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STRATEGIES USED BY GRADE FOUR EDUCATORS TO DECODE SCIENCE TERMINOLOGY: A CASE STUDY

ABSTRACT

In this paper, we discuss the results of a case study about the teaching strategies used by three primary school educators to decode Grade 4 science terminology. In South Africa, the study of science is formally introduced to learners in Grade 4. Additionally, Grade 4 is the year when learners transition from being taught in their native languages in Grades 1 to 3 to being taught in English. This presents the challenge of learning a new subject in an unfamiliar language. Research shows that the majority of South African primary school learners find science terminology difficult to comprehend due to linguistic challenges, which could account for their poor performance in science assessments. The way educators decode science terminology during science lessons could affect learners' comprehension of science vocabulary and consequently their performance in science. Semi-structured interviews were used to collect data in a qualitative case study in order to determine the strategies used by three science educators to teach and decode science terminology in Grade 4. The study findings suggest that the participating educators use ad hoc, teacher-centered teaching strategies to decode science concepts. These findings have implications for the preparation of primary school science educators in teacher training institutions.

Keywords: *Terminology, teaching strategies, decode, educators, scientific literacy.*

1. INTRODUCTION

The scientific literacy of most South African learners has been of concern to many scholars and policy makers (Lelliott, 2014; Pouris, 1991). According to Dragos and Mih (2015: 168), scientific literacy is "the ability of an individual to understand scientific laws, theories, phenomena and things". For learners to be successful in science, they need to develop the capacity to read and understand scientific texts; construct texts appropriate to the learning area; think about, discuss, and interact with texts and use these texts in subject-specific contexts (Gay, 2010). Beyond the comprehension of the overall meanings of science as a subject, learners are also expected to actively engage in observations and interactions with learning materials,

educators and their peers, as they explore new science terminology and expand their understanding of science (DBE, 2011). These activities require learners to be proficient in the language of science and the language of instruction which, in the South African context, is English.

According to Pretorius (2014), learners in Grade 4 across South African schools struggle with learning science, as it their first time studying the subject and it is taught in an unfamiliar language. In South Africa, learners are formally introduced to the study of science in Grade 4, where they learn the language of science, its principles and rules in English. At this time, primary school learners transition from being taught in their native languages in Grades 1 to 3, to being taught in English in Grade 4 (Pretorius, 2014; DBE, 2011). Therefore, they get to Grade 4 with limited proficiency in English. At the same time, learners need to develop more book-oriented academic literacy skills to cope with the increasing literacy challenges of the intermediate phase (Pretorius, 2014). Grade 4 learners are therefore faced with multiple learning challenges that could affect their comprehension of science concepts. This is particularly true for most South African learners who use English as second or even third language (Snow, 2010).

Learners need to be able to read the academic language, which guides the activities, communication and inquiry that constitute science, in order to engage with the subject (Yore, Bisanz & Hand, 2003). It therefore becomes critical for educators to be able to decode scientific statements and terminology for learners' comprehension of science. Decoding science terminology refers to the understanding and interpretation of terminology found in the field of science (Snow, 2010). Gay (2010) asserted that teaching and learning are culturally determined and are not the same for all. This is especially applicable to most South African schools, where there is diversity of cultures, social backgrounds and linguistic backgrounds. In this regard, Cochran-Smith (2001) argued that educators, within the South African education system, should use varied teaching strategies to help learners understand subjects better. Primary school science educators are therefore called upon to teach science in ways that make it accessible and engaging for all learners (National Research Council, 2012).

Literature suggests that the use of learner-centred and community-centred teaching strategies, such as inquiry-based learning (Padilla, 2010) and cooperative learning (Alexander & Van Wyk, 2014), in science classrooms could enhance learner performance in science, by allowing them to own their learning (Maluleke, 2015). Furthermore, inquiry-based teaching strategies could be beneficial to learners in the following ways: a) learners learn science vocabulary as they participate in inquiry activities, b) learners work collaboratively and interact with others about science content, using scientific language, and c) hands-on activities offer learners written, oral, graphic, and kinaesthetic forms of expression (Lee, Buxton, Lewis & LeRoy, 2006). Despite the availability of engaging instructional strategies, such as learner-centred instruction and community-centred instruction, Carrier (2013) observed that most science educators teach science terms using traditional teaching methods.

Traditional teaching methods often begin with educators presenting learners with science vocabulary and asking them to carry out activities such as writing down the words; finding the definitions from a dictionary or the glossary of the textbook; matching words to definitions; or using the terms in a sentence. The reasons for the adherence to traditional teaching methods vary from one educator to the other. The most frequently cited reason for not using engaging teaching methods, in the South African context, is time constraint, because the time allocated

for science lessons in primary schools is limited (DBE, 2011). Consequently, most educators do not have sufficient time to emphasise science vocabulary construction, in order to help learners to make sense of science related texts.

In South Africa, the learning of natural science and technology in Grade 4 is allocated three and half hours per week (DBE, 2011). This duration is barely enough to cover the science content prescribed in the national Curriculum and Assessment Policy Statement (CAPS) document. In their quest to complete the syllabus on time, educators often provide very brief introduction of science terms, when teaching science content. The need to complete the syllabus on time therefore plays a major role in educators' preference of traditional teaching approaches over engaging instructional strategies. Despite this general perception of educators' instructional practice in science classrooms, the teaching strategies used by South African Grade 4 educators to decode scientific concepts, in order to help learners to make sense of science texts are not well documented. The study reported in this paper explored the teaching strategies used by three South African primary school educators to teach science. and specifically to decode science terminology in Grade 4 classrooms. The following research questions were investigated:

1. Which science terms are perceived to be difficult for South African Grade 4 learners to understand?
2. Which teaching strategies do the educators in the study sample use in Grade 4 science classrooms?
3. How do the educators in the study sample decode science terminology in Grade 4?

2. CONCEPTUAL FRAMEWORK

Teaching is likely to be more effective if it considers learners' natural ways of learning. However, no single teaching strategy can cater for the different ways of learning, to produce desired learning outcomes. For instance, reading books may be a very efficient way of obtaining new information, while understanding the information would require other methods of learning. It is difficult for an educator to employ all instructional approaches required to produce the expected learning outcomes. Therefore, educators need to create learning environments with learning principles that could provide opportunities for learners to exercise different ways of learning. According to cognitive research dealing with how people learn, environments that best promote learning have four interdependent aspects; they are focused on learners, they have well-organised knowledge, they use ongoing assessment for understanding, and they include community support (Bascandziev, Tardiff, Zaitchik & Carey, 2018; Carey, 1986). These aspects are modelled in the "How People Learn – HPL framework" proposed by Bransford, Brown and Cocking (1999), which guided the evaluation of the teaching strategies used by the educators who participated in this study.

In line with the aspects recommended by cognitive researchers, for creating effective learning environments, the HPL framework consists of a combination of four instructional designs, namely: learner-centred; knowledge-centred; assessment-centred and community-centred instructions, as shown in Figure 1, and elucidated in subsequent texts (Brown, Brown & Cocking, 1999).

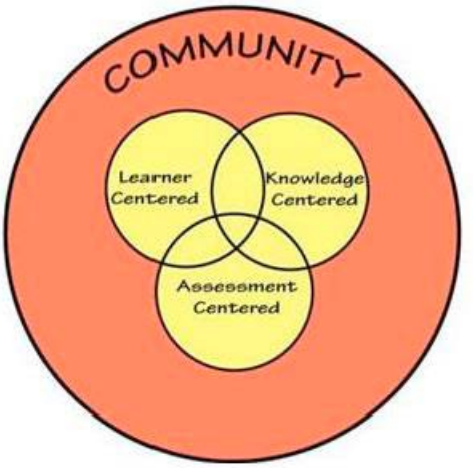


Figure1. How People learn - HPL Model
(Adopted from Bransford, Brown & Cocking, 1999)

Learner-centred instruction

According to the HPL framework, learner-centred instruction involves the acknowledgement and development of knowledge, skills, attitudes, beliefs and needs of learners, by actively engaging them in lessons. Educators need to unearth the attributes that learners bring to learning settings, so that they can either augment them or correct them. If educators ignore these attributes, learners may develop understandings that are contrary to the intended learning outcomes. In evaluating the strategies used by the study participants to decode science terms, attention was paid to evidence of determination of learners' prior knowledge and subsequent interventions, as well as the extent to which learning activities engaged learners.

Knowledge-centred instruction

This aspect of the HPL framework focuses on helping learners to develop a deep understanding of the content and processes of a discipline. This requires an educator to inform learners about the knowledge they are expected to gain, how the knowledge could be used and provision of the relevant concepts. This knowledge forms the foundation on which to build further knowledge. Helping learners to understand science terms and concepts was the main goal for evaluating participants' teaching strategies, in the study reported in this paper.

Assessment-centred instruction

For this aspect of the HPL framework, the emphasis is on formative evaluation of learners and the provision of frequent feedback, followed by revision in order to assess, reward and correct learners. Formative assessments provide learners with the opportunity to evaluate, revise and improve the quality of their learning for improved meta-cognitive ability. In the study reported in this paper, the frequency and quality of formative assessments reported by the participating educators were considered when evaluating the teaching strategies used by participating educators.

Community-centred instruction

This refers to environments that are based on a community of learners within a learning situation, who actively and constructively participate in learning activities. As the learners interact with one another, they constantly learn from each other's mistakes and achievements. Evidence for creation of community-based learning environments was also used to evaluate the teaching strategies used by the educators who participated in this study.

Brown, Brown and Cocking (1999) posited that a combination of the four instructional environments described above maximises learning. Other researchers have suggested similar instructional approaches for effective science learning (Alexander & Van Wyk, 2014; Fitzgerald & Smith, 2016; Padilla, 2010).

3. METHODOLOGY

A qualitative case study research design was used to collect data from three purposively selected Grade 4 educators. In sampling the participants, the researchers selected educators who have experience in teaching Grade 4 natural science in South Africa. Specifically, the following criteria were used to select the study participants. They had to:

- teach in a local primary school;
- teach Grade 4 natural science;
- be able to communicate in English; and
- have at least four years' experience in teaching science at primary school level.

The researchers visited principals from 20 primary schools in the Gauteng area. During these visits, the researchers explained the nature of the study to the principals and requested a list of educators who met the sampling criteria. The researchers then contacted these educators individually. Initially, nine primary school educators who met the stated criteria were invited to participate in the study. Ultimately, only three educators agreed to take part in the study. These educators came from three different schools in the Gauteng province of South Africa. Table 1 shows the profiles of the educators who participated in the study.

Table 1. Profile of study participants

Participant	Gender	School code	Qualification	Teaching experience (years)	Area of specialisation
Educator 1	Male	X	Higher diploma in primary school education; diploma in education management; and HR certificate	19	Science
Educator 2	Female	Y	BEd and BEd Honours in mathematics and science	25	Science and mathematics
Educator 3	Female	Z	BEd in science education	4	Science

4. DATA COLLECTION AND ANALYSIS

After obtaining ethical clearance and approval from all stakeholders, and explaining the ethical rights to the participants, semi-structured interviews were used to collect qualitative

data from individual participants. An interview schedule was used to guide the progression of the interviews. Interview items focused on three themes, namely:

- Theme A – Difficult science terminology taught in Grade 4 classrooms. Under this theme, participants were asked to list the science terms that they thought Grade 4 learners found difficult to understand.
- Theme B – Teaching strategies commonly used by the participants to teach science in Grade 4. Under this theme, the educators were required to name and describe the teaching methods that they frequently use in their science classrooms and to explain why they use them.
- Theme C – Strategies used to decode science terminology in Grade 4. In this theme, participants were requested to explicitly describe how they explain the difficult science terms that they identified in theme A. For example, educators were required to explain what they do to make sure that learners understand a particularly difficult science term.

The interview schedule was piloted using intermediate phase student educators at a certain university in Gauteng. During the pilot study, questions that were not clear or that confused the pilot study participants were either modified or discarded and replaced with clearer questions.

At the commencement of each interview, the researchers read out the interview questions to the interviewee. When the interviewee acknowledged that s/he understood the interview questions and was willing to participate in the interview, the researchers requested consent to record the interviews. The interview and the recording only commenced after the interviewee granted the researchers permission to proceed. In cases where the answers provided by the interviewees were either unclear or they did not respond directly to the question, probes and prompts were used to obtain more information from them. At the end of each interview, the researchers played the audio recording back to the interviewee to make sure that they were comfortable with their responses.

After the interviews, the researchers listened to the audio records and transcribed the information. Thereafter, content data analysis was used to analyse the data, by subjectively interpreting the data through a systematic classification process of coding and categorising statements into predetermined themes. In this respect, the researchers examined the transcribed statements and allocated them to the themes of difficult science terminology taught in Grade 4 classrooms, teaching strategies commonly used by the participants to teach science in Grade 4, and strategies used to decode science terminology in Grade 4. Subsequently, the statements were coded using the notations shown in Table 2.

Table 2. Notations used to transcribe interview responses

Themes	**Participants**
A – Represents the theme: Difficult Grade 4 science terminology	1 – Represents the first educator
B – Represents the theme: Instructional strategies used to teach science	2 – Represents the second educator
C – Represents the theme: Decoding of science terminology	3 – Represents the third educator
Roman numerals represent the number of the statement provided by a particular participant, in each theme.	

According to the notation in Table 2, the code 'A1iv' for instance, would represent a statement related to theme A, given by educator 1, as response statement number 'iv'. The coded data were categorised according to the stated themes (A to C).

The researchers reflected on the categorised information to identify possible gaps in the data. In order to ensure the accuracy and transparency of the data, and to solicit missing information from the participants, the researchers organised data sharing sessions with the participants where necessary. After adding the missing data, the researchers analysed the data further, and identified more data gaps. This was followed by additional data sharing sessions, until the researchers could not identify more data gaps. Data were therefore collected and analysed in an iterative and progressive manner until the required information was obtained.

5. FINDINGS

The participating educators were asked to identify science terminology from the Grade 4 CAPS document that they perceived to be difficult for learners to understand. Table 3 shows the terms frequently identified by the three educators as difficult for Grade 4 learners. The researchers corroborated these terms from the CAPS Grade 4 science content (DBE, 2011).

Table 3. Difficult science terminology in Grade 4

Science strand	Difficult science terminology
Life and living	Living, non-living, structure, plants, habitats, skeleton, yeast, reproduction, fertilised, sensing, breathing and excreting.
Matter and materials	Materials, ceramic, solids, cycle, vapour, condensing and solidifying.
Energy and change	Photosynthesis, process, wavelength, energy, transfer, sound, impaired, vibration and plucking.
Planet earth and beyond	Planet, rocket, solar, system, sediment, rock, galaxy, constellation and comet.

Participating educators were also required to explain the teaching strategies that they use during Grade 4 science lessons. The first and third participants indicated that they initially use question and answer to determine learners' prior knowledge and then build around that information, using other strategies such as discussions or demonstrations, as indicated in the following quotations.

> *B1i* *Mmmh, question and answer, I use the the…mostly question and answer, then sometimes I link with previews [previous] question, like for instance, when I start the lesson, I would ask a questions, then link it to another question later in the lesson.*

> *B3ii* *Mainly question and answer, then discussion and demonstration are involved to make sure that learners understand certain things.*

The second participant said that she explains the concepts first and then uses different teaching strategies to develop the lesson. She, however, did not specify the teaching strategies used, apart from stating that she gives classwork at the end of a lesson.

> *B2i* *The teaching strategies uuumh, I teach them, yah! I teach them by explaining first, about the concept, what does it mean, then I go about the concept and clearly explain to the learners, and then the [they] get the gist of it, so that they can understand it. Towards the end I give them classwork so that I can see what they understand.*

Finally, the educators were asked to explain how they decode difficult science terms to make sure that learners understand them. Educator 1 did not seem to understand the term "decode". However, after explaining the term, he explained that he uses the recommended textbooks (which he did not name) to provide definitions of terms, as stated below.

> *C1ii* *The big words, okay, okay! yah! The textbooks have key words on the side, so it is easy for them to understand because it is like a dictionary, it provides a word and then it explains it.*

In response to the same question, educator 2 laughed and paused for a long time, and later responded that she brings objects to class and uses pictures to explain science terminology. Her response is stated below.

> *C2i* *Ummh…sometimes I use, let me say coming to uhm (laughs), just wait a little bit, let me say you bring objects in the class…yes! I bring objects in the classroom. Sometimes I comprise [improvise] because our schools do not have the instruments. Sometimes I just bring a picture so that they can see the kind of thing I am talking about or even in the book, you will find that the drawings are there but you do not have the real objects to show them [learners].*

Educator 3 said she uses practical examples or whole class reading and a dictionary. She emphasised that it is important for learners to read, as quoted below.

> *C3ii* *To decode uuumh! Science terminologies? As I said, apart from doing practical examples, like reading, yes! Whole class reading is important because some of the learners in Grade 4 struggle with reading, the syllables of the word and all those things are difficult, so it is important for them to read, mainly whole class reading. And they have concepts dictionary, which they use as a form of classroom activity.*

When prompted to provide details of how they use the cited teaching strategies, the educators could not elucidate further, they instead reiterated the use of verbal explanations, individual and class reading, writing words on the board, demonstrations, use of practical examples and the use of pictures and dictionaries or textbooks. The educators failed to provide credible answers when asked to describe the type of dictionaries used and to explain why they use dictionaries to decode science terminology.

The CAPS (DBE, 2011) proposes some teaching resources and a variety of instructional methods, such as inquiry and cooperative learning, for teaching new information. When asked about the usefulness of these teaching strategies in decoding science terms, the three educators were evasive. Educator 1 did not respond to the question, and the other educators simply mentioned that the CAPS document is very helpful to educators, without providing detail, as indicated in the extracts below.

> *C1v* *Ijoooh! That is…I do not know (laughs). Ai no!*

> *C2iii* *Eeeh! (thinking) it [CAPS document] makes it easier for educators to teach science, especially in the primary level, it is especially useful for new educators.*

> *C3V* *They [CAPS documents] are helpful in a way, especially when you look at the skill in natural science…so it is very much helpful depending on the concepts you are dealing with.*

Two of the participants complained about the lack of teaching aids in township public schools, as illustrated by the quotation below.

C2iv *I wish we could have so many, eeeeh, learning aids, and uuhhhm, the modern things, I think it will be better for educators like myself because I cannot draw, I can draw but the picture I'm drawing is not good enough for them to capture it very clearly. If the school can buy the material or learning aids, it will make the work easier.*

When the two educators were pressed to explain how they ensure that learners understand science terms during science lessons, in the absence of teaching aids, they explained that they help learners in every way possible, including explaining science terms in vernacular. The third educator was quick to mention that code switching to vernacular could help learners in the short term, but learners are likely to fail science examinations, which are written in English, because learners struggle to express themselves in English during oral or written assessments.

6. DISCUSSION

In the study reported in this paper, we explored Grade 4 science terms that educators consider difficult for learners to comprehend, and the strategies used by educators to teach science and decode difficult science terms. The three sampled educators identified numerous difficult terms, including; photosynthesis, process, wavelength, system, sediment and galaxy. Several researchers have also acknowledged some of the terms identified by the participants in this study, as difficult for Grade 4 learners (Cervetti, Hiebert, Pearson & McClung, 2015). Even though different educators are likely to perceive the difficulty of science terms differently – depending on various factors such as duration of exposure to the terms; availability of appropriate resources; and educators' comprehension of the terms – there seems to be some consensus among science educators and researchers that Grade 4 learners could be facing difficulty in understanding some science terms. Various factors could account for this difficulty, including limited English language proficiency.

Although some researchers (Pretorius, 2014; Snow, 2010) have indicated that most Grade 4 learners in South African schools have limited English language proficiency and science experience, little research has been conducted to determine the language and science learning needs of Grade 4 learners. Such research would guide classroom practice regarding the teaching of science. For instance, it is necessary to investigate the effect of introducing English, the language of instruction, and the language of science simultaneously, on Grade 4 learners' comprehension of science terms. Introducing English in earlier grades could alleviate learners' challenge of trying to learn the language of instruction and the language of science at the same time.

Furthermore, in the South African context, the problem of limited language proficiency and science experience could be compounded by the fact that some educators are unfamiliar with some of the science terms taught in Grade 4, as acknowledged and demonstrated by the participants in this study. In such instances, it is possible for certain science terms to be ignored by educators during science lessons, depriving learners of the opportunity to comprehend the terms. Continuous professional development of primary school educators in elementary science could address the problem of limited science knowledge.

Current understanding of language in the service of science education is mostly informed by the practice of effective educators of science, the craft of science, and by the research of applied cognitive scientists (Yore, Bisanz & Hand, 2003). These stakeholders in science education seem to agree that learning to reason, which is one of the aims of science education, requires the ability to use the ideas and the language of science to learn how to formulate

statements and arguments, and to use familiar terms with their accepted scientific meaning, in scientific discourses. All these activities require proficiency in the language of instruction. Limited proficiency in the language of science and indeed the language of instruction, which are characteristic of most South African learners, can therefore impede the learning process considerably.

Despite the critical role played by the language of science in science learning, the power of this relationship is seldom emphasised during science instruction (Fradd, Lee, Sutman & Saxton, 2001). To substantiate this assertion, the findings from the study reported in this paper revealed that participating educators mostly used teacher-centred teaching approaches, such as explanations, question and answer, writing terms on the board, dictionaries, demonstrations and practical examples, to teach science. These teaching strategies do not explicitly focus on the development of the language of science in science learning. This finding is not unique to the educators who participated in this study, as various researchers have found similar results (Carrier, 2013; Hobden, 2005).

Interview responses from the reported study showed that educators did not have well-planned, systematic ways of decoding science terms. They rather used the instructional approaches stated in the previous passage, in an ad hoc manner. This is disheartening given the importance of the language of science in science learning, and the enormous challenge of learning science in an unfamiliar language faced by most South African Grade 4 learners (Snow, 2010). Failure to prioritise and clearly decode science terminology could limit learners' scientific vocabulary, which could in turn impact on their performance in science. It is possible that limited scientific vocabulary could partly account for the poor performance of most South African primary school learners in national and international science assessments (Pretorius, 2014; Reddy, 2006). Unless science instruction includes an explicit focus on scientific literacy development, second or third language English speakers are likely to be perpetually excluded from science learning (Westby, Dezale, Fradd & Lee, 1999).

Literature proposes explicit introduction of learners to new science terms and that the introduction should be bound to hands-on scientific investigations (Cervetti *et al.,* 2015). This suggestion aligns well with the learner-centred component of the HPL framework of instruction (Bransford, Brown & Cocking, 1999). Several instructional practices for promoting scientific literacy in learners have been suggested in literature (Fradd *et al.,* 2001). Some of these practices are discussed in the following texts.

The first instructional practice pertains to the development of learners' science vocabulary, which requires educators to be able to identify the terms to be used in a lesson and to use explicit instructions to integrate new terminology into learners' communication. In a study conducted by Fradd *et al.,* (2001), educators indicated that learners required clear instruction in combination with contextualised vocabulary use to integrate new terminology into their communication. This is particularly true for learners who learn new science terms using a language that is unfamiliar to them. In order for learners to be able to integrate new science terms into their communication, they need to participate actively in lessons, which could be achieved through learner-centred and community-centred instruction.

The teaching approaches used by educators who participated in this study largely fall short of learner-centred and community-centred pedagogy, suggested in the HPL instructional framework. These components of the HPL instructional framework are associated with science teaching approaches such as inquiry-based and cooperative learning, which have

recently re-emerged as crucial science instructional strategies, not only for effective science learning (Alexander & Van Wyk, 2014; Fitzgerald & Smith, 2016; Padilla, 2010), but also for the development of the higher-order thinking skills required for effective citizenry in the 21st Century (Trilling & Fadel, 2009). Educators' ability to promote inquiry and cooperative learning requires competences such as; knowledge of science, an understanding of the inquiry process, and the ability to determine learners' strengths and learning needs (Fradd *et al.,* 2001). The absence of these instructional approaches in South African science classrooms, especially at early primary school, could be the root cause of the high incidence of memorisation of science content without understanding, at different educational levels.

The second instructional practice for enhancing scientific literacy is the use of multiple representations. The focus in this instructional practice is the use of several representational formats such as drawings, charts, tables, graphs and computer-developed simulations to develop learners' content knowledge, which includes the knowledge of science terminology. Such representations reduce the language load required to participate and to comprehend scientific vocabulary. Multiple representations of science terminology provide learners with opportunities for concrete understanding of the terms so that they can focus on communication for understanding, rather than memorising science terms in order to reproduce them in assessments. Representations are premised on knowledge-centred instruction, as described in the HPL model. The knowledge acquired through representations forms the foundation upon which to build further knowledge.

While the educators revealed some evidence of knowledge-centred and assessment-centred teaching, some of them admitted that they do not understand some of the science terms taught in Grade 4. This could signal a deficiency in the preparation of primary school science educators. Primary school teacher trainers might have to revisit their programmes to ensure that their graduates have sufficient content knowledge to teach primary school science effectively. Educators' failure to understand science content could partly account for the abysmal performance of most South African learners in national and international science assessments (Lelliott, 2014; Pretorius, 2014). Assertions made by the participating educators about the lack of teaching aids are genuine and can be a significant impediment to effective science teaching, as pointed out by some of the participants. However, most primary school science activities do not require complex and expensive teaching materials. Educators could easily improvise by using cheap, day-to-day household products.

The third instructional practice for promoting scientific literacy in learners is the use of expository and narrative texts (Fradd *et al.,* 2001). The use of narratives has been an effective form of instruction from time immemorial. Our great grandparents used this form of instruction to pass information and knowledge from one generation to the next. Young learners are particularly intrigued by stories. Narratives about learners' science activities at home and their shared experiences at school could provide insights for linking science with real-world events, because stories make science more meaningful and relevant. The inclusion of science terms in narratives does not only help learners to remember the terms, but also enhances their understanding of the terms and the contexts in which they are used.

Furthermore, science-related stories based on home and school experiences, could foster community-centred learning, which enables learners to benefit from the experiences of others. Expository texts, which use clear, focused language that moves from general to specific facts and from abstract to concrete information, could be used for summarising, reviewing, reflecting

and expanding science content for better understanding of science texts (Cervetti *et al.,* 2015). None of the educators who participated in the reported study alluded to the use of story-telling or expository texts as strategies for teaching science or decoding science terminology. It appears that the participating educators were either ignorant of these instructional strategies or they did not consider them to be effective for decoding science terminology.

7. CONCLUSION

The findings of the reported study established that there are several science terms that educators consider difficult for learners to comprehend. Evidence from literature (Cervetti, Hiebert, Pearson & McClung, 2015) seems to suggest a consensus among scholars that similar science terms are difficult for Grade 4 learners to grasp. These terms need to be explicitly explained to learners using different teaching strategies, to enhance their understanding of science. The results also suggest that the participating educators did not have well-planned strategies for teaching science and decoding science terminology. They commonly use teacher-centred teaching methods are less effective in developing learners' understanding of new science terms.

Building on insights from interviews with participating educators, it was established that there is need for professional development of Grade 4 educators, in effective strategies for decoding science terminology. Educators' complaints about lack of teaching aids, although genuine, could be an indication of incompetence in improvisation and in learner-centred teaching strategies, which need to be addressed through professional development programmes.

The need for professional development is not unique to South African educators. Literature on science teaching indicates that many educators require extended assistance with science literacy and content area instruction in order to meet the learning needs of second language English speakers (McFarland, Hussar, Wang, Zhang, Wang, Rathbun, Barmer, Cataldi & Mann, 2018). In this respect, it becomes crucial to incorporate effective instructional strategies for decoding science terminology in intermediate phase teacher preparation programmes, in order to enable educators to deal with the challenges faced by second language English speakers in science classrooms. We therefore recommend the accentuation of learner-centred and community-centred instructional strategies, such as inquiry-based and cooperative learning in teacher education programmes. Of equal importance is the establishment of collaborative research projects among educators, researchers and science education scholars, to develop and test effective instructional strategies for decoding science terminology, to enhance second or third language English speakers' comprehension of science concepts. Such strategies would enable science educators to meet the educational needs of learners who struggle with challenges of learning new science terminology in an unfamiliar language.

The findings of this study should be viewed in the context of a limited sample of educators. A study with more participants is recommended to shed more light on these findings.

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