B, which seemed to emphasise the surveillance of corridors as a form of monitoring and support. Highly resourced schools tend to implement science support better than those with fewer resources. Hence, it is imperative for instructional leaders to use a variety of strategies and management abilities to support their teachers in improving science teaching and the learning outcomes of their learners, as indicated in the studies by McNeill et al. (2018, 2022).

Support for the teaching and learning of Life Sciences

The DH of school A, Mr Luke, mentioned that at the commencement of each term, teachers in his department were given a management plan which included due dates for tasks, tests, moderation, and analysis of learners' results. Also, his open-door policy ensured that his department was smoothly managed, such that his subordinates were free to speak to him about any concerns. Overall, he stated that his leadership style offered relevant and sound support to Life Sciences teachers by introducing innovative strategies, assisting them if there was a topic they were struggling with, and ensuring that they used technology to make lessons interesting. Additionally, he supported his co-workers by encouraging them to attend workshops on content delivery during cluster meetings. Workshops are beneficial for exposing teachers to innovative ideas and techniques, since educational methods are ever evolving.

On the other hand, Mrs Steve, the DH of school B, supported her colleagues by speaking to them informally, in order to check if they were facing any challenges regarding subject content, learner attendance, and learner discipline, so that if there were any problems, she would intervene timeously. Such informal collegial conversations promote reflection by encouraging teachers to become aware of their professional practice. Furthermore, after she conducted class visits, she made constructive suggestions to teachers informally during day-to-day interactions. The constructive feedback focused on the improvement of instruction and encouragement to attend workshops, such that novice teachers could grow in the profession.

Departmental heads are expected by policy and practitioners to have knowledge of their subject and expertise in teaching it (Angelle & DeHart, 2011; Malinga & Jita, 2016). This means that for any support provided for science, a deep understanding of the subject is a prerequisite to effectively exercise instructional leadership and provide feedback to teachers (Tsakeni et al., 2020). It is evident that the DH of school A had an understanding of the subject, as he was able to assist his teachers with topics that they found difficult to teach; introduced teaching strategies that he saw as effective; and ensured that teachers utilised the interactive projectors, smart boards, and virtual labs to make lessons interesting. As the DH of school B lacked an understanding of the subject, she did not seem to have any idea of the strategies she could implement to minimise curriculum problems and promote effective teaching and learning in Life Sciences.

According to observations in the two schools, Mr Luke seemed to have a deeper understanding of the subject than Mrs Steve, while he understood the dynamics of the instructional practices that he needed to perform to ensure the effective teaching and learning of Life Sciences. On the other hand, Mrs Steve seemed to have no idea what the subject entails aside from her duties as the departmental head, which presented her with a challenge. Mr Luke appeared to have established a supportive learning and working environment: he worked alongside his teachers and had access to technology. Unlike at school A, at school B there was a lack of resources and the science laboratory was non-functional. Furthermore, Mrs Steve was assigned to oversee a subject she was not qualified for nor had passion for. The literature suggests that the efforts of school leaders to create an effective teaching-learning environment are the result of instructional leaders being experts in areas such as subject knowledge, pedagogy, instruction, and evaluation, as well as working alongside teachers and providing resources to support teaching and learning (Lochmiller & Cunningham, 2019; Stein & Nelson, 2003).

Evaluation of teaching and learning

Evaluation in school A was systematic, involving the moderation of assessments and the ongoing analysis of learner performance. In school B, however, evaluation was less subject-specific and focused more on procedural compliance. This discrepancy reflects Lochmiller and Cunningham's (2019) finding that effective instructional leadership combines subject expertise with accountability structures, both of which were unevenly distributed across contexts.

RQ3: How do Life Sciences teachers experience and perceive the instructional leadership practices of principals and departmental heads?

Teachers' perceptions of monitoring and supervision

Ms Andy, a Life Sciences teacher at school A, mentioned that her DH advocated for science teaching and learning by monitoring (using the monitoring tool) these, through perusing the activities of learners to ascertain if teachers were adhering to the prescribed guidelines on learner activities. Furthermore, the DH monitored the attendance of learners; checked that teachers were not behind schedule; gave teachers extra time to catch up if they were behind with content delivery; and assisted them if they were struggling with teaching a certain topic. Also, Ms Andy mentioned that the DH was responsible for supervising her work. She added that this ensured that Life Sciences teachers produced good results.

Likewise, Ms Gail, a Life Sciences teacher at school A, stated that:

The DH is the one responsible for supervising my work. Every two weeks, he asked for learners' activity books to ascertain whether learners understood the subject content. The DH utilises the monitoring tool to check content coverage and period registers regarding attendance of learners, and whether teachers conform to instructional time guidelines.

Seobi and Wood (2016) emphasise that the focus of the instructional leader is to control, coordinate, and supervise all teaching and learning activities. Similarly, Leithwood (2016) stresses that effective DH leadership practices entail communicating the department's vision and goals, ensuring professional development, and modelling values and practices. The DH of school A appeared to be very hands-on when it came to monitoring and supervising the curriculum: he checked whether the content being taught was in alignment with the ATP. Also, the period registers that he used ensure that both teachers and learners respected the instructional time.

As observed in school A, Mr Luke monitored teaching and learning by using the CMF to check learners' books, in order to see whether what they were being taught was in line with the annual teaching plan (ATP).

Upon analysing the documents provided, a reporting tool for teachers to account for not submitting marks by deadlines was also found. They had to state the reasons for not submitting these on time, and the way forward in terms of assuring that marks would be submitted timeously in the future. This was done to ensure that teachers understood that there was accountability for the non-submission of marks on due dates.

Teachers' experiences of instructional support

Ms Andy, a Life Sciences teacher from school A, indicated that her DH helped teachers when dealing with troublesome learners, by firstly stepping in by calling in the parents of such learners. Also, the school principal provided every staff member with adequate and relevant resources needed to enhance the teaching and learning processes. The Life Sciences teachers had the advantage that their principal was also teaching the subject; as a result, she (the principal) was always aware of what teachers needed and she tried to provide the necessary resources.

Ms Andy further stated that:

The principal also supported the Life Sciences department by donating materials from her farm that were used for experiments. Moreover, I and the DH are Grade 12 Life Sciences DoE markers, but involved in different papers at the marking centre. During Grade 12 revision, I handle paper 1, while the DH focuses on paper 2. This is part of the support I receive from my DH.

In support, Ms Gail, a Life Sciences teacher at school A, indicated that if there was a problem, the DH would just sit her down and talk about the matter until they collaboratively found techniques to resolve it. If equipment required for experiments was inadequate, he would intervene expeditiously to ensure that they were made available to all. Additionally, the DH assisted with learner support, course design, content design, lesson delivery, networking, assessment, and evaluation. Furthermore, she mentioned that the support that she received from the DH was inspiring because it was in the best interest of learners.

Since a high level of academic achievement in the Life Sciences significantly depends on the direct transfer of information, teachers need to enhance their instructional practices by delivering interesting lessons. However, teachers can only do all of this if they receive the necessary supervision and support. Hallinger et al. (2016) assert that instructional leadership can contribute to learner achievement by enhancing the supervision of instructional programmes and providing appropriate instructional support and coordination for staff development. At school A, the Life Sciences teachers were privileged because the instructional leaders were hands-on in providing support and instructional resources. In addition, the DH assisted in providing support to learners who were underperforming, and ensured that teachers were not only using the textbooks to teach Life Sciences. Du Plessis and Mestry (2019) assert that teachers should not only use textbooks in their science instruction, but indulge students in laboratory sessions to better assist their understanding and interest in science.

Perceived gaps in instructional leadership

Mr Dove, a Life Sciences teacher at school B, mentioned that:

Teaching and learning of Life Sciences is monitored through checking teachers' planning and how they conduct assessments. The DH supervises teachers' work, report on the ATPs every two weeks, and attend cluster meetings regularly for teacher development. The DH conducts formal class visits once in a term as per schedule, where the teacher is made aware to thoroughly prepare for all aspects of the subject. Thereafter, post-classroom observation feedback is provided.

Ms Zoliswa, a Life Sciences teacher at school B, indicated that her DH promotes the teaching and learning of Life Sciences by scrutinising her lesson plans for the week against the annual teaching plan to ensure that she was on track, that learners were tasked with the prescribed number of activities, and that there was evidence of remedial work. She also checked learners' books. In addition, the DH pre-moderated and moderated School Based Assessment (SBA) tasks to ensure quality. The DH also supervised all the subjects in the Science Department. This overload of work made it impossible for frequent supervision or regular class monitoring, but at least it happened only once or twice a year.

As noted by scholars, many school leaders have a limited understanding of science practices (Ralebe et al., 2025a; Lowenhaupt et al., 2022), and this subject presents them with a challenge, as they find it hard to guide and supervise teachers (Sandholtz & Ringstaff, 2014). Thus, when an instructional leader focuses on general pedagogy when monitoring and observing science instruction and materials, it may negatively impact science teaching and learning. Some of these impacts include a limited understanding of the quality of practices and misalignment between the intended goals of the curriculum and instructional practices (Peacock & Melville, 2019; Ralebese et al., 2025b). At school B, the DH only monitored teaching and learning because it was part of her duty as a DH. The teachers indicated that their DH only perused through the documents and checked if the dates corresponded with the ATP; however, she had no idea if the teachers were teaching the correct content for the subject. Moreover, the class visits that were conducted were merely a formality, and they focused more on teaching and classroom management, rather than on the teaching of Life Sciences specifically. As noted by McNeill, Lowenhaupt and Katsh-singer (2018) many instructional leaders lack a background in science and as a result, they may be unsure as to how to provide science-specific support and feedback to teachers. Mrs Steve is one of those instructional leaders; as a result, she tended to focus more on content-neutral approaches to teaching such as classroom management (Lowenhaupt & McNeill, 2019).

During document analyses, the pre- and post-moderation templates that Mrs Steve uses to check the standard of SBA tasks were found.

Comparative teacher perceptions across Schools A and B

Both Mr Dove and Ms Zoliswa mentioned that they did not really receive adequate support from their DH. Because of receiving little support, they had resorted to networking with other teachers. In addition, they received minimal support from the principal as he was swamped with his own paperwork. This had led to Mr Dove somewhat assuming the role of being a subject head by attending to textbook issues, ensuring that teachers are correctly utilising teaching aids, and seeing to it that papers were set on time and that the timetable for school holiday classes was drafted beforehand. However, during subject meetings, their DH did offer feedback wherever she could and provided room for reflection.

Mr Dove further expressed the view that:

> *There is uncertainty about instructional leadership in our department. It is very difficult for us to see evidence of instructional leadership in the Life Sciences department as it is led by someone who is not an expert, [and] who cannot effectively monitor and provide support to both teachers and learners. Moreover, poor communication strategies by instructional leaders impede progress. Sometimes decisions are made without consulting us, teachers.*

Ms Zoliswa lamented that:

> *Teaching Life Sciences is challenging especially in local schools like ours with fewer resources. Our lessons are sometimes boring, and learners become uninterested in the subject. However, as teachers, we improvise to ensure that learners understand concepts.*

According to the literature, when teachers are not being adequately supported to integrate science practice into instruction, this can influence learning outcomes and achievement (McNeill et al., 2018; Osman & Mukuna, 2013; Yow et al., 2021). As a result, poor learner performance in Life Sciences can also be attributed to the inability of instructional leader to adequately support teachers (Dhurumraj & Broadhurst, 2023; Maduna, 2023). It is evident that at school B, the teachers did not receive enough support from their DH since she did not have a Life Sciences background, so she only monitored their work by following general procedures. At the same time, she could not gauge if teachers were behind with content delivery. Furthermore, during departmental meetings, it can be inferred that Mrs Steve was indeed unfamiliar with the subject, but she knew about the duties of a DH. Hence, the senior teacher dominated the meetings by informing teachers about what was expected of them. This confirms the findings of Sandhaltz and Ringstaff (2014) that leaders who are not experts in science find it difficult to supervise and support the instruction of science.

The findings reveal essential instructional leadership practices for Life Sciences, shaped by both role (principal vs DH) and school context. Principals provided broad oversight and structural support, while DHs engaged in closer pedagogical monitoring and mentoring. Teachers perceived DHs as the main instructional leaders, especially when the latter possessed subject expertise. Resource disparities influenced leadership practices, with school A demonstrating structured, science-specific leadership, and school B reflecting generalised, resource-constrained approaches. These findings, which affirm Peacock's (2014) framework, also reveal the need for contextual adaptation in resource-limited schools.

CONCLUSION

This study set out to examine how principals, departmental heads (DHs), and Life Sciences teachers experience and enact instructional leadership across two contrasting high schools in the Gert Sibande District. The findings revealed that while both schools demonstrated efforts to monitor, support, and evaluate Life Sciences instruction, their approaches and outcomes differed significantly according to context and capacity. In the well-resourced school, structured monitoring tools, frequent classroom visits, and subject-specific support fostered a collaborative environment that included professional development and adequate resource provision. This appeared to strengthen teacher motivation, instructional quality, and student engagement. In contrast, the under-resourced school relied more heavily on general pedagogical oversight, occasional class visits, and compliance-driven supervision. The absence of Life Sciences expertise among leaders, coupled with resource constraints such as non-functional laboratories, hindered sustained instructional support and innovation.

Taken together, these findings affirm that effective instructional leadership in Life Sciences is not limited to administrative oversight but requires disciplinary expertise, context-sensitive strategies, and systemic support. Leaders without strong subject knowledge are constrained in their ability to provide meaningful feedback or model effective science pedagogy, often defaulting to generic classroom management practices. Equally critical is the creation of professional learning communities that enable teachers to move beyond compliance towards genuine collaboration, reflection, and shared problem-solving. However, persistent systemic inequities remain a fundamental barrier, with resource disparities continuing to compromise the quality of Life Sciences teaching and learner outcomes. Overall, this study underscores that instructional leadership in Life Sciences is inherently multidimensional, requiring a balance between school-level innovation and broader systemic support. Policy frameworks provide broad expectations, but the enactment of instructional leadership ultimately lies in the everyday practices of principals, DHs, and teachers as they navigate their unique contexts. Strengthening instructional leadership will therefore require approaches that are simultaneously discipline-sensitive and equity-driven, ensuring that every learner, regardless of school context, has access to high-quality science education.

Recommendations

The study points to the need for systemic reforms that strengthen instructional leadership in Life Sciences. For policymakers, this requires moving beyond generic management programmes to leadership development initiatives that integrate subject-specific training, particularly in science. Equitable resource allocation remains vital, with the need to give priority to providing functional laboratories, internet-enabled facilities, and clear monitoring frameworks that emphasise formative, discipline-sensitive feedback. The Department of Basic Education (DBE) must also ensure that DHs with strong subject expertise are appointed and retained, as this knowledge is essential for offering meaningful guidance and instructional support.

At the school level, principals and DHs must work collaboratively to create supportive environments for teachers. Principals should act as advocates for science by embedding it in school development plans, allocating resources strategically, and fostering professional learning communities (PLCs) that move beyond compliance to genuine collaboration. DHs, in turn, should adopt mentoring and coaching approaches that combine supportive monitoring with developmental feedback, while also leading subject-focused workshops and collaborative planning. Teachers, as central agents of curriculum delivery, should actively engage in PLCs, share resources to counter material shortages, and integrate feedback from instructional leaders into their practice. Collectively, these strategies highlight that strengthening Life Sciences education requires alignment across policy, leadership, and classroom practice.

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