Journal of Culture and Values in Education

https://cultureandvalues.org

E-ISSN: 2590-342X

Volume: 7 Issue: 1 2024

pp. 19-36

Chronicling the Experiences of Life Sciences Teachers and Learners on the Usage of Enquiry-Based Learning in Enhancing Learners' Academic Performance

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Article Info
Received: November 18, 2023
Accepted: January 14, 2024
Published: February 23, 2024

10.46303/jcve.2024.2

How to cite
Siphukhanyo, L., & Olawale, B. E. (2024). Chronicling the experiences of life sciences teachers and learners on the usage of enquiry-based learning in enhancing learners' academic performance. *Journal of Culture and Values in Education*, *7*(1), 19-36.
https://doi.org/10.46303/jcve.2024.2

ABSTRACT
Life sciences research provides critical insights into disease processes and allows for the development of novel treatments and innovative medical technologies, thereby directly improving human health and technology. Despite the widely acknowledged relevance of life sciences, there has been a long-term pattern of low performance. This is due to inefficient teaching methods, as how a lesson is delivered influences the learners' level of understanding, among other things. Hence, the present study examined the experiences of life sciences teachers and learners in using IBL to enhance the academic performance of life science learners. This study was underpinned by the interpretivism paradigm, a qualitative approach, and a participatory research approach. The study population consisted of all life sciences learners in a rural school in the Amathole West district, Eastern Cape province of South Africa, from which 2 life sciences teachers and 14 learners were conveniently sampled. Data were collected using interviews, observations, and document reviews, and they were analysed using thematic analysis. The research findings revealed that enquiry-based learning has the potential to foster the development of critical thinking, problem-solving, and communication skills among life sciences learners. However, several issues make it difficult to successfully implement enquiry-based learning in the context of teaching and learning life sciences, including a lack of resources, time constraints, misreading of instructions, a lack of support or supervision, and a lack of pedagogical topic expertise among teachers. The study concludes that enquiry-based learning, when done right, can help learners understand life sciences concepts deeper and remember what they have learnt for a longer period.

KEYWORDS
Curriculum; enquiry-based learning; method; performance; life sciences.

INTRODUCTION

Any system of knowledge that deals with the physical world and its phenomena is referred to as science (Tang, 2020). It encompasses objective observations and methodical experiments, as well as the pursuit of knowledge that embraces universal facts. Aparicio-Ting and Slater (2019) define life science as a branch of science that studies living things and their fundamental processes. The study of life sciences contributes significantly to our understanding of disease processes and makes it possible to develop new treatments and cutting-edge medical equipment that improve both human health and technology (Aparicio-Ting & Slater, 2019). It produces ongoing innovation (organisational, managerial, and technological), which is responsible for productivity gains as well as the dynamic competitive advantage of companies, sectors, and countries in the emerging global economy (Navalpotro, 2021). Although life sciences is widely acknowledged to be important, there has been a long-standing trend of low performance in this subject (Butler, 2018), and South African students are no exception. Given that the way a lesson is delivered affects both its effectiveness and the students' degree of understanding, Reche (2018) contends that this is the result of inefficient teaching methods. According to Trujillo-Torres (2018), a significant relationship exists between a teacher's grasp of the subject matter, instructional approach, and the academic achievement of students. Consequently, the utilisation of insufficient pedagogical approaches persists in eliciting disengagement among learners, subsequently leading to subpar academic achievement (Ngema & Maphalala, 2021). To address the difficulties associated with subpar academic achievement in the field of life sciences, educators should effectively employ several pedagogical approaches such as visualisation, cooperative learning, technology integration, and Enquiry-Based learning (IBL). These tactics have been recognised as highly effective means of mitigating the negative impact of low performance (Tammen, et al., 2018).

IBL is one of the best teaching strategies that can improve performance in the biological sciences (Tammen et al., 2018). In IBL, students ask, investigate, and respond to questions to put themselves at the centre of the learning process and take responsibility for their education (Onyema, 2019). According to Loeng (2020), it is also recognised as a form of self-directed learning technique where students assume accountability for their education. IBL is recognised as a teaching approach that fosters the growth of students' critical thinking and problem-solving skills (Gholam, 2019). Cheng et al. (2022) assert that IBL encourages students to formulate questions as a means of learning about a particular subject as opposed to imparting knowledge conventionally, like a lecture. According to Al Mamun (2020), enquiries in an IBL approach serve to delineate learning requirements, ignite students' curiosity, and cultivate the capacity for analytical thinking. According to Baharin et al. (2018), this strategy enables students to engage in problem investigation, explore alternate solutions, conduct observations, pose enquiries, experiment with ideas, and engage in creative and instinctual thinking. In contrast, IBL engages students in scientifically oriented projects that cultivate their ability to prioritise evidence, assess explanations, and substantiate their decisions (van Riesen, 2018). Although the necessity

for enquiry-based teaching and learning is becoming more widely acknowledged, many South African educators find it challenging to implement this pedagogical approach, especially in rural schools (Machado & Nahar, 2021). The employment of outdated, ineffective teaching techniques by teachers is the main source of the severe issues with the teaching tactics they employ when instructing science classes (Mabhoza & Olawale, 2024; Olawale & Hendricks, 2024), which harms learners' performance in the life sciences (Antonenko, 2019). Hence, the present study aimed to examine the experiences of life sciences teachers and learners in using IBL to enhance the academic performance of life science learners.

LITERATURE REVIEW

The benefits of using enquiry-based learning methods in teaching and learning science subjects

Life sciences is viewed as one of the most crucial subjects in our education to increase motivation and participation. According to Romero-Ariza (2020), learners who are interested in their learning are most likely to be motivated to continue learning new information and abilities. Learners are inspired to immerse themselves in the learning process by adopting this learning approach, and when they reach their conclusions, they will be able to research different topics, make additional connections, ask questions, and learn more (Oliver, 2020). Enquiry-based learning seems to be one of the strategies that increase the motivation and engagement of the learners. Also, Robledo and Miguel (2023) investigated the effects of enquiry-based learning in teaching and learning sciences and how it would improve learners' grades in Turkey. Based on the research findings, it was suggested that learners work in groups, given that the strategy can help students develop collaboration and communication skills essential for scientific research. Similarly, a study conducted by McLoughlin and Findlayson (2020) explored how IBL improved the engagement of teachers and learners in Ireland. It was reported that enquiry-based science education has been promoted into modern times as an innovative teaching and learning methodology that engages students in science and motivates them to pursue careers in this area (McLoughlin & Findlayson, 2020). Through this approach, learners have become capable of identifying main questions and finding relevant answers. This is because IBL fosters ownership among learners, allowing them to research topics of personal interest as well as those of others, enhancing their autonomy in learning (Ruzaman, 2020). As stated by Grandgenett and Boocker (2015), the implementation of IBL facilitates learner engagement and acquisition of knowledge through personalised and comfortable approaches. By utilising open-ended questions, learners are encouraged to employ their problem-solving strategies and cognitive processes, thereby assuming a central role in the learning process (Aparicio-Ting, 2019). The effectiveness of setting objectives for learners and monitoring their progress is maximised when learning and development initiatives foster a culture that promotes ongoing enhancement (Rosmaiti, 2021). In general, IBL facilitates the development of learner ownership, as supported by research conducted by McLoughlin et al. (2015), Ruzaman (2020), and Mansour (2021).

Challenges of using enquiry-based learning in teaching life sciences

Teachers have considerable challenges due to the misconception of the IBL method. One of the misconceptions held by certain educators in IBL classrooms is the assumption that learners will autonomously direct their learning (Gholam, 2019). According to Penn (2020), some educators engage in enquiry-based practices due to their adherence to the guidelines provided in the Curriculum and Assessment Policy Statement (CAPS) about the implementation of classroom strategies. Moreover, arguably, educators have challenges in stimulating students' curiosity and engagement with a subject matter before granting them the opportunity to pursue an autonomous investigation or collaboration with peers (Eltanahy, 2019). Some learners begin to complain about IBL and consider it uninteresting, losing interest and motivation, and this misperception is seen as a difficulty in teaching and learning. Another problem that teachers encounter is the emergence of unstructured groups. Some learners in unstructured groups are unlikely to cooperate because they lack knowledge on how to collaborate and exchange ideas for the tasks provided to them (Khalaf, 2018). Failure to form organised groups is comparable to conventional learning in that there is no obligation for learners to collaborate to attain the group's goal (Romero-Ariza, 2020). This drives other students to compete with one another or work alone in order to achieve their objectives (Gholam, 2019). According to Gholam (2019), another challenge of implementing IBL lies in the struggle that some students become unwilling to collaborate with others on the prescribed assignment. Similarly, the size of the class harms both students and teachers. This is due to time spent scolding some students rather than instructing (Bovill, 2020).

Anderson and Cha (2019) noted that classrooms should have at least 30 students for IBL to be effective because smaller scientific classes are easier to manage; nevertheless, adopting IBL will be challenging if classes are overloaded. As a result, (Firman et al., 2019) cite class size as one of the issues in the IBL class. Large classes are difficult to manage, and usually, they perform poorly. Students are less disruptive in smaller classes, and teachers spend less time on discipline, thus providing more time for lectures. Instructors' views have a substantial impact on IBL adoption, particularly in rural regions where instructors are less likely to use IBL in their lessons (Crotty, 2020). According to Fränkel et al. (2023), science teachers' attitudes regarding enquiry-based methods influence their teaching practices; when teachers' basic values contradict enquiry practices, using IBL as a teaching strategy becomes challenging. Similarly, beliefs are one of the most significant problems that science teachers confront while using IBL as a teaching and learning strategy (Romero-Ariza, 2020). Romero-Ariza (2020) adds that most science teachers are untrained in the use of IBL as a teaching approach, hence, they struggle with IBL since they were not taught how to use it (Romero-Ariza, 2020). On the other hand, many teachers avoid IBL due to a lack of information about it and a preference for teacher-centred methods (Vella, 2021). As such, if these difficulties are not addressed, IBL implementation may be unsuccessful and ineffective.

THEORETICAL UNDERPINNINGS

This study is theoretically grounded in constructivism learning theory, which dates back to Jean Piaget's 1936 cognitive-developmental work. According to the educational theory known as constructivism, students learn new material by integrating it with what they already know through social discourse and experience rather than by passively absorbing it through a direct process of knowledge transmission (Weingartner, 1969). According to Beilin (1992), the constructivist learning theory, as expounded by Piaget (1930), posits that the most effective means of acquiring knowledge is through active creation and introspection. Hence, knowledge can be understood as an individual's subjective interpretation. Amineh and Asl (2015) assert that students are expected to engage in the analysis of instructional materials and construct their interpretations drawing upon personal beliefs, prior experiences, and cultural context. Within the constructivist framework, it is widely recognised that two distinct schools of thought exist: cognitive constructivism and social constructivism. According to the cognitive constructivist perspective, the process of knowledge construction is influenced by an individual's subjective interpretation of their active experiences (Chiari & Nuzzo,1996). The second school of social constructivism posits that human development is contingent upon social context, and information acquisition is facilitated by interpersonal exchanges (Vygotsky et al., 1934).

According to Piaget's constructivism thesis, people learn from their experiences and create meaning. Learning theories, instructional strategies, and educational reform were all included in Piaget's philosophy (Hein, 1991). Assimilation and accommodation are two essential elements in the formation of a person's new knowledge. The process by which a person integrates new experiences into preexisting ones is known as assimilation (DeVries, 2000). Ultimately, this changes people's perceptions by inspiring them to form fresh viewpoints, examine long-held beliefs, and choose what matters. Contrarily, accommodation is the process of reinterpreting the outside world and novel experiences considering one's preexisting mental capacity (Murray, 2012). People have certain ideas about how the world should work. When items do not function in the situation, they must adjust and reframe the outcomes' expectations.

Constructivism, as advocated by Piaget, is concerned more with the process of learning than the causes of learning. Teachers are incredibly important. In this concept, teachers help students deepen their understanding by acting as facilitators rather than lecturers. This shifts the emphasis to the learner and their learning rather than the teacher and the lecture. In addition, the resources and lesson plans required for this theory of learning differ from those used in traditional education. The instructor ought to start posing enquiries in place of telling (Goodyear & Casey, 2015; Adebola, 2021). In this case, the facilitator must make sure that the student learns from their conclusions rather than being instructed by providing answers to questions that are only relevant to their curriculum. Furthermore, teachers engage in ongoing conversations with students, resulting in a learning experience that is open to several paths

depending on the students' requirements as the learning progresses. Rodwell (1998) stressed that teachers who adhere to the constructivism theory must push their pupils to become good critical thinkers and serve as mentors, counsellors, and coaches in addition to being teachers.

Problem Statement

Educational institutions worldwide are actively endeavouring to achieve favourable outcomes in the domains of Mathematics and Science (Gudyanga, 2019). According to Maringe et al. (2015), educational institutions in South Africa are significantly disadvantaged in terms of their scientific experimentation capabilities due to insufficient funding. According to Jita (2019), European science education has transformed conventional instructional approaches to IBL, resulting in enhanced comprehension and knowledge acquisition among students. Although there is a consensus regarding the necessity of enquiry-based teaching and learning, numerous educators in South Africa, particularly those in rural schools, struggle to include this pedagogical method (Machado, 2023). The utilisation of teaching methodologies in science courses by educators is currently facing a significant issue. The primary factor contributing to the low performance of students in life sciences is the utilisation of outdated and inadequate instructional approaches (Antonenko, 2019). Thus, in the present state of science education, it is imperative to teach science topics to integrate modern teaching and learning approaches that bridge the disparity between the knowledge imparted in schools and that knowledge acquired from other information sources (Cabalang & Cabalang, 2022). In light of this, it is imperative to seek out novel pedagogical methods and approaches that are more efficacious in the realm of science education to enhance learners' engagement, motivation, and academic performance.

Research Question

i. What are the experiences of life sciences teachers and learners on the use of enquiry-based learning in enhancing learners' academic performance?

RESEARCH METHODS

Underpinned by the interpretivism paradigm, this study employed a qualitative research approach. According to the interpretivism paradigm, a single phenomenon can have multiple interpretations, making reality multifaceted and diversified (Leader, 2020). It encourages the notion that individuals actively create their social reality through their intentional and creative acts. According to interpretivism, meanings and understandings at the social and experiential levels form the intersubjective foundation of reality (Galimberti & Spanò, 2017). The foundation of interpretivism is the qualitative approach to data collecting, which includes observation and interviewing (Schmidt, 2020). This study used a qualitative research approach as a result. To ascertain the underlying significance of the situation, this method used phases of reasoning (Blackstone, 2018). Because the qualitative research approach focused on obtaining as much information as possible from a limited sample size, it was determined to be appropriate for this study (Bai et al., 2020). Given that participants can express themselves while providing data, it is a more flexible method (Creswell et al., 2020). Besides, the qualitative research approach was

a good fit for this study because it helped the researchers better understand the challenges that teachers and students face when teaching and learning the biological sciences and strive to devise innovative solutions.

The design of the study was participatory action research. As per Galletta and Torre (2019), participatory action research (PAR) is regarded as a qualitative investigation that is democratic, equitable, freeing, and enriching of life, setting it apart from other qualitative approaches. For this study, two life sciences teachers and fourteen Grade 10 life sciences learners from a chosen school in Buffalo City Metro District, Eastern Cape Province, were conveniently sampled, making a total of 16 participants. The school is a well-performing school in the sub-urban areas of Bisho, the capital of the Eastern Cape Province, South Africa. During participant selection, gender equity was considered in the selection of 8 female learners and 8 male learners, as well as 1 male and 1 female teacher. As a result, data were acquired through observation, document analysis, and in-person semi-structured interviews with instructors and students studying the life sciences. Documents for analysis included all the CAPS documents, report cards, and performance sheets. The triangulation of data sources guaranteed the reliability of the data. Confidentiality, anonymity, and privacy were preserved for ethical reasons, except for information indicating that no harm would be done to a person. Before the commencement of data collection, this provision was explained and accepted, and each participant's consent was requested.

Data Analysis

The methodical use of logical and/or statistical techniques to characterise, illustrate, and evaluate data is known as data analysis (Vanier et al., 2021). The researchers employed a thematic analysis for this investigation. The process of extracting themes from a dataset involves going over it and searching for consistent patterns in meaning (Braun & Clarke, 2021). Thematic analysis is a type of qualitative data analysis. There are multiple approaches to conducting thematic analysis, but, the most widely used approach has six stages: familiarisation, coding, generating themes, reviewing themes, defining, and labelling themes, and writing up (Braun & Clarke, 2021). A helpful method for comprehending events, ideas, or behaviours within a data collection was thematic analysis. For this study, thematic analysis made sense because it offered the benefit of being a flexible approach to qualitative analysis and that allowed the researchers to produce new insights and concepts derived from data.

RESULTS AND DISCUSSION

This study examined the experiences of life sciences teachers and learners on the use of enquiry-based learning in enhancing learners' academic performance. The results and discussions are presented under the following themes:

- Benefits of using enquiry-based learning in the teaching and learning of life sciences
- Challenges of using enquiry-based learning in the teaching and learning of life sciences.

Table 1.

Code representing the research participants

Participants	Codes
Life Sciences Teacher 1 &2	LST 1 & LST 2
Life Sciences Learner 1,2,3,4……14	LSL1, LSL2, LSL3……. LSL14

Benefits of using enquiry-based learning methods in teaching and learning science subjects

To understand the benefits of using enquiry-based learning methods in teaching and learning life sciences, participants were asked, **"**In what ways has the implementation of enquiry-based learning improved the academic performance of Grade 10 learners in life sciences?" The research findings reveal that the implementation of enquiry-based learning has helped most teachers to improve their results in their classrooms, assisted learners in mastering their thinking skills, and enhanced collaboration.

For instance, a teacher said that:

> *The implementation of enquiry-based learning in Grade 10 life sciences has been shown to improve academic performance through active engagement and developing critical thinking skills. These positive outcomes contribute to learners' success in the subject and their ability to apply scientific principles effectively. (LST1)*

Similarly, another teacher posits that:

> *Learners were tasked with conducting an enquiry-based investigation into a local ecosystem. They explored the interrelationships between different organisms, studied environmental factors, and analysed the impacts of human activities. Through data collection, conducting experiments, and drawing conclusions, learners gained a profound understanding of ecological concepts and the delicate balance within the ecosystem. (LST2)*

From the above, it is evident that IBL means helping learners to collaborate and improve their problem-solving skills with the teachers. However, this understanding of IBL is in line with those of learners who stated that:

> *The implementation of enquiry-based learning has made me understand life sciences better and made me know how to apply what I am learning in real life. It encouraged me to think more outside the box and helped me understand life sciences and how it works in real life. So, rather than solely relying on our teachers and textbooks, this approach encourages us to explore, investigate, and discover knowledge from our curiosity. (LSL1)*

Furthermore, research findings show that learners do not gain only one or two skills when enquiry-based learning is implemented in the teaching of life sciences, but they also acquire thinking skills and collaborative skills, which help them work cooperatively., Furthermore, using IBL has assisted learners in conducting experiments on their own, as well as working with peers collectively, which has strengthened their communication skills. A learner also supports the above view by claiming that:

> *Enquiry-based learning has helped me better in doing group work and understanding projects and also made me able to do experiments. It has helped me to engage more in group work and made me more curious about experimenting. Also, it helped me to think critically and has made me understand life sciences better in the outside world. It has broadened my understanding of life sciences because I get to connect with the real world and learn new things. (LSL 8)*

Similarly, another participant iterates:

> *Using this method allows us to learn more interestingly because we can conduct research, work in groups, solve problems together with my friends …. and I even learn a lot from them when we work in groups because we are all working towards the same goals. (LSL 14)*

Research findings from the above revealed that IBL requires learners to solve problems and make connections between different concepts, which helps them develop valuable problem-solving skills that are essential in the study of life sciences. Similarly, the findings revealed that the use of IBL in teaching and learning of life sciences encourages critical thinking, fosters curiosity and motivation amongst learners, promotes a deeper understanding of life sciences concepts through experiments and hands-on approach, and encourages collaboration and communication through teamwork. These findings are similar to those of Cabalang and Cabalang (2022), who stated that enquiry-based learning is an educational approach that facilitates learners in actively engaging in the processes of knowledge generation and acquiring information through enquiry. As such, this approach entails cultivating research skills among learners, leading to the eventual adoption of a lifelong learning mindset (Cabalang & Cabalang, 2022). During observations, it was evident that the learners actively engaged in the learning process through different enquiry-based learning activities such as projects, group work, and classroom debates. This showed the heightened level of curiosity and motivation to explore scientific concepts and phenomena. Through hands-on experiments and research, learners gained a deeper understanding of life sciences topics, demonstrated by their ability to apply knowledge to real-world situations. Additionally, the collaboration and communication skills of Grade 10 learners were enhanced through enquiry-based learning.

The findings from the interview and observation corroborate those of the reviewed document. The CAPS for life sciences Grades 10-12 emphasises the effective use of different teaching and learning strategies to improve the performance of learners. Similarly, one of the specific aims of the policy document emphasises establishing numerous links among various ideas and concepts because the establishment of linkages allows learners to effectively transfer and use their acquired information in novel and unfamiliar situations. According to Berhanu and Sheferaw (2022), the implementation of enquiry-based learning in the teaching and learning of life sciences has the potential to create such linkage, augment student engagement, bolster academic accomplishment, and foster the cultivation of higher-order thinking skills. Similarly, Gholam (2019) maintains that an enquiry-based learning (IBL) environment provides students

with an opportunity to participate in a genuine process that reflects real-world practices. In this environment, students develop and utilise seven crucial skills, including critical thinking, problem-solving, collaboration, leadership, agility and adaptability, initiative and entrepreneurialism, effective oral and written communication, as well as information access and analysis, in addition to curiosity and imagination. Enquiry-based learning is rooted in the theoretical framework of constructivism, a learning theory that asserts that individuals actively construct their knowledge and derive meaning from their unique experiences (Tamim & Grant, 2013). IBL enables the acquisition of information (learning) through active construction rather than passive transmission facilitated by the teacher.

Challenges of using enquiry-based learning in teaching and learning life sciences

To understand the challenges in the use of enquiry-based learning for teaching and learning life sciences, participants were asked, "What are the challenges of using enquiry-based learning in the teaching and learning of life sciences?" Research findings revealed that the use of IBL is more time-consuming than the traditional lecture style method, given that it requires more facilitation and guidance from the teachers. For instance, a participant shared that:

This type of teaching approach seems to be good, but the problem is that it takes so much of your time as a teacher because you have to move from one group to the other, and by the end of the teaching period, you realise that you have not covered what is expected of you in that period – this is why most of the time I teach using the traditional way. (LST 2)

While time management seems to be one of the major challenges in the use of IBL in teaching and learning life sciences, research findings also revealed that a lack of resources, and teacher pedagogical content knowledge also contribute to the non-implementation of IBL. For instance, a participant stated:

> *…I think this teaching method is very interesting, but it could have been funnier if the teacher had provided us with materials that bring life to the class. For instance, when we were taught animal behaviour, the teacher only showed us from our textbooks instead of taking us to observe these animals ourselves and write down what we observed. (*LS11)

In line with the above response, another participant indicated:

> *There is a lot that we would like to teach our learners, but we do not have enough materials or resources that can accommodate this type of teaching approach. Sometimes, you want to implement that specific strategy, but you end up using the traditional approaches because the number of learners in my class is too much and my class is small, therefore, it becomes very difficult to teach and assess them using the IBL strategy. (LST 1).* Similarly, a participant added thus:
>
> *The teaching method is good and interesting, but whenever we try to solve a task through enquiry, we most times misunderstand the question, and this always leads to a lack of interest to fully engage in the teaching and learning activities.* (LS8)

From the above, it is evident that a good instructional strategy is not without a hitch. This view was corroborated by a participant who stated thus:

This is a good teaching method which is different from what our teachers used to teach us but sometimes, when a question is posed, you get confused and need the teacher to provide clues on how to go about answering the question you realise that by the time you are calling the teacher, someone else also needs her assistance. (LS13)

Research findings from the above responses revealed that although enquiry-based learning helps learners develop critical thinking, problem-solving, and communication skills, its effective implementation is not without some challenges. Hence, the findings revealed that limited resources, time constraints, misinterpretation of instructions, limited support or guidance, and teacher pedagogical content knowledge contribute to the challenges that hinder the implementation of IBL in the teaching and learning of life sciences. These findings corroborate those of the formal observation. During observation, it became very evident that life sciences teachers sometimes switch from the use of IBL to a traditional approach of teaching, which makes them struggle to finish the topic at hand within the allocated time. The observation findings also indicate a lack of resources in the field of life sciences that support the implementation of enquiry-based learning. Additionally, the large class size poses challenges for teachers in providing individualised assistance and assessing student work. These findings corroborate those of some studies (Alhendal et al., 2015; Gelder et al., 2015; Quigley et al., 2011), who stated that the primary problem for educators who possess the necessary training and qualifications to teach using enquiry approaches typically revolves around the issue of large class sizes and its potential impact on effective classroom management.

In a similar vein, Nicol (2021) posited that educators exhibit a reluctance to employ enquiry-based methodologies due to a deficiency in essential skills about the incorporation of technology that facilitates enquiry-based learning. Additionally, teachers are deterred by the substantial temporal and energetic investments required for the meticulous preparation of enquiry-based science lessons, which are designed to foster students' substantive engagement in investigation and discourse within the classroom setting. According to Hofstein and Mamlok-Naaman (2007), the existing research literature does not provide a definitive consensus on the effectiveness of enquiry-based instruction in enhancing overall conceptual understanding. However, staunch opponents and critics of these instructional approaches argue that there is a lack of empirical evidence supporting the assertion that learners derive greater benefits from receiving partial information about concepts and procedures as opposed to complete information. Numerous scholars have contended that it is imperative to provide learners with tailored instructional support in their respective domains (Hofstein & Mamlok-Naaman, 2007; Olawale, 2023). According to Nicol (2021), it is argued that the successful implementation of an enquiry-based science lesson within a reasonable timeframe can be accomplished through effective planning, a comprehensive understanding of the curriculum's structure and topic sequence, the presence of appropriate curricular resources that can be adapted as needed, and the utilisation of pedagogical skills that incorporate technology.

Furthermore, Nicol (2021) argued that in light of the progress made in science education research and the rapid pace of technological advancements, the future of enquiry-based science instruction necessitates a deliberate emphasis on professional development within science education institutions. The objective of such professional development initiatives would be to alleviate teachers' anxiety levels while simultaneously enhancing their confidence and self-efficacy. The aforementioned areas can be enhanced by the implementation of a consistent, year-round training programme, which is bolstered by the collaboration of colleagues within the educational setting and the support of school management. Similarly, Kilinc et al. (2016) added that enhancing the technological proficiency of teachers, offering more in-service training focused on technology, and expanding access to such training for all teachers will promote the utilisation of technology in preparing students for the future.

CONCLUSION

The current study examined the experiences of life sciences teachers and students about the use of enquiry-based learning as a strategy to enhance students' academic performance. The research findings indicate that enquiry-based learning possesses the capacity to facilitate the cultivation of critical thinking, problem-solving, and communication abilities in learners. However, factors such as limited resources, time restrictions, misreading of instructions, limited support or supervision, and inadequate teacher pedagogical topic expertise pose problems that impede the successful implementation of enquiry-based learning in the context of teaching and learning life sciences. Therefore, the study concludes that when successfully implemented, enquiry-based learning can facilitate a more profound comprehension of life sciences ideas and facilitate the long-term retention of knowledge. Furthermore, this approach fosters the cultivation of essential abilities and helps learners develop important skills such as research, communication, and collaboration, which are essential for success in life sciences. Based on the aforementioned, the study recommends that life sciences teachers should encourage the use of hands-on activities, collaborative learning, and the integration of technology, which is capable of providing learners with access to a wide range of resources and information. In addition, teachers are encouraged to employ real-world applications that connect life sciences concepts to real-world examples, which can assist learners in seeing the relevance and importance of what they are learning.

Limitations

The limitations of the study were caused by two major factors: the language barrier and the nature of the research approach used for the study. Firstly, the school is in a deep rural area, therefore, learners were unfamiliar with the use of English when asking questions, and that presented a challenge for the researcher during the interview because sometimes learners did not understand the questions properly and interpreted the questions wrongly. To avoid those misunderstandings and enhance better communication, the researchers decided to address the interview questions both in isiXhosa (local language) and English. Secondly, due to the

qualitative character of the research, there was concern that certain participants could be reluctant to participate in the study due to the sensitive nature of the research topic, which delved into the ability of teachers to use teaching methods in life sciences classes. The researcher made concerted effort to explain the specific focus of the research, emphasising that the study centred on the methods employed in the instruction and acquisition of knowledge in the field of life sciences and not necessarily on their ability to use specific methods.

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