

OVERCOMING PARTICIPATION BARRIERS IN A PHYSICAL SCIENCES CLASSROOM: INSIGHTS FROM THE USE OF A SHARING STICK AND SHARING CIRCLES

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ABSTRACT

This article explores how culturally responsive, guided strategies – specifically sharing circles and the use of a sharing stick can support inclusive participation and collaborative learning in a rural secondary school science classroom. Drawing on Vygotsky’s sociocultural theory, the study examines how these tools mediate learner engagement and sense-making during lessons on abstract scientific concepts such as Newton’s second law of motion. The analysis focuses on how structured, dialogic spaces foster a sense of belonging and enable equitable communication among Grade 11 learners from a rural school with varying levels of confidence and linguistic backgrounds. Data collection methods included focus group interviews (sharing circles) and learners’ reflective journals, with an inductive thematic analysis employed. Findings suggest that sharing circles create a supportive classroom environment where learners feel encouraged to voice their thoughts, while the sharing stick helps regulate participation, ensuring that all learners can contribute without fear of being interrupted or overlooked. The study integrates culturally relevant practices into science education to reduce affective barriers, promote inclusivity and enhance learners’ agency. It further offers insights into how simple, low-cost interventions can transform the classroom into a more interactive and empowering space for science learning. Implications for classroom practice and curriculum design are discussed, with a view to more inclusive and dialogic science-teaching approaches in diverse educational contexts.

Keywords: Physical Sciences, barriers, Indigenous cultural tools, sharing stick, sharing circles

INTRODUCTION

Active participation in science classrooms does not come easily to many learners, especially those who are shy and introverted, from rural schools, or feel disconnected from the taught material. Various scholars (Condon and Ruth-Sahd, 2013; Flanagan and Addy, 2019; Zulfikar, Hasibuan, Rahmati, and Nasution, 2024) have explored different ways to help introverted learners benefit from lessons. In traditional practice, teacher-oriented instruction is emphasised, with learners receiving information passively (Yang, 2021). This might dissuade active learner participation, especially by less confident and less comfortable learners in big classes. This issue is most apparent in subjects like Physical Sciences, where abstract ideas are likely to intimidate learners, making them aloof and reluctant to engage in classroom discussions (Ahmad, 2021).

To overcome these difficulties, teachers have tried various methods to encourage active and inclusive participation. One such method is the use of a “sharing stick” in group discussions, in which only the learner holding the stick can speak. Allen (1993) refers to the sharing stick as the “talking stick” and describes it as a tangible object that grants the holder permission to speak and command the group's attention. This is an easy-to-use tool that increases the chances of equal participation. Furthermore, it gives every learner a chance to share their thoughts without being overshadowed by the dominant voice of more chatty learners. The sharing stick method can be used in conjunction with facilitated sharing circles to create a classroom setting where all learners’ voices are heard. In their study, Veloria and Boyes-Watson (2014) used the term “learning circles” to refer to sharing circles, explaining that everyone in the class is included in the circle and that, as such, every voice is respected and valued.

The study is grounded in Vygotsky’s (1978) sociocultural theory, utilising its various concepts, with a central focus on the mediation of learning, culture, and language, as well as social interactions and the zone of proximal development (ZPD). It investigates how the use of a sharing circle and a sharing stick influences learner participation and explores learners’ experiences of this innovative approach in a Grade 11 Physical Sciences classroom. The research explores how these techniques can overcome participation barriers, enhance collaborative learning, and deepen understanding of scientific concepts. The following research questions were addressed:

- How do sharing circles mediate social interaction and collaborative meaning-making among Grade 11 learners during lessons on Newton’s second law?
- In what ways does the sharing stick function as a mediational cultural tool to support equitable participation and communication in science learning?

LITERATURE REVIEW

Barriers to participation in science classrooms

Our understanding of the various causes of low motivation among learners in science classes and how to address them is still evolving. More research is needed to explore its effects across diverse learning contexts and populations. The causes of low motivation include, among others, fear of making mistakes, self-doubt about scientific facts and language problems (Ahmad, 2021; Severe, Stalnaker, Hubbard, Hafen and Bailey, 2024). Using a descriptive survey method, Ahmad (2021) identified several reasons for college students' reticence to speak in class discussions, including fear of being called on, fear of speaking in front of the class, and difficulty with English pronunciation. The findings from their study revealed that the reasons were moderately common among students, and that the most frequent coping strategy was psychological preparation before speaking. Similarly, Severe *et al.* (2024) explored barriers to student participation in college science classrooms through qualitative interviews. Their study found that external factors, such as teacher behaviour, peer dynamics and course content, influenced students’ willingness to speak, with women more affected by fear of judgment and men by their interest in the material taught.

Zulfikar *et al.* (2024) found that hesitant learners often feel excluded, leading them to become disengaged and perform poorly academically. Their study examined the challenges and strategies of teaching English as a Foreign Language (EFL) learners, with a focus on the value of one-on-one instruction. The instructors reported minimal learner engagement and limited vocabulary, but achieved success through strategies

such as modelling, small-group discussions, and peer teaching. These strategies were observed to be effective in improving engagement and motivation. In addition, in most classes, participation in class discussions seemed dominated by a couple of boisterous, forceful learners, who did not provide opportunities for others to contribute their opinions or ask questions. This led to a need to find methods to address the challenge so that introverted learners feel included.

One of the main challenges is the 'science identity' barrier, where learners perceive science as irrelevant to their everyday lives and are thus discouraged from studying it (Chow-Garcia, Lee, Svihla, Sohn, Willie, Holsti, et al., 2022). This barrier is prevalent when learners feel disconnected from what they are learning, leading to a sense of inadequacy and disengagement from active participation. The study by Chow-Garcia et al. (2022) explored the impact of culturally responsive summer research programmes on science persistence among Native American learners. Findings showed that science identity, moderated by both self-efficacy and cultural identity, predicted intent to persist in science fields. Learners evaluated programmes that aligned with their cultural beliefs and offered a sense of belonging. In combination, these studies highlight the intricate interactions between participation barriers in science classes and suggest the need for psychologically safe, inclusive, and culturally responsive learning settings to increase learner participation.

The sharing circle as a cultural tool for engagement

Cooperative learning strategies, particularly group discussions using sharing circles, have proven effective in breaking barriers to learner participation in science classrooms. These strategies enable learners to articulate their ideas, listen to others and develop a clear understanding through discussion, thus facilitating both engagement and learning. Group discussions also facilitate critical thinking and enable learners to articulate scientific ideas with greater confidence (Braun, Billups, Gable, LaCroix and Mullen, 2021).

In addition to cognitive benefits, small-group discussions or sharing circles help establish a sense of community and belonging, both of which are powerful motivational determinants. If learners feel that their input is being taken into consideration, they are more likely to participate in discussions and take ownership of their learning experience (Veloria and Boyes-Waston, 2014). Sharing circles facilitate collaborative problem-solving, meaning negotiation, and the skill of asking clarifying questions, all of which enhance learning.

Research by Braun et al. (2021) highlighted the role of leadership in promoting greater equity in learner learning. The research demonstrated that applying Core Leadership Practices (CLPs) to professional learning positively impacted the learning outcomes of disadvantaged learners. The research also emphasised the importance of inclusive practices, such as group work, in enabling learner success.

Moriau, Matolay, McKenna, Toarniczky, Gáspár, Frigyik, *et al.* (2025) explored the impact of learning circles as a professional development tool in higher education. Drawing on the Erasmus+ CIRCLET project, their qualitative study illustrated how learning circles enabled adaptive, collaborative learning environments in which teachers could adopt hybrid roles and renegotiate their professional identities. The

findings emphasised the value of inquiry-based, participatory approaches in academic practice (values that are equally applicable to learner learning communities).

Veloria and Boyes-Watson (2014) emphasised the dialogic and humanising pedagogical practice, such as circle practice, where learners and teachers engage in guided communication based on their lived experiences. By attending to empathy, respect, and a deeper connection to content and community, this kind of practice cultivates caring and responsive classrooms.

In a related study, Williams and Svensson (2021) analysed small-group talk among science student teachers. Their results showed that “explorative talk” (characterised by questioning, testing ideas, and revealing a variety of perspectives) enabled student teachers to reach a deeper understanding of scientific concepts. This confirms the idea that formal discussions can enhance variation and depth in science learning.

Moreover, Dewi, Erna, Martini, Haris and Kundera (2021) studied the role of contextual collaborative learning using ethnoscience in enabling scientific literacy. In their quasi-experimental study, they determined that learners’ understanding of scientific content, process and attitude was enhanced considerably through culturally relevant group work. This suggests that cooperative learning, provided it is contextualised and adapted to the culture, can play a role in significantly improving scientific literacy. These studies confirm that sharing circles are successful Indigenous pedagogical tools for fostering learner participation, equity and comprehension, especially when they are culturally responsive and inclusive (Mhakure and Otulaja, 2017).

The use of a sharing stick

The sharing stick is a simple yet effective tool for managing classroom discussions and ensuring that all learners have an equal opportunity to participate. The concept of the sharing stick is based on the principle of turn-taking, which helps create a more structured and inclusive discussion environment (Allen, 1993). The sharing stick ensures that every learner has a chance to speak, preventing the more confident learners from dominating the conversation and giving quieter learners a platform to share their thoughts.

Research has shown that strategies such as the sharing stick can enhance classroom dynamics by fostering a sense of fairness and inclusion (Saihu, 2020; Sari and Sembering, 2019). When learners know that they will have a turn to speak, they are more likely to engage actively in the discussion, reducing the fear of being overlooked or interrupted. The talking stick and sharing circles can be used in conjunction to establish a classroom culture where learners express their opinions freely while listening attentively to one another. Such a classroom culture fosters respect for one another, open communication and a feeling of shared responsibility for learning.

Allen (1993) discusses the power of storytelling as an educational and cultural tool, drawing on Indigenous traditions such as the talking stick, which gives individuals the authority and attention to share stories. This metaphor is extended to the classroom, where both teachers and learners use narratives to make sense of personal and collective experiences. The implication is that stories in education do more than convey information; they also shape understanding and meaning across time.

Building on this, Sari and Sembering (2019) provide empirical evidence of how the talking stick method (inspired by Indigenous practices) can actively improve learners' English-speaking skills. Their classroom action research (CAR) shows clear academic improvement and enhanced classroom engagement. Learners became more active and motivated, creating a more vibrant learning environment.

Saihu (2020) reinforces these findings with a quasi-experimental study focused on Fiqh, showing that learners taught using the talking stick model outperformed those taught with conventional methods. This study, with statistically significant results, confirms that the model not only enhances participation but also improves learning outcomes.

Together, these studies support the pedagogical value of storytelling and participatory methods, such as the talking or sharing stick. Whether fostering cultural connection, enhancing language acquisition or improving religious studies comprehension, the approach proves versatile and effective. The common thread is that giving learners a voice fosters deeper learning and engagement, making the sharing stick not just a cultural symbol but a practical educational strategy.

THEORETICAL FRAMEWORK

A theoretical framework provides a structured approach to addressing a problem while influencing how data is analysed (Bertram and Christiansen, 2020). In this study, Vygotsky's (1978) sociocultural theory served as the analytical lens. Sociocultural theory, rooted in the idea that learning is fundamentally shaped by social and cultural influences, offers a crucial perspective for examining the dynamics of learning. Vygotsky (1978) argued that our daily interactions and activities play a pivotal role in shaping our higher mental functions. This theory provides a framework for examining learning, particularly in the context of learners.

As stated by Vygotsky (1978), sociocultural theory is defined by the following concepts, although they are not exhaustive: mediation, culture and language, social interaction and the ZPD. Mediation involves learners working collaboratively under teacher guidance, using physical and symbolic tools to connect theory with practice (Vygotsky, 1978). This dual process – external activity and internal transformation – fosters both cognitive and social growth. Peer-assisted learning strategies (PALS), as described by Zayyad (2020), exemplify structured mediation, promoting verbal engagement, corrective feedback and social collaboration, all of which contribute to deeper learning and academic success (Alkhudiry, 2022; Dalsgaard, 2020; Neto, 2020).

Culture and language are explored as critical mediating tools in learning. Vygotsky (1978) views learning as embedded in cultural contexts and language as both a means of communication and a vehicle for transmitting culture (Erbil, 2020; Caronia, 2021). Learners, especially in multilingual settings such as rural South Africa, often face cultural dissonance between their home and school environments, a phenomenon referred to as "border crossing" (Aikenhead and Jegede, 1999). Bridging these gaps through culturally responsive pedagogy enhances accessibility and meaning-making in learning (Mavuru and Ramnarain, 2017; Kim, 2020).

Social interaction plays a foundational role in learning development. From early childhood, learners acquire knowledge through collaborative experiences (Bodrova, 1997), and teachers can build on this by aligning classroom instruction with learners' prior experiences (Turuk, 2008; Gwekwerere, 2016). Children engage in argumentation even from a young age (Rapanta, 2023), highlighting their innate social reasoning skills. Interactive strategies, such as group work and role-playing (Zhou, 2020), and structured collaboration (Erbil, 2020), cultivate critical thinking and cooperative learning.

Finally, the ZPD is the space in which learners can progress with support from more knowledgeable others (Vygotsky, 1978; Zaretsky, 2021). Effective teaching activates this zone by providing scaffolding (Bruner, 1960), enabling learners to internalise new skills and ultimately self-regulate their learning. While the ZPD offers a robust model for understanding cognitive development, critics such as Ameri (2020) argue that it may overlook exceptional learners who operate beyond typical social scaffolding. While various elements of the theory were considered, the primary emphasis was placed on social interactions.

METHODOLOGY

This study employed a qualitative research design, focusing on case studies within a single Grade 11 Physical Sciences classroom with 10 learners. The research explored how the use of a sharing circle and a sharing stick influences learners' participation and experiences. Data was generated using focus group interviews (sharing circles) and learner reflective journals.

The 10 Grade 11 learners were from a mixed-gender class at a rural secondary school in Mqanduli. The learners spoke isiXhosa as their first language and English as their second. The learners had varying levels of confidence in speaking English and had previously shown mixed participation in class discussions.

The information in Table 5.1 below provides a clear demographic breakdown of the study participants, which is important for understanding the context and potential implications of the findings. One of the learners was a 31-year-old female who decided to go back to school after realising that promotions at work were passing her by because she did not have a Grade 12 certificate. The remaining learners' ages ranged from 17 to 21.

Table 1: Learners' profiles

Biographical Information	Categories	Learner Names (L = Learner)	Total Number
Age	17–31	L1, L2, L3, L4, L5, L6, L7, L8, L9, L10	10
Gender	Female	L1, L2, L3, L4, L5	05
	Male	L6, L7, L8, L9, L10	05
Groups	Group 1 (G1)	L1, L3, L5, L7, L9	05
	Group 2 (G2)	L2, L4, L6, L8, L10	05

Sharing circles are like focus groups, but they emphasise learning through discussion (Chilisa, 2012). In this study, sharing circles were employed to understand learners' perceptions of using Indigenous knowledge (IK) to learn about Newton's second law of motion. The learners were asked to find information from their communities about Newton's second law, and their findings were then discussed in the sharing circles. During the first trial of the sharing circles, a group of five learners was chosen by their peers to represent them. However, it became clear that some learners were dominating the discussions, while others struggled to contribute.

To solve this problem, we introduced a sharing stick in the second sharing circle. The stick was passed around, and only the person holding it could speak. Once they were done or if they had nothing more to say, they passed it to the next person. This method ensured that everyone had an equal opportunity to contribute to the study. In addition, learners were asked to keep journals in which they reflected on their experiences with the sharing circles and the sharing stick. These reflections provided insights into learners' perceptions of the strategies and their impact on participation.

The data were analysed using an inductive thematic approach, allowing themes and subthemes to emerge from the qualitative data. For instance, data from the sharing circles was coded to identify patterns in participation, sharing circle dynamics and the use of the sharing stick. Learners' reflective journal entries were also analysed to extract themes related to engagement, confidence and participation.

Ethical clearance was granted by the university following approval from the Eastern Cape Department of Education to conduct the research. An approval letter was then submitted to the principal of the participating school, along with assent and consent forms for the participants and their parents. Before conducting the interviews, we explained the study's purpose to the learners, who voluntarily agreed to participate. We also requested permission to videotape the sharing circles. To protect their identities, the participating learners remained anonymous and are referred to by pseudonyms, such as Learner 1 (L1) and Learner 2 (L2). The school's identity will also remain confidential.

FINDINGS AND DISCUSSION

The themes were developed by coding recurring patterns from the interviews and in learners' reflections, then grouping related ideas into clear categories. The key themes that emerged from the focus group interviews and learners' reflective journals are discussed below, highlighting how the cultural tools mediated social interaction, conceptual development and equitable participation in the Grade 11 Physical Sciences classroom. Vygotsky's (1978) sociocultural theory served as the theoretical lens, with an emphasis on mediation, culture, language, social interaction, and the ZPD.

Structured dialogue and collaborative meaning-making

One key finding was that sharing circles created a structured space for learners to articulate and refine ideas collaboratively. Learners reflected on how this practice enabled them to express their thoughts and listen to their peers, thereby enhancing their understanding of abstract concepts. L3 stated, "In the sharing circle... you gain more points and are able to hear some people's views", indicating that the sharing circle encouraged diverse perspectives and mutual cognitive scaffolding. This collaborative engagement aligns with Vygotsky's (1987) emphasis on the importance

of social interaction for cognitive development, as learners co-constructed knowledge through dialogue with their peers.

The sharing circle created opportunities for learners to clarify and challenge ideas within their ZPD. L4, for example, observed the benefit of group discussions, noting, “You are able to talk and listen to other points with your group and understand more about the activity”. This highlights how sharing circles serve as mediational spaces for learners to refine their understanding through social interaction and guided participation.

Equitable participation through mediational artefacts

The data from learner journals indicate that sharing circles were effective mediational tools that fostered peer interaction and collaborative knowledge building. Learners described how the structured format of the circle helped them hear diverse ideas and process content collectively. For example, L3 reflected, “In the sharing circle... you gain more points and are able to hear some people’s views”.

This reflects the value learners placed on the group's dialogic process. Sharing circles created a space for meaning-making, not in isolation but through dialogue, aligning with Vygotsky’s (1978) sociocultural theory, which posits that cognitive development initially occurs on a social level before being internalised individually.

Several learners reported that these discussions enhanced their understanding of scientific concepts by connecting abstract ideas to real-life experiences. For instance, L7 wrote, “Understanding different forces and the impact of mass and acceleration”. This connection between learner talk, peer engagement and conceptual understanding supports Affolter’s (2020) view that structured social interaction facilitates the integration of theory and practice. In addition, references to familiar examples such as wheelbarrows, cars and the Indigenous game *umtyibilizi* demonstrate the power of contextualised learning (Fadiran, Van Biljon and Schoeman, 2018; Stott, 2016).

The sharing stick also served as a mediating tool, ensuring equitable participation in the sharing circle. It allowed each learner an equal chance to speak, fostering inclusivity and reducing dominance by more vocal learners. This practice supports Vygotsky’s notion that cultural tools, like the sharing stick, mediate interactions and the flow of communication. The stick also helped regulate the structure of conversations, ensuring that learners took turns, that each voice was heard, and that engagement was equitable.

L4 reflected on how the sharing circle created a safe space for nervous learners to share their thoughts: “I was nervous because I wasn’t sure if I was going to share the correct information”. The sharing stick thus provided a mechanism for learners to navigate their anxieties, promoting a sense of safety and belonging within the group. This aligns with the work of Affolter (2020), who argues that cultural tools can shape communication norms, thereby fostering inclusivity.

Bilingual expression as cognitive access

Bilingualism was a critical factor in mediating learners' understanding of Newton’s second law. Learners’ frequent code-switching between isiXhosa and English

reflected their use of both languages as cognitive tools. Learners used their home language to access foundational understanding while transitioning to English for scientific terminology, as seen in L9's statement: "Si-understand-a uba uNewton's second law *uthi noba ugqibo kwenza ntoni kodwa uba kulento uyenzayo uno-apply-a iforce*" (We understand that Newton's second law says in whatever you are doing you apply a force).

This illustrates how learners navigated between everyday and scientific discourse, a phenomenon Aikenhead and Jegede (1999) termed border crossing. The sharing stick helped structure this negotiation by creating a culturally safe environment where both isiXhosa and English could coexist in the service of meaning-making (Mapfumo, 2024; Otulaja and Ogunniyi, 2017).

This bilingual engagement aligns with Vygotsky's (1978) assertion that language plays a fundamental role in cognitive development. Learners bridged the gap between everyday knowledge and formal scientific language by using both isiXhosa and English, thereby enhancing their comprehension. This finding supports the work of Otulaja and Ogunniyi (2017), who advocate for bilingual pedagogies that enable learners to transition between informal and formal discourse, thereby promoting a deeper conceptual understanding.

Cultural relevance and learner engagement

The integration of cultural practices into the science lessons further mediated learners' connection to the material. For example, L6 noted, "I learnt that Indigenous mountains got to be an activity thing, and they are attracted to play the game called *umtybilizi*, where forces can be seen..." showing that learners related the science concepts to their everyday experiences. Similarly, L1 noted that cultural context enhances problem-solving: "Cutting grass on the mountain before playing the game demonstrates how personal and cultural experiences influence problem-solving approaches." By embedding IK into the lessons, the teacher created culturally relevant learning experiences that bridged scientific concepts and learners' lived realities.

This approach aligns with Vygotsky's (1978) belief that cultural tools shape thought processes and supports Seehawer and Breidlid's (2021) advocacy for contextualising science learning within learners' cultural practices and knowledge. These findings underscore the importance of integrating local cultural practices to make learning more engaging and meaningful.

Growth within the zone of proximal development

The use of the sharing stick within the circle further mediated learners' interaction by promoting turn-taking and respect for each learner's voice. As a cultural and physical tool, the stick ensured that learners, especially those who might otherwise remain silent, were included in the conversation. L4's reflection captures this dynamic: "I was nervous, but I was happy that I got a chance to share". This shows how the sharing stick supported learners operating in their ZPD by providing emotional safety and predictability in the interaction. The stick functioned as a mediational artefact, guiding learner behaviour and facilitating cognitive participation (Schneuwly and Leopoldoff, 2022; Zaretsky, 2021).

The reflective journals provided clear evidence of learners' growth within their ZPD. As they engaged in collaborative activities and discussions, learners moved from uncertainty to greater understanding. L3 expressed, "I was nervous because I wasn't sure if I was going to share the correct information", indicating that the learner was operating within their ZPD, requiring guidance and peer support to gain confidence. As learners interacted with peers and the teacher, they received the necessary scaffolding to gradually internalise complex concepts such as force components and the relationship between mass and acceleration.

The learners' progression in understanding, from initial uncertainty to more confident problem-solving, supports Vygotsky's (1978) assertion that effective teaching occurs within the ZPD. Similarly, L7's progression in grasping Newton's second law, from basic knowledge to a more detailed understanding of forces ("Understanding different forces and the impact of mass and acceleration"), demonstrates how scaffolding (Bruner, 1960) and peer support contribute to the development of competence over time.

CONCLUSION

This study explored how the integration of cultural tools, specifically sharing circles and the sharing stick, mediates social interaction and supports collaborative meaning-making among Grade 11 Physical Sciences learners during lessons on Newton's second law. Grounded in Vygotsky's sociocultural theory, the research demonstrated that dialogic pedagogical strategies and cultural artefacts can serve as effective mediational means for both conceptual development and learner engagement.

The findings further demonstrated that sharing circles created a structured, inclusive space for collaborative dialogue, enabling learners to co-construct knowledge through peer engagement and teacher guidance. These circles supported the integration of theoretical concepts with real-life experiences, fostering deeper understanding. The process encouraged learners to function within their ZPD by providing opportunities for guided participation and cognitive growth. Vygotsky's (1978) notion that learning is inherently social was evident in the way learners built meaning collectively through structured interactions.

The sharing stick functioned as a mediational tool that ensured equitable participation. It promoted turn-taking, reduced dominance by more confident learners and gave space for quieter voices to be heard. Beyond its procedural role, it served as a symbolic and cultural artefact that created a safe environment for bilingual communication, allowing learners to shift between isiXhosa and English. This supported cognitive engagement and facilitated access to both everyday and scientific discourse. The use of the sharing stick, in combination with culturally relevant activities, provided learners with both emotional safety and intellectual structure to explore abstract scientific ideas.

These Indigenous strategies helped to create a more equitable learning environment, fostering increased engagement and collaboration among learners. By giving every learner a voice and encouraging peer interactions, teachers can enhance understanding and participation in science, ultimately leading to more effective learning experiences. Future research should explore ways to further refine

participation strategies and address the remaining barriers to full engagement, particularly in multilingual classrooms.

Recommendations

Despite the success of the sharing stick and group discussions, challenges remain. Some learners continued to face language barriers, which affected their ability to fully engage in discussions. Future studies could investigate how bilingual strategies or language support interventions can help overcome these barriers and enable all learners to participate fully in science lessons.

Disclosure statement

The authors declare no competing interests.

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