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Language of Instruction as a Limiting Factor in Learner Participation in the Classroom

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ABSTRACT

This study explored the role of the language of teaching and learning as a limiting factor in learner participation at selected schools in the Vhembe district. This research utilized an interpretative qualitative approach; the research involved physical science teachers and learners from three schools. Data were collected through classroom observations. The findings revealed that the use of English as the medium of instruction in physical science hindered both classroom interaction and discourse. Limited interaction was observed between teachers and learners, as well as among learners themselves, due to the use of a language that was neither the teachers' nor the learners' first language. As a result, learners struggled to engage fully in class activities because they did not completely understand the language of instruction. Additionally, the language barrier hindered their ability to grasp scientific concepts, ask questions, and participate in discussions. Based on these findings, the study recommends the development of teaching and learning materials in African indigenous languages to improve learner participation and performance. Furthermore, it advocates for the use of a language that both teachers and learners are comfortable with to enhance teaching and learning outcomes. The study highlighted how the language of instruction impacts learners' learning, while also suggesting ways to advocate for change.

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INTRODUCTION

Teachers play a vital role in the teaching and learning process at schools, acting as leaders, mediators of learning, administrators, managers, interpreters, designers of educational programs and resources, researchers, scholars, and lifelong learners. According to Netshivhumbe and Mudau (2021), science teachers are crucial to the advancement of science education, as it cannot progress without their involvement. For teaching and learning to be effective, teachers need support from departmental officials, parents, learners, and the community.

Without adequate support, teachers may struggle to fulfil their responsibilities, such as lesson planning, selecting appropriate teaching materials, designing learning activities, and addressing learners' questions. Therefore, schools must provide sufficient infrastructure and ensure that each subject is taught by qualified teachers. Netshivhumbe and Mudau (2021) emphasize the importance of having qualified teachers in schools to facilitate learning and address misconceptions effectively.

In the context of teaching and learning, interaction and discourse are essential. Consequently, interaction and discourse are important elements that greatly influence how science is taught and learned. According to Mudau and Netshivhumbe (2022), interactions and conversations between teachers and learners in the science classroom led to the development of knowledge and thematic

content of science education. Classroom discourse is generally connected with the way in which the teacher speaks with the learners and causes teacher-learner interaction to happen in the classroom (Mudau & Netshivhumbe, 2022). As a result, through classroom discussions, a teacher can guide learners into scientific discourse in which they can apply their thinking skills to communicate and write in the needed scientific language.

The types and patterns of discourse, the communicative approach, and the teacher's questioning are all highlighted in the classroom interaction and discourse. Science classroom discourse can be divided into three categories: authoritative, dialogic, and reflective. Alkhouri (2021) and Saglam (2022) defined dialogic discourse as one that fosters discussions and challenges, whereas authoritative discourse is one in which a teacher imparts knowledge, and the utterances are frequently composed of factual statements and instructional questions. According to Alkhouri (2021), reflective discourse is a situation in which teachers help learners grasp concepts by negotiating alternative ideas rather than by transmitting or confronting them.

Netshivhumbe (2023) and Tang (2020) indicated that initiation, response, and evaluation (IRE) pattern of discourse is a three-fold figure in which the teacher initiates communication by asking students a question, the learner will next respond to the question, followed by the teacher, who will evaluate the learner throughout the process. Communication is an important aspect of science classroom engagement and discourse because it helps learners form relationships with one another, with their teachers, and with their surroundings. According to Ntuli and Mudau (2024), classroom interaction entails teachers and learners collaborating closely to investigate and resolve specific scientific ideas and concepts.

The physical sciences curriculum consists of six knowledge areas (materials, chemical systems, chemical change, mechanics, waves, sound and light, and electricity and magnetism). studying physical sciences allows both teachers and learners to understand the physical world, using scientific inquiry, models, theories, and laws to explain and predict environmental phenomena. Teaching and learning in this field require both theoretical knowledge and practical application. According to Mudau and Netshivhumbe (2022), science classroom activities assist learners to gain knowledge and understanding of scientific concepts. Sciences prepares learners for specialized education, the workforce, active citizenship, holistic development, socioeconomic progress, and environmental management, fostering active learning beyond the classroom (Baloyi et al., 2023).

Learners should acquire essential skills in physical sciences, such as classifying, communicating, measuring, designing investigations, drawing and evaluating conclusions, formulating models, hypothesizing, identifying and controlling variables, inferring, observing, comparing, interpreting, predicting, problem-solving, and reflecting. Physical science education should be learner-centred, with teachers facilitating the development of these skills during instruction (Netshivhumbe & Mudau, 2021). Thus, the selection of teaching methods and materials must align with the content being taught to ensure learners acquire the necessary knowledge and skills in scientific inquiry and problem-solving.

According to Netshivhumbe (2023), language has a big impact on the education system because both teachers and students use language as a communication tool throughout teachers' classroom practices. The type of language utilized influences the amount of classroom engagement practices; the more learners use their native languages, the more actively they participate in science lessons (Motloung et al., 2021). The language of instruction significantly influences the teaching and learning of subjects like physical sciences. Hence, developing inclusive and productive learning environments where all learners can succeed requires teachers to be aware of how the language of instruction limits learners' participation. Beginning in grade 4, learners in South Africa are typically expected to switch to learning largely in English. This indicates that from that time on, learners would be taught in English in areas like science, math, and life orientation.

The study conducted by David and Nsengimana (2022) found that the use of English as a medium of instruction in teaching life sciences inhibited learners from adequately grasping the subject, and learners also struggled with new terminology introduced by policy changes. It is a reality that learners face significant challenges when taught in a language other than their mother tongue, such as struggling to actively participate in class discussions or activities, which can lead to frustration and negative attitudes toward both the language and the learning process. As a result, there is a gap in the use of African indigenous languages as a medium of instruction beginning with grade 4. According to Netshivhumbe and Mudau (2021), some learners in rural schools are not proficient in English and find it difficult to grasp the concepts, which causes the teacher to teach at a slower pace in order to accommodate all learners.

In rural areas of the Vhembe district, Tshivenda and Tsonga are the most spoken indigenous languages. However, English is the medium of instruction in many schools, creating challenges for both teachers and learners, as it is not their home language. While Tshivenda and Tsonga are used as the medium of instruction in the foundation phase, from Grade 4 onwards, they are taught only as home language subjects, and English becomes the primary language of instruction. Some learners only encounter English at school and struggle to develop the ability required in the language of instruction and learning (Madima & Makananise, 2020). Several studies (Buenaflor et al., 2023; Fesi & Mncube, 2021; Kisumbe & Mashala, 2020; Madima & Makananise, 2020; Nazir & Özçiçek, 2022) revealed that the use of English as the language of instruction poses a major barrier to science learning for many South African learners. Motloung et al. (2021) argue that this issue is exacerbated when science teachers themselves lack proficiency in English.

According to Shubani and Mavuru (2022), learners perform poorly in physical sciences exams because they are unable to engage in meaningful classroom discussions due to their limited fluency in English, the medium of instruction. Kamati and Mavuru (2020) found that learners struggle to comprehend and conceptualize scientific content when they face difficulties with the language of instruction. Since English is not their first language, many learners find it difficult to participate actively in lessons, leading to minimal or no classroom interaction (Leonet et al., 2019; Kretzer & Kaschula, 2019; Smith-Walter et al., 2016). Maimona and Mokgadi (2021) assert that non-native English speakers face multiple learning barriers, including cultural diversity, psychological and social challenges, and teachers' limited proficiency in their learners' home languages. As a result, many English second-language learners lack self-confidence and struggle to express themselves effectively.

When English is the primary language of instruction, there is sometimes little to no interaction in the classroom since learners find it difficult to participate in the lesson and advance if they do not comprehend the language (Leonet et al., 2019; Motloung et al., 2021). Leonet (2019) indicated that English is the most widely used language in South African schools and that African learners are compelled to use it, which limits their freedom of language choice and the diversity of this country.

Research by Netshivhumbe and Mudau (2023) indicates that many teachers in the Vhembe district use their native language, Tshivenda, instead of English to help learners grasp scientific concepts. Similarly, Shunani and Mavuru (2022) found that some teachers use learners' home languages in physical science lessons to facilitate understanding. Incorporating indigenous languages into teaching and learning helps teachers overcome the obstacles posed by the medium of instruction (Mavuru & Ramnarain, 2020; Mawela & Mahlambi, 2021; Ticheloven et al., 2021). Furthermore, improvements in learner interactions and discourses demonstrate the advantages of using indigenous languages, which result in more meaningful learning and improved performance (Mavuru & Ramnarain, 2020; Mawela & Mahlambi, 2021; Ticheloven et al., 2021).

Studies by Motloung (2021) and Netshivhumbe and Mudau (2023) reported that learners studying in their mother tongue process information more naturally and can better relate new curricular content to prior knowledge. Understanding the language of instruction helps learners better understand concepts, pick up new terminology, and improve their academic performance in general. Additionally, learners are more likely to ask questions, participate in class discussions,

and work together on learning tasks when they feel at ease and secure with the language of instruction (Netshivhumbe, 2023).

Ntuli and Mudau (2024) argue that, to enable all learners to study science in their home language, scientific language registers must be developed for physical sciences in indigenous languages. Studies conducted by scholars (Madavha, 2024; Madavha et al., 2025; Ntuli, 2024; Ntuli, 2022; Ntuli et al., 2024; Netshivhumbe, 2023; Netshivhumbe & Mudau, 2023; Phalandwa, 2024) indicated that teachers, learners, and parents believe studying science in indigenous African languages enhances academic performance. Botha (2022) asserts that learners must be educated in a language they understand to reach their full potential, as this enables them to express themselves effectively and engage in meaningful learning.

South Africa has 12 official languages: English, Afrikaans, Tshivenda, Sesotho, isiXhosa, isiZulu, siSwati, Setswana, Sepedi, Sign Language, isiNdebele, and Xitsonga. However, in schools and higher education institutions, Afrikaans and English remain the primary languages of instruction. Despite the fact that South Africans speak a number of African indigenous languages by nature, Choi (2021) noted that English's global supremacy has permeated the nation's early education system. Netshivhumbe and Mudau (2023) highlight that most South African learners complete their primary, secondary, and tertiary education in a language other than their mother tongue.

Several studies have focused on developing and implementing scientific registers in indigenous African languages. Findings from research (Madavha, 2024; Madavha et al., 2025; Ntuli, 2024; Ntuli, 2022; Ntuli et al., 2024; Netshivhumbe, 2023; Netshivhumbe & Mudau, 2023; Phalandwa, 2024) indicated a consensus that using scientific language registers in indigenous languages enhances classroom engagement and improves learning outcomes. Madavha (2025) found that using the Tshivenda scientific language register fosters more meaningful and engaging learning experiences than English. Similarly, Ntuli and Mudau (2024) reported that when learners were taught natural sciences using the isiNdebele scientific register, their classroom interactions and engagement improved significantly.

Ntuli (2024) noted that stakeholders view the adoption of scientific language registers positively, as it allows learners to learn effectively in a language they are familiar with. Phalandwa (2024) found that using the Tshivenda scientific register in agricultural sciences enhanced classroom interactions and improved academic performance. Similarly, Madavha (2024) reported that the use of this register promoted engaging and meaningful learning experiences.

Netshivhumbe and Mudau (2023) caution that both teachers and learners are often unfamiliar with scientific terms in the Tshivenda scientific register, making the transition to indigenous language instruction challenging. Ntuli (2023) found that learners engaged most actively in natural sciences lessons when taught using the isiNdebele scientific register. Likewise, Netshivhumbe (2023) observed that implementing the Tshivenda scientific register in physical sciences influenced classroom discussions, leading to more meaningful learning and improved academic performance.

Ntuli (2022) further demonstrated that the use of indigenous scientific registers significantly impacts classroom interactions and discourse in natural sciences. These findings have inspired further research into how the use of the English scientific register affects interaction and discourse in 10th-grade physical sciences classrooms in the Vhembe district. Since the language of instruction has a direct impact on a learner's capacity to learn and engage in class, it is imperative to investigate it as a limiting factor to learner engagement. Lack of proficiency in the language of instruction impairs learners' understanding of the subject matter, their capacity to participate in class discussions, and their general involvement in the educational process. In order to give every learner an equal chance of success, this research will assist in identifying and addressing differences in learning outcomes based on language background. The research's conclusions will guide policy decisions about the language of instruction, including encouraging multilingualism, offering language assistance to learners, and making sure that educators receive the necessary

training to assist learners who speak a variety of languages. This study aims to explore the following research question: What effects does the use of the English scientific register have on interaction and discourse in physical sciences classrooms?

RESEARCH METHOD

This section offers a thorough explanation of the study's methodology. The flow chart for the research process is displayed in Figure 1 below.

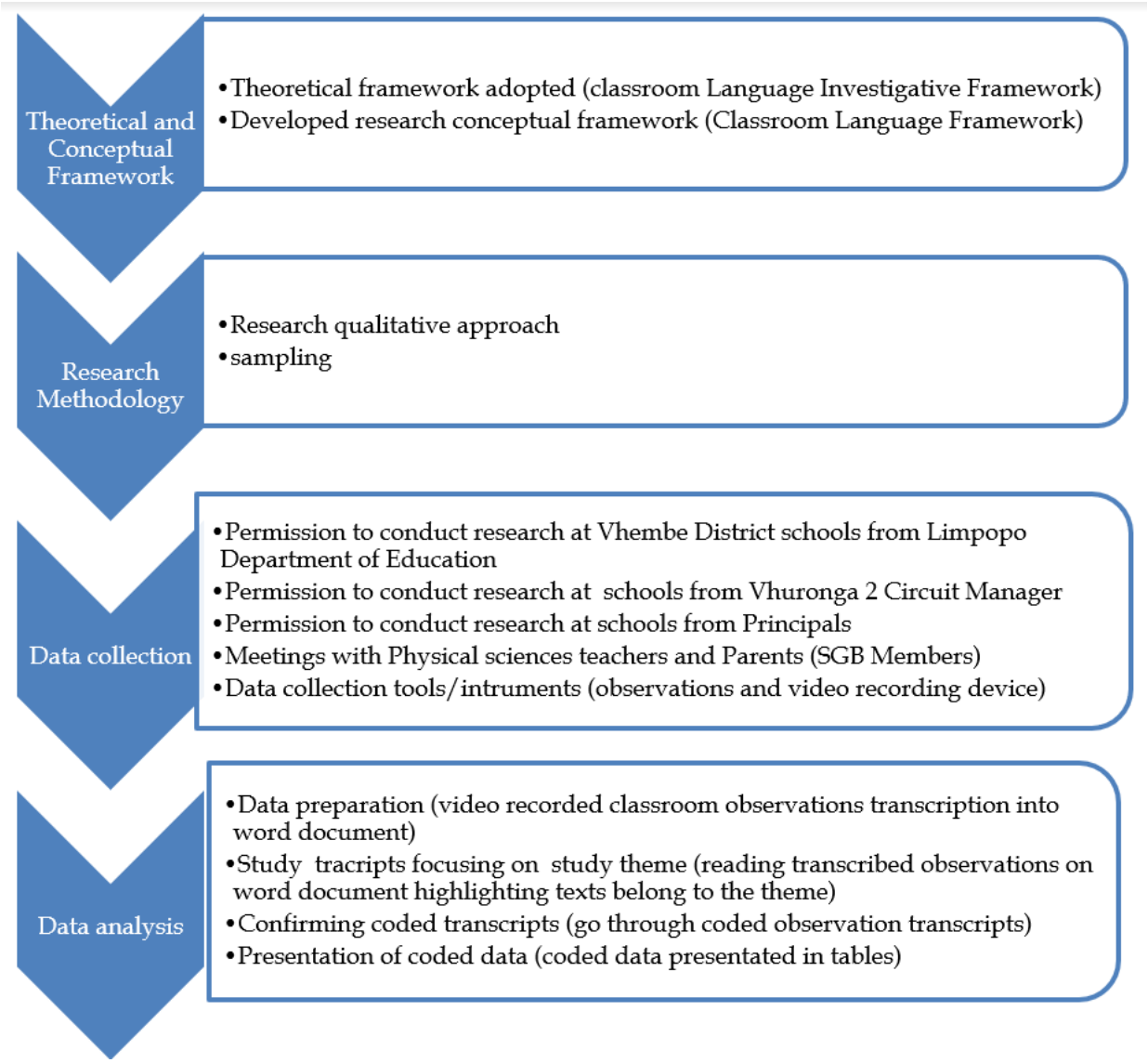


Figure 1. Research process flow chart

Theoretical and Conceptual Framework

The classroom language investigative Framework by Netshivhumbe (2023) was adopted as the theoretical foundation for this study, as one of its key components emphasizes language, an essential aspect for this research. Building on this framework, the study developed its own approach, integrating relevant elements from the Classroom Language Investigative Framework. The primary focus of this newly developed framework is on teacher-learner interaction and classroom discourse.

To understand the impact of the English scientific register on the teaching and learning of physical sciences, the researcher utilized the classroom language framework (Figure 2). As shown in **Figure 2**, Classroom interaction and discourse are mediated through language, which is the

primary means of communication between teachers and learners. Given the pivotal role of language in the learning process, the study focused on examining the influence of the English scientific register on physical sciences instruction. Specifically, this research investigated classroom interactions and discourse, with an emphasis on both learner-to-learner and learner-to-teacher communication during physical sciences lessons.

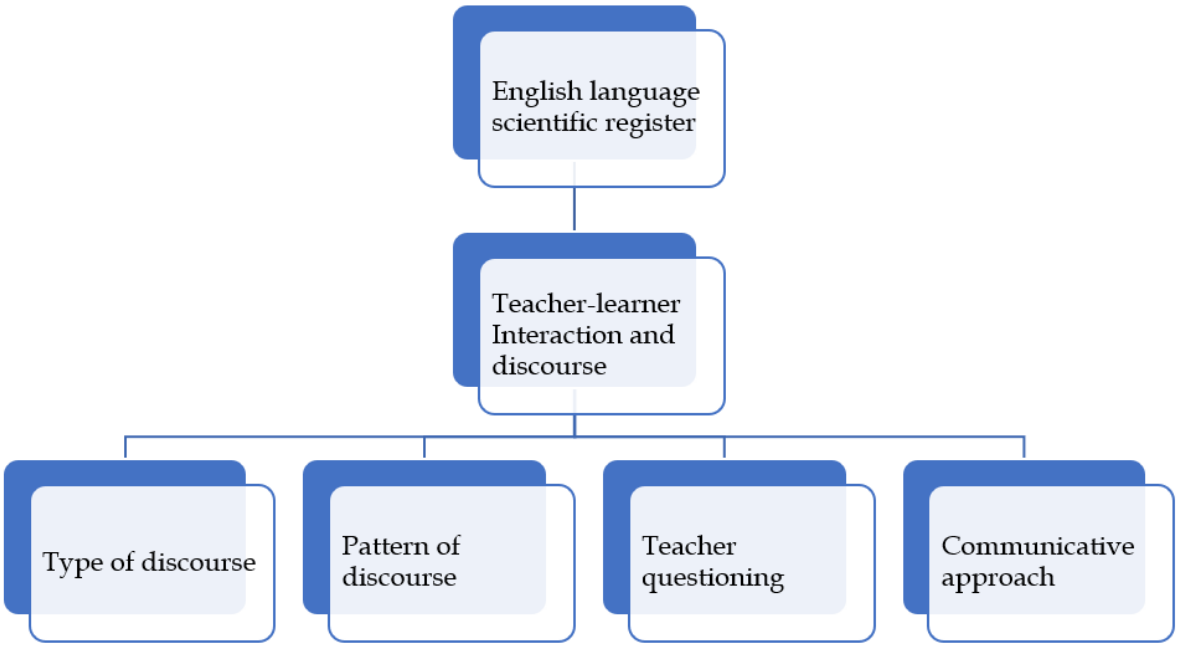


Figure 2. Classroom language framework

Research Design

The research design refers to a researcher's chosen framework for research methodologies and strategies for conducting a study (Sumbl & Deeba, 2023). The primary objective of this paper was to examine how physical sciences are taught and learned in classrooms using the English scientific register. To effectively address the research question, a well-defined research design was essential for utilizing the collected data. To analyse teacher-learner interaction and classroom discourse in physical sciences lessons, the study adopted a qualitative research design. According to Netshivhumbe (2023), a qualitative approach takes place in a natural setting in which events occur virtually. This approach was particularly appropriate as it allowed the researcher to observe and collect data in real-time within the classroom setting, offering a deeper understanding of the interactions and discourse between teachers and learners.

Sample and Participants

This study was conducted in rural schools of the Vhembe district, Limpopo province. Vhembe district was chosen because the quality of education in some of the rural schools is hampered by the language used to teach and learn physical sciences (Netshivhumbe, 2023). Figure 3 depicts the locality of the Vhembe district. For this study, purposeful sampling was employed to select three physical sciences teachers and their learners from three public schools in Vhuronga 2, Vhembe district. To maintain confidentiality and privacy, pseudonyms were assigned to both participants and schools. All three participating teachers held qualifications in physical sciences and had over five years of teaching experience in the subject.

Purposive sampling was used with the criteria that participants (i.e., teachers) must be currently teaching physical science in secondary schools, preferably in the Vhuronga 2 circuit, and be eager to engage in the entire study. This selection criterion was designed to minimize potential gaps in pedagogical content knowledge and subject expertise, ensuring the study

focused on the role of language rather than limitations in content knowledge. In qualitative research, purposeful sampling involves finding and choosing participants who are knowledgeable about and have first-hand experience with relevant phenomena (Annan et al., 2019; Nyimbili & Nyimbili, 2024). Additionally, this method is used when a researcher has already learned about certain individuals or situations and specifically chooses them because they are most likely to offer useful information (Gumbi & Twinomurinzi, 2025). Purposive sample participants are chosen for a specific reason, based on their relevance to the investigation's issue. As a result, the chosen teachers helped the researcher address research problems and accomplish the goal of the study. However, gathering information from every rural public school in the Vhembe district was not required to produce reliable results.

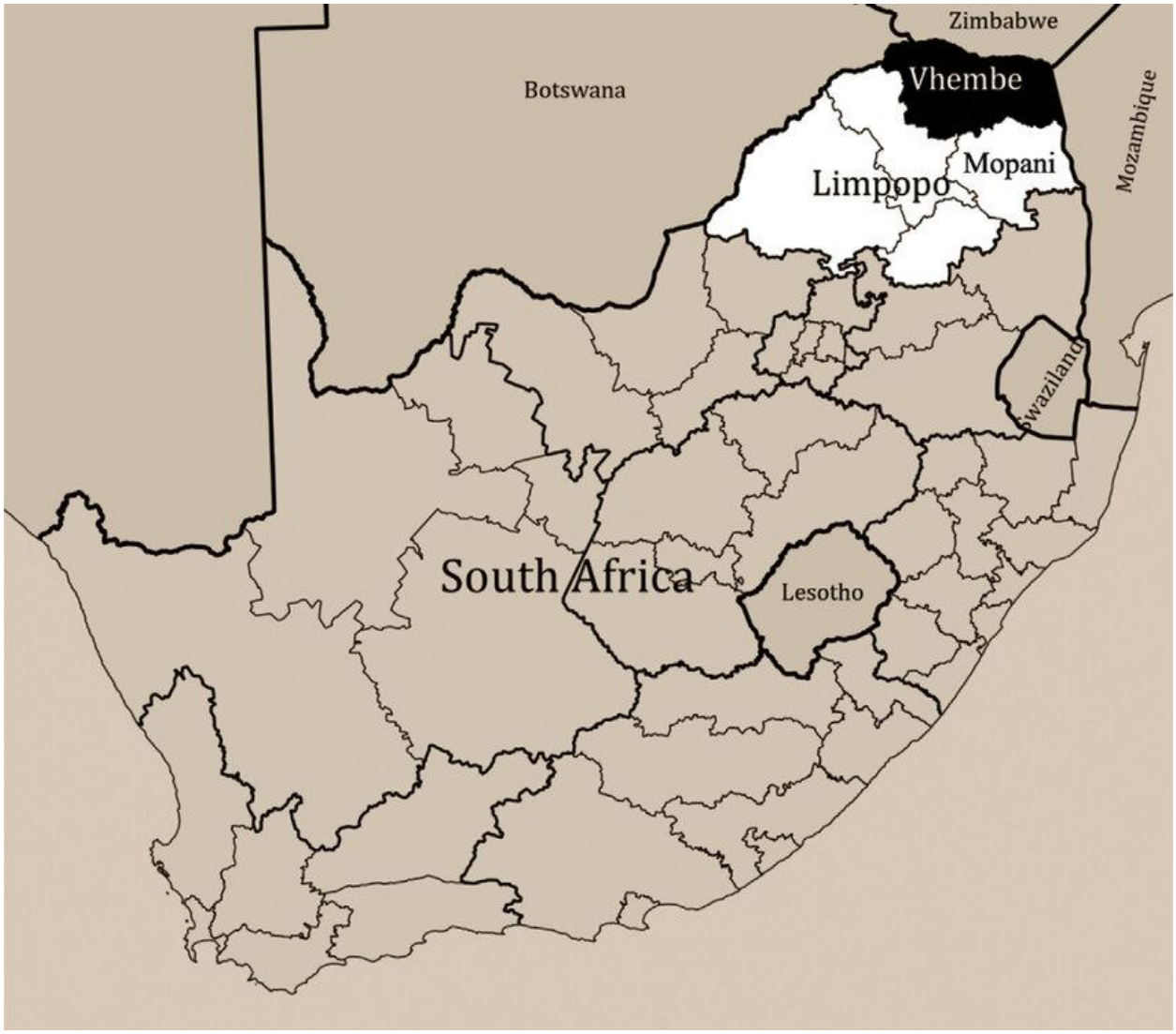


Figure 3. Vhembe district in the study region of Limpopo province in South Africa

Data Collection Tools

Data for this study were collected through classroom observations. Observations were conducted to examine the classroom practices of three physical sciences teachers, with each teacher being observed during three lessons. These lessons were recorded to ensure the accuracy of the collected data. An observational tool was used to document teacher-learner interactions and discourse, particularly focusing on the use of the English scientific register. Prior to the observations, the researcher obtained consent from the participants to record the lessons, ensuring reliability and minimizing potential errors during analysis. The recorded lessons were

captured using a video recording device and later transcribed by the researcher into a Word document for further analysis.

Data Analysis

The data collected from the three schools were analysed and interpreted by the researcher. Cross-checking refers to the independent evaluation of data or findings to verify their accuracy and reliability. Using several sources or ways to corroborate conclusions is crucial in research and science (Sürücü & Maslakçı, 2020). Cross-checking allows researchers to improve the credibility of their work and give a solid foundation for findings. Video-recorded lessons were transcribed into a Word document, and to ensure accuracy, the researcher reviewed the recordings while cross-checking the transcriptions. Before finalizing the transcripts, the researcher presented the transcribed data to the respective participants for verification. The researcher employed cross-checking to improve the reliability and validity of findings by comparing data from a video-recorded device and transcription to a Word document. However, participants' grammatical errors were intentionally left uncorrected to preserve the authenticity of the data and maintain its original meaning. During the analysis, the primary theme identified was interaction and discourse in the teaching and learning of physical sciences using the English scientific register. Only data relevant to this theme were included in the study. The text highlight colour tool and track changes were used to codify categories and characteristics of interaction and discourse themes. The researcher went through the coded data in order to confirm the transcripts. Thereafter, the coded data were presented in tables.

RESULTS AND DISCUSSION

Result

The findings of this study were derived from observations conducted in three schools, where physical sciences teachers and learners were observed during lessons. The researcher used codes to present cases of the participants: School 1/Teacher 1=S1/T1; School 2/Teacher 2=S2/T2, and School 3/Teacher 3=S3/T3. The data presented in this section focuses on the theme of interaction and discourse, specifically examining the use of the English language scientific register in physical sciences classrooms. The researcher's primary interest in this theme was to explore the impact of the English language scientific register on classroom interaction and discourse. As a result, the study identified key interactions, both between teachers and learners and between learners and the subject content. Table 1, Table 2, and Table 3 illustrate the types of discourse, discourse patterns, teacher questioning strategies, and communicative approaches employed by teachers during their Physical Sciences lessons using the English language scientific register. Additionally, while learners interacted with both their teacher and peers, their engagement was largely limited, as the lessons were predominantly teacher-centred, as reflected in the tables below. Figure 4 below shows an example of a coded transcript.

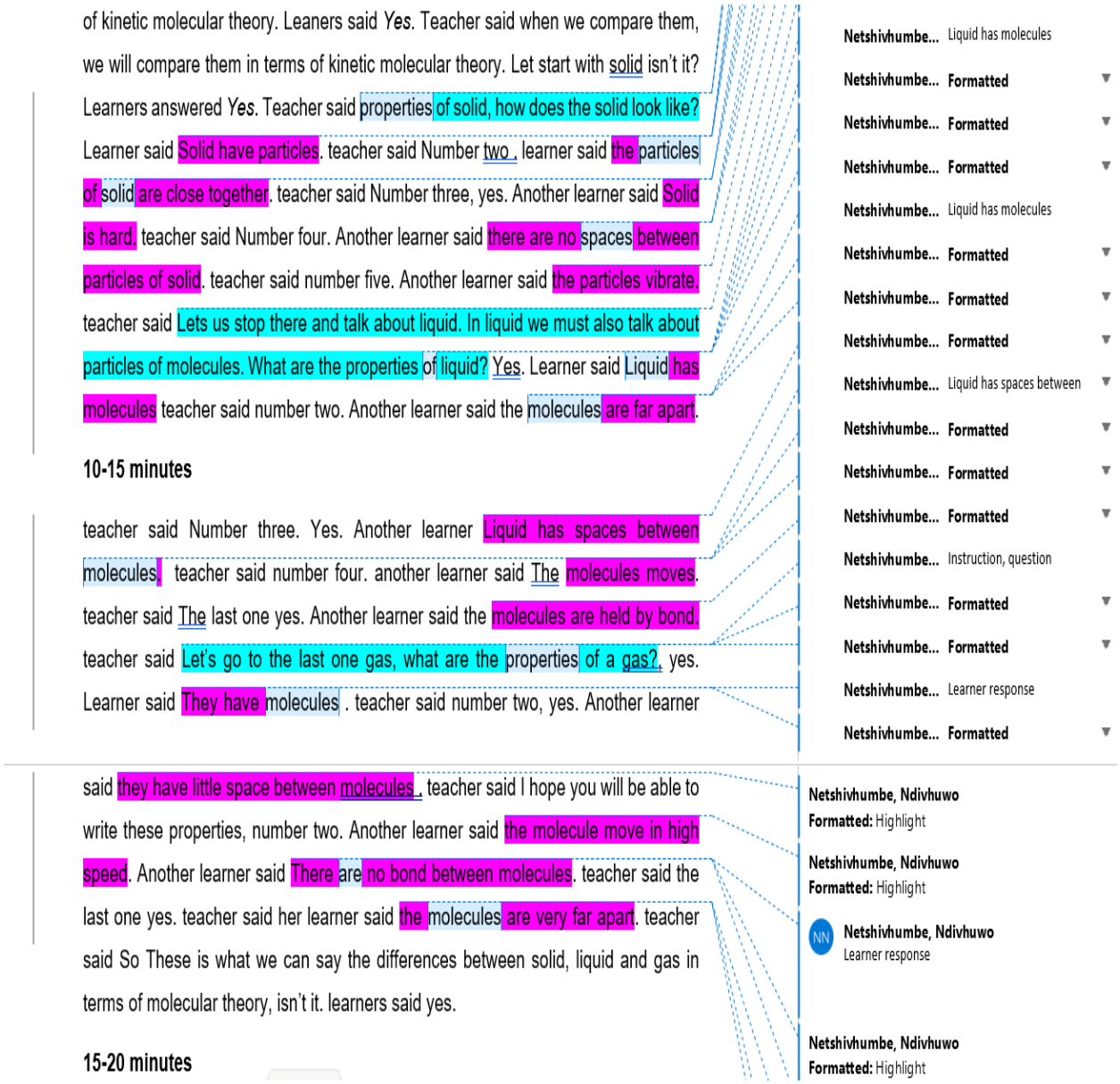


Figure 4. Example of coded transcript

Table 1 below presents Classroom interactions and discourse in school one during teacher classroom practices.

Table 1: S1/T1 classroom interaction and discourse

Discourse	Interaction
Type of discourse (Authoritative discourse)	"Let's talk about the heating curve. This curve will explain how phases change from one form to the other. When we draw a curve, there must be a vertical axis and a horizontal axis. The horizontal axis shows us the changes, but the vertical axis shows us the decrease in temperature or the increase in temperature. The temperature will be 20^0C, 40^0C, 60^0C,80^0C,100^0C,120^0C. Remember, temperature will be in degrees Celsius, and here on the x-axis is a phase change. Remember, we are talking about heating. When we heat, we are increasing the temperature. So, say this one is solid, when you heat it, the temperature will go up. Then we come to a state where solid will turn into Liquid. So here we have solid and liquid. So, the temperature increases, so there

Discourse	Interaction
	will be a state where liquid will change into gas. So here we have liquids and gases. And here we have gas. So automatically here we have phase changes" Teacher 1 (conveying information, illustration)
Pattern of discourse (Initiation, response, evaluation)	"Properties of solid, how does the solid look like?'' Teacher 1 (initiation, authoritative, questioning) "Solid have particles. The particles of solid are close together. Solid is hard. There are no spaces between particles of solid. The particles vibrate'' Learners (responses from different learners) "Lets us stop there and talk about liquid. In liquids, we must also talk about particles of molecules. What are the properties of liquid?'' Teacher 1 (instruction, sequencing ideas, questioning) "Liquid has molecules. Molecules are far apart. Liquid has spaces between molecules. Molecules move. Molecules are held by a bond. Learners (responses from learners). "Let's go to the last one gas, what are the properties of a gas?" Teacher 1 (instruction, question). "They have molecules. They have little space between molecules. The molecule moves at high speed. There is no bond between molecules. The molecules are very far apart." Learners (responses)
Teacher questioning (Drives lesson, develop thinking skills, Encourage and motivate)	"The topic of today's lesson is phase change. How many phases do we have?" "Where solid changes into liquid, what do you call this?" "Liquid can also change into solid, what do you call this, yes?" "Process where liquids can change into gas, what do you call this?" "Process where gases change into liquids, what do you call this?"
Communicative approach (Interactive-authoritative)	"So, the homework is, the homework you are going to write the cooling curve, when you write the cooling curve, you must also explain the phase changes from a gas to a solid, explain each phase using kinetic molecular theory. So, this is a very big task. You must do this at home, relax, and try to choose the best answers." Teacher 1 (instruction, interactive-authoritative) "Draw a cooling curve, and you may discuss with each other. The first group will come and draw'' Teacher 1 (instruction, authoritative) "We are done," Learners "Are you sure you are ready to report?" Teacher "Yes'' learners "Just go and write. Look at his drawing and yours. He is drawing. After his drawing, we will talk about his drawing'' Teacher 1 (instruction, interactive-authoritative)

Table 2 below presented Classroom interactions and discourse in school two during teacher classroom practices.

Table 2: S2/T2 classroom interaction and discourse

Discourse	Interaction
Type of discourse (Authoritative discourse)	"Physical state of a substance. When ice is heated to its melting point, it transforms into water. When water reaches its boiling point, it turns into vapor. The phase or physical state of a substance at a specific temperature. First, we have the freezing point; second, the melting point; and third, the boiling point. The temperature at which a liquid turns into a solid is known as the freezing point, and it falls under number 1. The second is the melting point, which is the temperature at which a

	solid becomes liquid. The temperature at which a liquid turns into a gas or vapor is known as the boiling point. ." teacher 1 (initiation, conveying information, illustration)
Pattern of discourse (Initiation, response, evaluation)	"Water in solid state it has a fixed volume while liquid water it occupies space and take the shape of the container. Water vapour, it takes the volume of the container. Create a three-column table and write solid, liquid and gas. Under solid?" teacher 2 (convey information, instruction, authoritative, questioning) "Solid has a solid form" learner (response) "The form can only change by denting, breaking, or bending it. Under liquids? Teacher 2 (sequencing ideas, questioning) "Liquids do not have a fixed form" learner (response) "Under gas?" teacher 2 (question) "Gas do not have a fixed form" learner (response)
Teacher questioning (Drives lesson, Encourage and motivate)	"We will discuss kinetic theory and the states of matter today, define matter" "We have three states of matter, what are they and give example on each state?" "Consider the following curve for water. Between points A and B ice cubes are heated and between C and D water liquid is heated. Between which two points does heating increases the temperature?"
Communicative approach (Interactive-authoritative)	"When ice placed in a beaker that is heated up very slowly at a constant heat, it melts to form liquid water. If water in a solid state to form water as liquid. Water as liquid when we continue heating it to form water vapor. Now we are going to deal with the heating curve of water. "Teacher 2 (initiation, instruction, interactive-authoritative) "Matter is anything that has mass and occupies space. we have three states of matter we have what? Teacher 2 (initiation, sequencing idea, questioning) "Solid. Liquid. Gas." Learners (answers from different learners) "Example of solid?" teacher 2 "ice'' learner "We have water as ice. Example of liquid? Teacher 2 (evaluation, interactive-authoritative) "water'' learner "Liquid water. Example of gas?'' teacher 2

Table 3 below presents Classroom interactions and discourse in school three during teacher classroom practices.

Table 3: S3/T3 classroom interaction and discourse

Discourse	Interaction
Type of discourse (Authoritative discourse)	"Matter is anything that has mass and occupies space. The fact that matter has mass and takes up space is its most crucial characteristic. The ability to weigh a thing indicates that it has mass. In this instance, I am holding two items that fall within the category of matter. The first is the jug itself and the water within. We have a container that stands here. If you look at it from this angle, you can see that it takes up space. If we put it on anything that can be used to measure weight, we can determine the mass of the object. So, it means that thing is a matter. Even this basic duster counts as a matter because it has mass and takes up space in this room" teacher 3 (initiation, conveying information, demonstration) "Water is one of the good examples of those three states of matter that we are going to discuss. Water in its natural form is liquid. Then water can change its state into a solid and into a gas. Meaning that we have three states of matter. The first one is solid, the second one is liquid, and the last one is gas; however, these are the only ones that we learn about in grade 10" teacher 3 (instruction, convey information)

Discourse	Interaction
Pattern of discourse (Initiation, response, evaluation)	"Besides liquid, tell me the other two states in which water can appear, yes? ''teacher 3 (initiation, instruction, authoritative, questioning, encourage and motivate) "Solid and gas", learner (response) "This water has the potential to be solid. What conditions can cause it to be solid? What situations will cause it to be solid? What form can it take? Can you tell me any conditions that can cause this water to solidify?" teacher 3 (sequencing ideas, demonstration, improve learning, questioning, develop thinking skills) "Water solidifies when it is refrigerated." learner (response) "Therefore, this water can also be in the form of gas. Under what conditions can we find water in a gaseous state?" teacher 3 (convey information, question, develop thinking skills). "evaporation", learner (response) "Evaporation is a process. When you boil water, you will start to see something like a flame coming out, and that form, we classify as a gas" Teacher 3 (convey information)
Teacher questioning (Drives lesson, Encourage and motivate)	"Today we are going to study the phases of matter. But before we proceed, it is, however, important for us to go back to the prior knowledge of what we have done in previous classes. Who still recalls what matter is, what is a matter?" "We have three phases of a matter. What are those phases?" ''Thus, we have three states: solid, liquid, and gas. What does the word "solid" mean to you in plain English, and is there anything in the class that you can identify as being in a solid form? "Which one is heavier than the other between solid and liquid? "So now what about gas, does gas have high density or low density?"
Communicative approach (Interactive-authoritative)	"So, what you are going to do now, you are going to write how solid, liquid and a gas differ or what are the similarities according to certain properties. In other words, you are going to write what properties solids have which is related to liquids and gases. You are doing this as a group. So, you are discussing as a group how these three phases differ or which properties are the same. Teacher 3 (instruction, interactive-authoritative) "Now in your own words explain how water can be in all form of matter. The form of matter we are talking about is liquid, solid, and a gas. So, tell me how it is possible that water can be in all those three forms. In your own words, you can just explain according to your understanding'' teacher 3 (instruction, question, develop thinking skills, interactive-authoritative) "Water can change into a solid when we put it in the refrigerator, water can change into a gas when we boil it." learner (response) "Water can change into a solid when we put it in the refrigerator, water can change into a gas when we boil it'' teacher 3 (evaluate, interactive-authoritative)

Tables 1, 2, and 3 presented interactions and discourses diagnosed during the classroom practices of three teachers who participated in the study. The above tables illustrated the types of discourse, discourse patterns, teacher questioning strategies, and communicative approaches employed 6by the three teachers during their physical sciences lessons using the English language scientific register. The findings of this study revealed that learners interacted with both their teacher and peers; however, their engagement was largely limited, as the lessons were predominantly teacher-centred, as reflected in the three tables above. The results displayed in the tables are elaborated in detail in the discussion section.

Discussion

In this study, teachers were observed using the English language scientific register to teach physical science. According to Shubani and Mavuru (2022), learners score poorly in physical sciences exams because they are unable to engage in meaningful classroom discussions due to their limited fluency in English, the medium of instruction. The researcher found that the use of this register limited learners' participation in the lessons. Kamati and Mavuru (2020) found that learners struggle to comprehend and conceptualize scientific content when they face difficulties with the language of instruction. Learners' performance and engagement were average, primarily due to the language barrier, as English was not the first language of either the teachers or the learners. Some learners struggled to understand the content, leading to disengagement and passive participation. When English is the primary language of instruction, there is sometimes little to no interaction in the classroom since learners find it difficult to participate in the lesson and advance if they do not comprehend the language (Leonet et al., 2019; Motloung et al., 2021). Overall, the classroom interaction and discourse—both between the teacher and learners, and among learners discussing physical science concepts—were below the researcher's expectations.

In addition to using the English language scientific register, teachers also made use of available classroom materials such as dusters, rulers, tables, books, pens, and chalk. They improvised with materials like water, jugs, beakers, stones, and containers for demonstrations. Various teaching methods, including lecturing, demonstrations, examples, and question-and-answer sessions, were employed. However, despite the use of visual aids, demonstrations, and practical activities, learner participation remained minimal. During instruction, teachers should support the development of these skills, and physical science education should be learner-centered (Netshivhumbe & Mudau, 2021). However, in this study, the lessons were predominantly teacher-centered, with teachers serving as the primary source of information, which limited opportunities for learner engagement.

The teachers began their lessons by introducing topics and asking questions related to the material. This helped capture learners' attention and assess their prior knowledge. While some learners participated actively, others did not engage fully in the lessons. According to Alkhouri (2021) and Saglam (2022), authoritative discourse is one in which a teacher shares knowledge, and the comments are frequently composed of factual assertions and instructional questions. Throughout the lessons, teachers employed authoritative discourse. For example, Teacher 1 explained the heating curve of water using illustrations, Teacher 2 described the physical conditions of substances with visual aids, and Teacher 3 elaborated on matter, discussing mass and space with demonstrations and examples of classroom objects. This authoritative discourse structure limited opportunities for learners to interact with each other and engage deeply with the subject matter.

All teachers followed an initiation-response-evaluation pattern of discourse. Netshivhumbe (2023) and Tang (2020) indicated that the initiation, response, and evaluation (IRE) pattern of discourse is a three-fold figure in which the teacher initiates communication by asking students a question, the learner will next respond to the question, followed by the teacher, who will evaluate the learner throughout the process. In this model, the teacher asked questions, evaluated responses, and learners primarily provided answers. Some learners struggled to respond accurately, as the English used in instruction was a barrier. Teachers often provided correct answers when learners gave inappropriate responses. However, some questions posed by the teachers helped drive the lessons and encouraged learners to participate in answering questions and completing class activities.

According to Netshivhumbe (2023), the communicative approach in teacher classroom practices focuses on how a teacher collaborates with learners to address the lesson's concepts. Two communicative approaches were observed: interactive-authoritative and non-interactive-authoritative. Teachers occasionally provided large amounts of information in a sequential manner without soliciting learners' opinions or asking questions, resulting in a non-interactive, authoritative approach. As a result, some learners simply listened without actively processing

the information due to language difficulties. In contrast, the interactive-authoritative approach was employed when learners participated in group activities, where they later shared their findings with the class. Teachers also engaged in discussions with learners, reflecting on their responses.

While group activities allowed learners to share their understanding of scientific concepts, some learners were reluctant to participate due to the requirement to communicate in English, which negatively impacted their confidence. Additionally, some learners avoided participating in group activities altogether. Alongside group activities, learners were also assigned homework based on the lesson content.

In all observed lessons, learner participation was generally poor, with almost half of the class not engaging by answering questions or participating in group activities. Therefore, the findings suggest that teaching and learning through English instruction limits learners' participation in the classroom. It is crucial for teachers to provide learners with opportunities to ask questions, contribute ideas, and demonstrate their understanding of the lesson concepts.

CONCLUSION

This study investigated the use of the English language scientific register in 10th-grade physical science classrooms. The findings revealed that the use of English in teaching and learning physical science led to poor learner participation, primarily because English was not the learners' first language, making it challenging for them to understand the subject content. Additionally, some learners struggled to express their ideas during group activities, which could have provided valuable opportunities for interaction. Learners also refrained from asking questions based on the lessons, contributing to a lack of engagement. The lessons were predominantly teacher-centered, which further limited learners' ability to grasp the content taught through the English language scientific register.

Due to the learners' difficulty in understanding certain concepts, teachers occasionally switched from English to the learners' mother tongue, Tshivenda, to facilitate comprehension. This highlights the challenges English poses in teaching and learning Physical science, particularly for learners in rural schools with limited English language proficiency. To help learners understand the content better, teachers attempted to use simplified or plain English; however, this approach was largely ineffective, as nearly half of the class still struggled to participate due to the language barrier. As a result, the use of the English language scientific register had a limited impact on classroom interaction and discourse, further hindering learner performance and involvement.

According to the study's findings, learners' participation in school is limited when English is the exclusive language of instruction because of cognitive difficulties and language hurdles. In situations where English is not their mother tongue, learners find it difficult to comprehend and engage, which impacts their overall learning and growth. Both involvement and academic performance suffered as a result. For learners to take greater control of their education, teaching and learning in their mother tongue should be considered. However, this has implications for stakeholders in the education system, as language regulations would need to be updated, and teachers may need additional training to properly employ the mother tongue in teaching and learning. Using the learners' native language would eliminate the need for code-switching, making it easier for both teachers and learners to engage with the content without the added challenge of language barriers.

Limitations

This study's primary limitation was that it only looked at three public schools in the Vhembe district of the province of Limpopo. Although this restricted emphasis can be viewed as a drawback, the analysis's detailed data descriptions imply that the conclusions might apply to other districts with comparable situations.

Recommendations

Using English as the medium of instruction in physical science classes can pose significant barriers to both teaching and learning, particularly for students who are not native English speakers. To enhance comprehension and academic performance, it is essential to consider the development of teaching and learning materials in indigenous languages that are familiar to the majority of learners. Employing these indigenous languages as the medium of instruction can lead to greater student engagement and improved understanding of scientific concepts. Additionally, further research is needed to explore the specific challenges faced by second-language English speakers in physical science, with a focus on the linguistic and cognitive demands of the subject.

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