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## Teachers' Perceptions and Experiences of Integrating Islamic Indigenous Knowledge in Life Sciences teaching and learning

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**Abstract.** The Life Sciences curriculum in South Africa presents learners with complex and abstract concepts, hindering their comprehension and academic success. To remedy this situation, the Curriculum and Assessment Policy Statement (CAPS) document for Life Sciences has directed teachers to integrate Indigenous Knowledge (IK) when teaching. As such, this article presents the findings from a qualitative study exploring teachers' perceptions and experiences of integrating Islamic IK when teaching Life Sciences in Grades 10-12. In-depth, qualitative questionnaires were administered to ten teachers to collect data, while five teachers were observed integrating Islamic IK into their teaching. The teachers participating in the study were purposively selected from nine schools located in Johannesburg. The data analysis process followed Saldana's manual coding system, leading to the emergence of codes, themes, and findings. The findings showed that teachers value Islamic IK integration as essential for making Life Sciences more relatable. Several teachers described how linking cellular processes to Islamic purification practices or using dietary laws to explain human nutrition made lessons more meaningful for learners. However, teachers also expressed uncertainty about how to integrate IK systematically, citing the absence of structured guidelines and limited professional development. Data obtained from lesson observations confirmed that, in the absence of clear pedagogical guidelines, teachers relied on personal initiative to design integration strategies. Consequently, the study points to concrete needs: professional development focused on curriculum-aligned IK integration, faith-informed pedagogical workshops to support meaningful integration of Islamic concepts, and clearer policy directives outlining when and how IK should be integrated.

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## 1. Introduction

One of the significant challenges of the South African education system is that learners struggle to understand the value of learning experience, a disconnect between the theoretical science content and the natural world (Mansir, 2021). This issue is particularly prevalent in Science, Technology, Engineering, and Mathematics (STEM) subjects, such as Life Sciences. Edson and Govender (2021) have attributed this disconnect to the absence of learners lived experiences and cultural heritage in the curriculum. Although the Curriculum and Assessment Policy Statement (CAPS) for Life Sciences encourages teachers to integrate Indigenous Knowledge (IK) (Department of Basic Education [DBE], 2011), the integration of IK, including Islamic IK, remains underdeveloped in Life Sciences classrooms (Mkhwebane, 2024).

In addition, while numerous studies have addressed African IK integration, little attention has been paid to religiously grounded knowledge systems such as Islam. Mavuru (2024) has asserted that, inter alia, this is due to the failure of the CAPS document to offer detailed and clear guidance for teachers on the meaningful integration of IK when teaching. As such, this study investigated Life Sciences teachers' experiences of integrating Islamic IK when teaching various topics in Grades 10-12. In this study, IK is viewed as consistent with Tawanda and Mudau's (2024) definition of IK as a comprehensive knowledge base developed by local cultures through their interaction with the environment and transferred across generations.

There is a common notion that religious knowledge, as a form of IK, should be separated from science and treated as a separate entity (Zainuri et al., 2022). However, several researchers view science and religion as interconnected and call for integrating religious knowledge into the teaching of science (Mansir, 2021). Given that most of the existing academic research in South Africa focuses solely on the integration of African IK, the integration of religious knowledge, particularly Islamic IK, presents a step forward in re-evaluating what constitutes South African IK. In addition, the integration of Islamic IK aligns with the CAPS directive to incorporate IK into Life Sciences teaching. The CAPS document does not privilege any form of IK, rather, it advocates for the inclusion of all forms of IK, reflecting the cultural and religious diversity of South Africa.

However, without essential guiding pedagogy in the curriculum, where teachers bear excessive responsibility in integrating IK, religious systems offer a fertile foundation for the instruction and comprehension of scientific concepts. Moreover, recording the integration of IK practices can aid teachers in minimizing the unfamiliarity of the curriculum and foster a more decolonized approach to education. Sarip and Sunhaji (2021) reported that integrating religion with science can enhance learners' critical thinking abilities, strengthen comprehension, and facilitate active learning, thereby creating more authentic

student knowledge. Furthermore, when science teachers integrate IK into their teaching, science is demystified because it becomes rooted in familiar local knowledge and learners' culture, fostering a sense of belonging and inclusion.

### **1.1 Research Problem**

Several researchers have called for the integration of IK into learning spaces, citing that scientific and traditional knowledge should be viewed as complementary ways of contextualizing human interactions with the natural world (Bruchac, 2014). Mavuru and Ramnarain (2020) cite that the ongoing low achievement in science in South Africa might stem from educational environments that are disconnected from the real-life experiences of learners. In addition, South Africans possess diverse belief systems deeply rooted in their cultural viewpoints, life experiences, languages, and traditions, reflecting their spiritual heritage (Mavuru & Ramnarain, 2020). Within the South African context, a considerable portion of academic inquiry into IK concentrates exclusively on incorporating African IK, overlooking the notable presence of a Muslim community as indicated in the recent Census (Department of Statistics SA, 2022).

This indicates that when Islamic IK is not integrated into Life Sciences teaching, a significant number of learners from the Muslim community face cognitive and epistemic injustice. According to Odora-Hoppers (2015), cognitive injustice refers to a lack of recognition and acknowledgment of different forms of knowledge. In the context of this study, the lack of Islamic IK integration into science teaching indicates that this form of knowledge is currently marginalized and sidelined. Arguably, the continued marginalization of Islamic IK could lead to its loss and degradation. Hence, the current study advocates for the integration of Islamic IK to ensure that this knowledge is safeguarded, preserved, and conserved for future generations.

In an effort to preserve, disseminate, safeguard, and transmit IK, the South African government has developed policies such as CAPS, encouraging teachers to integrate IK, such as Islamic IK, when teaching. Unfortunately, several studies in South Africa paint a concerning picture of the integration of IK by Life Sciences teachers in their classrooms. These studies include Mkhwebane (2024), Mavuru & Ramnarain (2020), among others. Mavuru and Ramnarain (2020) highlight that implementing IKS into science classrooms has challenged teachers, as no explicit guidance has been provided.

A study by Mkhwebane (2024) reported that when teachers attempt to integrate IK, they tend to rely on traditional teaching methods. These methods include teachers simply narrating IK to learners and sharing one or two examples of IK with learners. This indicates that Life Sciences teachers are struggling to integrate IK meaningfully and effectively into their teaching. Against this backdrop, this study explored Life Sciences teachers' experiences with integrating Islamic IK.

## 1.2 Research Aim and Research Questions

The main question guiding this study is: What are teachers' experiences integrating Islamic Indigenous Knowledge when teaching Life Sciences in Grades 10-12?

**The study also explored the following sub-research questions:**

1. What are teachers' perceptions of integrating Islamic Indigenous Knowledge when teaching Life Sciences?
2. How do teachers integrate Islamic Indigenous Knowledge when teaching Life Sciences in Grades 10-12?

## 2. Literature review

The attempt to integrate IK within the science curriculum is not unique to South Africa (Ogunniyi, 2007), as numerous studies have emerged from other African countries, the USA, Australia, the Middle East, and Indonesia. Against this backdrop, a pressing demand exists to integrate more IK into the South African school curricula. Additionally, the existing research predominantly focuses on African IK (Reddy, 2018), overlooking the notable presence of a Muslim community as indicated in the recent Census (Department of Statistics SA, 2022).

The Pew Research Centre (2017) forecasts that Islam is set to become the fastest-growing religion globally, with the Muslim population anticipated to surge by 70 percent by the year 2060. Galal (2023) highlights that Muslims have a significant presence in Africa, with an estimated 50 percent of the continent's population identifying as Muslim. According to the recent Census (Department of Statistics SA, 2022), Islam is the third most prevalent religious affiliation in South Africa, following Christianity and Traditional African religions.

Mansir (2021) argued that challenges arise from an educational system in which learners fail to grasp the significance of learning and experience a disjuncture between theory and real-world application. Mansir (2021), therefore, advocated for integrating scientific and religious knowledge to foster a deeper understanding of the world. Moreover, the intensive and systematic integration of science and religion involves science providing a scientific interpretation of theology, while theology, in turn, lends meaning to science. Hence, science and Islam are seen as mutually reinforcing (Suparjo et al., 2021).

Purwati et al (2023) argue that integrating Islamic values into science education enhances holistic learning outcomes across the affective, psychomotor, and cognitive domains. de Beer (2019) shared similar sentiments and viewed IK as a vehicle acting as the driving force to address the affective domain within the science learning space. Additionally, utilising a socio-scientific approach to infuse IK into the Life Sciences curriculum can be beneficial in raising learners' awareness of moral dilemmas that are frequently overlooked in science classrooms (Mothwa, 2011).

As early as 1988, Ogunniyi discovered that learners' understanding of concepts in Life Sciences is significantly shaped by their religious beliefs. Hence,

neglecting spirituality within the science classroom is not viable, as it elucidates the interdependence between humans and nature. Mavuru and Ramnarain (2020) concurred and emphasised the importance of IK as learners' cultural assets representing valuable forms of capital. According to de Beer (2019), the school science curriculum is often irrelevant to the local context. It emphasizes that learners do not enter the classroom as "tabula rasa" or as blank slates. However, they are holding localized IK that could contextualize abstract scientific concepts, making science education more relevant and meaningful for learners and fostering their interest in science. Mavuru (2024), therefore, advocates for integrating learners' belief systems into the teaching and learning of Life Sciences, asserting that neglecting these beliefs could be detrimental to acquiring scientific knowledge and skills, as it may hinder the development of critical thinking.

In contrast, Polkinghorne (2010) and Forsythe (2017) believe religion and science are fundamentally incompatible and contradictory and should be viewed as separate entities. Seehawer (2018) alluded that while there have been calls for teachers to integrate IK into science learning spaces, there is a lack of clarity and guidance on the specific content and pedagogical approaches that enable such integration. Madlela (2023) added that whilst new policies may be in place, efforts to decolonise the curriculum have largely been ineffective and superficial. Mavuru (2024) notes that certain beliefs pose challenges to Life Sciences teachers when they attempt to engage in scientific discussions. Dhurumraj and Mudau (2022) reinforced this idea, citing that various divergent viewpoints exist regarding science-related topics such as evolution, stem cell research, genetic engineering, abortion, and human reproductive technologies, which conflict with Islamic notions.

It is worth noting that this could be challenging for both Muslim and Non-Muslim Life Sciences teachers to navigate around these contentious topics within the science-leaning space. Nevertheless, even though challenges exist in relation to IK integration, the researchers hold the view that IK should be integrated, and teachers should be supported by relevant stakeholders for meaningful integration.

## **2.1 Theoretical framework**

The theoretical framework underpinning this study is social constructivism, as developed by Lev Vygotsky (1978). Vygotsky's theory greatly emphasized the role of culture and language-based social interactions, citing that social exchanges between individuals are key contributors to cognitive growth (Robinson & Lomofsky, 2010). The science curriculum during the apartheid era was characterized as content-centred and had barely any connection to the lives of non-White South Africans, resulting in low levels of participation and achievement in science (Stears, 2009).

Stears alluded to Vygotsky's view that learning occurs not in isolation, but within the context of activities and social exchanges informed by daily cultural practices. Constructivism can be used to promote multicultural education by

empowering learners through the acknowledgment of different cultural experiences and ways of knowing (Stears, 2009). In line with the theory of social constructivism, the current argument is for Life Sciences teachers to break the four walls of the classroom and allow learners to contribute to classroom discussions using the knowledge from their cultural and religious backgrounds. In these classrooms with no walls, Life Sciences teachers can create culturally inclusive and responsive classroom environments that is welcoming to all learners, including Muslim learners.

### **3. Research methodology**

#### **3.1 Research design**

The approach adopted for this study was a qualitative one, which explored teachers' experiences of integrating Islamic IK when teaching Life Sciences in Grades 10-12. A collective case-study approach formed the basis of this research methodology. Creswell & Creswell (2018) refers to a case study as a phenomenon bounded by a timeframe that involves an in-depth exploration of a program, event, activity, process, or individuals. McMillan and Schumacher (2014) assert that this approach combines several individual cases into a single, comprehensive study that provides extensive data and in-depth understanding.

As such, this study collected data from ten teachers from a single location in Johannesburg. This enabled the researchers to gain more insights into the experiences of Life Sciences teachers from Johannesburg regarding the integration of Islamic IK into their teaching. Since qualitative approaches rely on diverse realities and viewpoints, this approach enabled insight into the lived experiences of the teachers who participated in the study. This was made possible by the lesson observations conducted with five teachers, wherein their lived experiences of integrating IK were practically observed.

#### **3.2 Participants and sampling**

Purposive sampling was employed in this study, which required the selection of participants with specific characteristics (McMillan & Shumacher, 2014). This study focused on teachers' experiences integrating Islamic IK when teaching Life Sciences in Grades 10-12. The sampling criteria followed were that participants had to be teaching Life Sciences in the FET Phase (Grades 10,11, or 12). This requirement ensured that participants were familiar with the subject content and pedagogical approaches utilized in teaching Life Sciences.

Moreover, the participants must adhere to the Islamic faith and be familiar with Islamic knowledge, customs, and practices to share their experiences. Accordingly, ten teachers from nine schools located in Johannesburg completed a questionnaire and participated lesson observations, with five additional teachers selected for follow up. The participants were teachers based at various public and private schools located in the Johannesburg region. These teachers were either employed by the Department of Education or the school's Board in the case of private schools.

### 3.3 Data collection and instruments

Ten Life Sciences teachers completed an in-depth qualitative questionnaire individually using Google Forms. A link and instructions were emailed to participants to help them access the questionnaire. Each questionnaire took approximately fifteen minutes to complete and consisted of a set of pre-determined, open-ended questions that ensured that all participants were asked the same questions. The questionnaire items were developed using literature related to Ik integration, and the items were: Life Sciences teachers' understanding of IK, teachers perceived benefits of integrating Islamic Ik, challenges encountered by teachers when integrating Islamic IK, and developmental support received by teachers to integrate Islamic IK.

Using Google Forms enabled participants' responses to be easily captured and accessed, thus enabling the researcher to identify themes within the responses. In addition, this collection instrument was time-efficient and eliminated the need for the researcher to transcribe participants' responses. Moreover, both participants and the researcher could access the questionnaire and the emerging data at a convenient time for them (Creswell & Creswell, 2018). The questionnaires sought to explore teachers' experiences and perceptions of integrating Islamic IK when teaching Life Sciences in Grades 10-12. The questionnaires enabled the researcher to gain insights into teachers' perceptions of integrating Islamic IK when teaching Life Sciences.

This was followed by non-participant lesson observations with five selected teachers to investigate how do Life Sciences teachers integrate Islamic IK when teaching. A rubric was utilized during the observations and provided evidence of teachers' integration of Islamic IK when teaching Life Sciences in Grades 10-12. This sample formed part of the convenience sample of the study and was selected based on their proximity to the researcher. Each teacher was observed for two lessons, which provided a total of ten lesson observations. This data collection instrument allowed the researcher to observe the natural dynamics within the research environment, facilitating a comprehensive understanding of the phenomenon being studied (McMillan & Shumacher, 2014).

The researchers acted in the capacity of non-participant observers, and thus refrained from engaging in class activities, interacting with learners, or providing guidance on instructional methods (McMillan & Shumacher, 2014). Assuming the role of a participant observer carries the potential for becoming distracted from the data collection, resulting in limited observations. Furthermore, engaging with participants or learners may have influenced their responses, thereby compromising the study's credibility (McMillan & Schumacher, 2014).

### 3.4 Data analysis

The data obtained from the questionnaires and observations were analyzed using Saldana's (2013) manual coding system. A code is typically a word or brief phrase that encapsulates a significant attribute of the data (Saldana, 2013). This process consolidated the data from each questionnaire and observations to form categories of the codes and extract themes from the participants' responses.

Themes were generated and assigned a given code, which was indicated on the questionnaire responses across all ten questionnaires. Linneberg and Korsgaard (2019) maintained that developing codes enable the researcher to organize the data, acquire comprehensive insights into the data, and make the data more accessible. Saldana (2013) assert that coding is a subjective process influenced by the type of qualitative study being conducted and the researcher's disposition.

### **3.5 Trustworthiness and validity of the study**

To ensure the trustworthiness and reliability of the study's findings, triangulation was employed by multiple data collection methods, in this case, utilizing questionnaires and lesson observations. This allowed for cross-validation among data sources and was used to establish the recurrence of patterns (Maxwell, 2008). Furthermore, it minimised the likelihood of chance associations and systematic bias inherent in a specific method, enabling a more thorough evaluation of the general patterns emerging from the data.

Since case studies are not easily generalised to populations (Yin, 2014), strict case-study protocols were followed to develop a reliable database and maintain the study's credibility. All supporting documents were retained as evidence to ensure transparency in the interpretation of data. Additionally, detailed verbatim responses were retained to preserve participants' voices and provide an authentic account that supports confirmability, enabling readers to judge the study's transferability.

The study was shaped by the positionality of its three researchers. One researcher is a member of the Muslim community and possesses an insider understanding of Islamic practices, values, and knowledge systems. This perspective offered nuanced insight into how Islamic IK is embedded in everyday life and how teachers might draw on it in their classrooms. The other two researchers do not share this religious background and approach the study from an outsider standpoint. Their distance from the cultural context required deliberate attentiveness to participants' explanations and continual reflexive engagement to avoid imposing external assumptions. The combination of insider and outsider perspectives strengthened the analysis by balancing cultural familiarity with critical distance, allowing for a more grounded and reflective interpretation of the data.

### **3.6 Ethical considerations**

Ethical clearance (certificate no: SEM 1-2023-007) was obtained from the researchers affiliated institution to ensure adherence to ethical standards throughout the study. A comprehensive proposal for this study and supporting documents were submitted for approval from the Faculty of Education Research Ethics Committee. In addition, consent forms were provided to all participating schools. Each consent form contained information about the researcher and explained the requirements and purpose of the study. Additional information provided in the consent form served as an assurance that pseudonyms would maintain anonymity and confidentiality. Participants were informed and acknowledged that their contribution to this study was entirely voluntary, and

that they could withdraw their consent and participation at any time without penalty.

#### 4. Research findings

The research findings were presented under five themes: 1. Participating teachers' biographical details, 2. Teachers' perceptions of integrating Islamic Indigenous Knowledge when teaching Life Sciences in Grades 10-12, 3. Teachers' experiences of integrating Islamic Indigenous Knowledge when teaching Life Sciences in Grades 10-12, 4. Teaching approaches reflecting the integration of Islamic Indigenous Knowledge in their Life Sciences teaching and 5. Findings emerging from observation of the lessons.

##### 4.1 The participants biographical information

Table 1 below presents the biographical details of the Life Sciences teachers who participated in this study.

**Table 1: The participants biographical data**

Participant pseudonyms	Gender	Highest qualification	Years of teaching experience	Type of school
Adam	Male	PGCE	+10 years	Public
Aleeyah	Female	B.Ed.	<5 years	Public
Maryam	Female	B.Ed. Hons	<5 years	Public
Farhana	Female	M.Ed.	<9 years	Private
Sumaya	Female	B.Ed.	<5 years	Private
Faaiza	Female	B.Ed.	+10 years	Public
Sameera	Female	B.Ed.	+10 years	Private
Raiza	Female	B.Ed.	+10 years	Private
Farhaad	Male	PGCE	<9 years	Public

The study drew on the experiences of ten Life Sciences teachers from both public and private schools in Johannesburg, representing diverse educational and religious contexts. The participants, whose pseudonyms were used for confidentiality, varied in gender, qualifications, and teaching experience, ranging from less than five years to over a decade. While most held a Bachelor of Education degree, a few held postgraduate qualifications, including honours and master's degrees. The schools also differed in learner demographics, with some serving Muslim-majority populations, others with Muslim minorities, and a few with equally distributed religious groups. This diversity provided a rich context for exploring how Islamic IK is integrated into Life Sciences teaching across different school settings and learner backgrounds.

#### 4.2 Teachers' perceptions of integrating Islamic Indigenous Knowledge when teaching Life Sciences in Grades 10 - 12

All the participants attempted to define indigenous knowledge as part of expressing their awareness and views about its integration. However, similar to the findings of Mavuru and Makhunga (2020), none of these definitions recognize IK as a valid body of knowledge that can be integrated into the science curriculum, despite later indicating that they do in fact engage in this practice during their Life Sciences teaching. Several teachers defined IK as the knowledge and belief systems unique to a specific cultural or religious group. Adam described his understanding of IK as *"knowledge unique to a specific group and normally passed on from one generation to the next"*. Razia's response referred to IK as *"knowledge that stems from a particular religion or culture"*. Nabeela described her understanding of IK as *"the knowledge that reflects religious and cultural beliefs...also (refers to) local knowledge, specific to a place or group of people"*.

Some of the participants incorporated the element of IK, recognizing its generational nature and identified the ways in which this knowledge can be transferred through storytelling, as well as engaging in traditional customs and practices. This was demonstrated in Farhana's response, *"Indigenous knowledge refers to the deep understanding and wisdom that Indigenous communities have developed over generations about their environment, culture, and ways of life. It is also knowledge that is passed down through storytelling, traditions, and practices, and is often closely tied to their specific lands and ecosystems"*. This is consistent with Tawanda and Mudau's (2024) definition of IK. Two of the participants used the terms *"wisdom"* and *"ways of life"* to describe IK. Such definitions suggest a positive view and, to some extent, indicate an appreciation for IK.

Teachers also indicated that Islamic IK should be integrated into the Life Sciences curriculum. Similarly, nine out of the ten teachers expressed that integrating Islamic IK into their Life Sciences teaching increased the content relevance for learners. This concurs with de Beer (2019), who emphasized that localised IK held by teachers and learners could be used to make science education more relevant and meaningful for learners. Only one out of the ten participants indicated that they do not integrate Islamic knowledge and perspectives into the teaching of Life Sciences, citing that *"teaching must stick to the curriculum"*.

This can be alluded to the opinion expressed by Forsythe (2017) that views religious knowledge and science as separate entities. Vandeyar (2019) highlighted that beliefs are often resistant to change, and that a teachers' ability to recognize their individual belief systems as well as those of the learners can influence how effectively they respond to diversity in the classroom. However, the responses from the remaining nine participants indicate a willingness to integrate Islamic IK. Maryam stated that *"it is a natural inclination to bring Islamic knowledge to support the content covered in the Life Sciences syllabus"*. This indicated that Life Sciences teachers support the notion of integrating Islamic IK in their lessons.

### 4.3 Teachers' experiences of integrating Islamic Indigenous Knowledge when teaching Life Sciences in Grades 10-12

All participants who integrate Islamic IK into their Life Sciences teaching indicated that this resulted in favourable outcomes for their learners. Atiyyah's response cited that learners were *"intrigued"* and *"inquired more"*, while Adam stated that his learners *"had a greater zeal for knowledge"*. Maryam stated that *"learner values and attitudes towards the subject changed considerably"*. Other responses indicated that learners demonstrated an increased willingness to participate and engage during lessons. Similarly, Mavuru and Ramnarain (2020) found that learner engagement increases when teachers are mindful of learners' cultural norms and values.

Adam expressed that his learners were able to identify with the content on a personal level and *"relate the content to their own identity"*. de Beer (2019) contends that while learners often feel alienated from the science content, the integration of IK acts as a driving force in bridging this gap. Several participants reported that learners were able to create connections between the Life Sciences content and Islamic knowledge, which led to a deeper understanding and appreciation of both their religious beliefs as well as the Life Sciences content.

Maryam, a Life Sciences teacher based at a non-denominational school, indicated that *"learners were more receptive to learning about different views"*. Farhana cited that *"despite the majority of learners being Christian, they relate quite well to my faith-based contributions"*. This alludes to Aikenhead and Elliott's (2010) assertion that the integration of IK widens perspectives by exposing learners to diverse views. While the above responses suggest that participants find value in the integration of Islamic IK into their Life Sciences teaching, the challenges experienced by participants were also highlighted in the questionnaire data. A trend emerged from the data, which indicates a greater willingness to integrate Islamic IK from participants teaching in Islamic schools, which may be attributed to the fact that this practice is *"encouraged by the school management"*, as indicated by Sameera.

Several of the other participant responses revealed that whilst participants in non-Islamic schools do integrate Islamic IK into their teaching, a degree of hesitancy and reservation is evident. Adam indicated that the integration of Islamic IK can be challenging since one's approaches must be *"universal and unbiased to accommodate [for] learners of other faiths"*. Farhaad, a Life Sciences teacher based in a public school, cited that it was challenging to navigate the teaching of *"contentious topics such as abortion, cloning and evolution"*, which had the potential to *"spark debate due to different beliefs and perspectives"* and that *"one has to be careful when discussing these topics"*.

Dhurumraj and Mudau (2022) reinforced this idea, citing that various divergent viewpoints exist regarding science-related topics that conflict with Islamic notions. Faaiza was the only participant who mentioned that she does not integrate Islamic IK into her Life Sciences lessons. She attributed this to the need to *"stick to the curriculum"* and to the fact that most of her learners are from other faiths and show little interest.

Four teachers reported that a lack of opportunities to collaborate and share best practices with other Life Sciences teachers within the immediate school environment, paired with the lack of specific resources to guide the integration of Islamic IK posed a challenge. Razia maintained that *“there is very little guidance provided on how to incorporate IK into Life Sciences lessons, it is up to teachers on how to incorporate which can be challenging at times”*. Nabeela shared similar sentiments, stating that *“I am the only Life Sciences teacher at my school. It can be difficult because I do not have any other teachers who I can share my ideas with and learn from. There are no specific resources available that stipulates what and how one should implement”*. The teachers’ responses indicated that teachers not only lack resources for Ik integration, but also there is no collaboration among them.

#### **4.4 Teaching approaches reflecting Islamic Indigenous Knowledge integration in Life Sciences classrooms**

Six out of the nine participants who engaged in the integration of Islamic IK into their Life Sciences teaching cited that reference was made to Islamic concepts, beliefs, customs, and practices during discussions. Participants were able to provide concrete examples of these concepts, which included the concept of ḥalāl, which refers to the type of diet followed by Muslims and was linked to the topic of the digestive system covered in Grade 11, as well as including Islamic perspectives on the topic of evolution covered in Grade 12. Razia indicated that she *“relates lessons to Islamic beliefs and allows learners to make comparisons and look for similarities”*.

In reference to the topic of evolution, Adam cited that *“it is important for learners to have an understanding of the conflict and how they can still learn the content without compromising their belief systems”*, which suggests that science and Islamic IK are viewed as complementary forms of knowledge and mutually reinforcing (Suparjo et al., 2021).

Participants were able to identify topics in the Life Sciences curriculum that allow for the integration of Islamic IK, some of which include evolution, diets covered under the digestive system, stages of embryonic development and pregnancy, cloning, as well as abortion. This suggests that despite the absence of clear and explicit guidelines on the integration of IK, teachers are resourceful enough to draw on their own understandings and knowledge to ensure implementation.

Five participants indicated that reference is made to teachings stipulated in verses of the Qur’ān, which is the primary religious scripture of Muslims and specifies what is lawful and prohibited, provides guidelines for social and moral conduct, and encompasses a comprehensive religious philosophy (Al-Islam, 2024). These participants also cited the reference to ḥadīth, which are a collection of sayings of the Prophet Muhammad and revered by Muslims as a key source of religious law and ethical guidance (Britannica, 2024).

Several of the participant responses indicate that teachers relate Life Sciences content to real-life experiences of learners, with Sumaya citing that *“religious knowledge is used as a guide for learners’ thinking”*. This is consistent with

observations made by Mavuru and Ramnarain (2020) that learners' understanding of concepts in Life Sciences are significantly shaped by their religious beliefs, and that neglecting spirituality within the science classroom is not viable.

Only one of the participants, Nabeela, indicated the involvement of community elders, religious leaders, and scholars as holders of IK, noting that she “*verifies and checks in with the religious leaders and scholars at my school, which can be quite helpful*”. This may suggest that several of the participants do not recognise their communities as rich reservoirs for IK and realise the potential for Islamic IK integration into the science learning space.

The responses from participants suggest that the integration of Islamic IK is used to develop an appreciation for both the Life Sciences content as well as the Islamic knowledge, with Maryam mentioning that the use of the Life Sciences content is a way to “*recognise and develop an appreciation for their Creator in the smallest of spaces, to marvel at His perfection*”.

These findings align with a social constructivist perspective, which posits that learning is a process shaped by social interaction, shared meaning, and cultural context. Teachers drew on familiar religious concepts not merely as add-ons but as culturally grounded tools for sense-making, enabling learners to negotiate scientific ideas through frameworks already embedded in their lived experiences. Their pedagogical choices—such as linking evolution to religious dialogue, utilizing ḥalāl dietary principles to explain human nutrition, or referencing Qur'ānic teachings during lessons—reflect the ways knowledge is collectively constructed within cultural settings. The reliance on discussions, comparison-making, and learners' own belief systems illustrates how classroom meaning-making emerges through social processes rather than the transmission of isolated facts.

#### 4.5 Data analysis from lesson observations

The data obtained from the lesson observations sought to address the following research question: How do teachers integrate Islamic IK when teaching Life Sciences in Grades 10 -12?

**Table 2: The findings from ten lesson observations performed over the course of this study**

Teacher (pseudonyms used)	Topic	Grade	Integration of Islamic IK
Sameera	Human Response: Nervous System	12	Yes - relates the practice of <i>wudhu</i> (ablution before prayer) and its effects on the parasympathetic nervous system. References <i>ḥadith</i> on the spiritual benefits of <i>wudhu</i> .
	Evolution	12	Yes - incorporates Islamic perspectives and verses from the Qur'ān.
Farhaad	Indigenous plants	10	Yes - references beneficial foods mentioned in the Qur'an and <i>ḥadith</i> , which have healing

			properties.
	Endocrine System: Regulation of glucose levels	12	Yes - Relates content to the effect of fasting on the glucose levels and significance of consuming dates when breaking the fast, which is a common practice among Muslims.
<i>Faaiza</i>	Digestive System: Diets	11	No - Does not deliver beyond what is prescribed in the textbook. Provides a textbook definition of the concept of <i>halāl</i> .
	Evolution	12	No - Makes no reference to the fact that some religions reject the theory of evolution.
<i>Nabeela</i>	Gaseous exchange	11	Yes - Refers to a supplication (prayer) uttered after sneezing and the impacts on the body during sneezing. Not directly linked to the content covered.
	Human Response: Nervous System	12	Yes - Refers to the benefits of <i>sujood</i> (prostration) during prayer and its effects on the human nervous system by referring to a research article. Involvement from a religious scholar. Reference made to both Qur'ānic verses and <i>hadith</i> .
<i>Razia</i>	Meiosis	12	Yes - content linked to Qur'ānic verse.
	Human Reproduction: Fertilisation and Embryonic Development	12	Yes - content linked to Qur'ānic verse explaining the process of fertilisation and stages of embryo development.

The data obtained from the above lesson observations indicate that teachers generally have a good grasp of the subject matter, Islamic knowledge, and suitable teaching strategies to deliver this content. This suggests that religious systems provide a fertile foundation for teaching and understanding scientific concepts, especially when teachers utilize suitable pedagogical strategies (Mavuru & Ramnarain, 2020). Moreover, learner participation, interest, and engagement improved significantly when they were presented with concepts that they were familiar with and practiced almost daily. Learners' willingness to participate and contribute to discussions as well as developing confidence in the subject may suggest that the incorporation of Islamic IK demystified science for them, since it was rooted in familiar local knowledge and learners' culture, which helped to foster a sense of belonging and inclusion (Mavuru & Ramnarain, 2020).

It is evident that even in the absence of guiding pedagogy, teachers are equipped with the necessary skills and a well-developed Pedagogical Content and Indigenous Knowledge (PCIK) to effectively integrate Islamic IK into the teaching of Life Sciences. Despite the lack of integration by one of the teachers, learners demonstrated a willingness to expand on their knowledge to include perspectives other than their own. This suggests that, in addition to incorporating their own IK, learners may also be receptive to the integration of other forms of IK.

## 5. Conclusion

The study shows that teachers generally view IK positively and recognize its importance in making Life Sciences more meaningful for learners. Most participants demonstrated a clear willingness to integrate Islamic IK and described improvements in learner engagement, relevance, and participation. Their experiences demonstrate that scientific and religious ways of knowing can coexist in the classroom, with many teachers using Qur'ānic verses, Hadith, and everyday religious practices to help learners make sense of complex scientific ideas. However, teachers also reported that they often work alone when planning for integration and encounter difficulty when teaching sensitive or contested topics, particularly in contexts where learners hold diverse beliefs.

A central insight from the study is that teachers' efforts occur in the absence of structured guidance or sustained professional support. The lack of explicit curriculum directives and training has placed the full responsibility for IK integration on teachers, resulting in uncertainty about what counts as appropriate or accurate knowledge to include. These gaps highlight the need for targeted professional development, practical pedagogical support, and purposeful collaboration with community knowledge holders such as religious scholars and elders.

Overall, the study emphasises that meaningful IK integration requires more than teacher willingness; it requires systemic support. Strengthening teacher training, clarifying curriculum expectations, and involving community stakeholders can create the conditions for a more culturally responsive Life Sciences curriculum that values multiple knowledge systems and better reflects the realities of South African learners.

## 6. Implications for further research

The findings have broader implications for curriculum reform, teacher education, and ongoing decolonization efforts. The limited guidance on Islamic IK integration suggests a need for curriculum frameworks that explicitly recognize diverse knowledge systems and offer structured examples of how they can be integrated into Life Sciences content. For teacher education, both pre-service and in-service programmes should embed practical training on integrating IK in ways that are pedagogically sound and culturally responsive, ensuring teachers do not rely solely on personal initiative.

At a broader level, the patterns observed in this study contribute to debates on decolonization by highlighting how the exclusion of community knowledge reproduces epistemic marginalization. Strengthening collaboration with communities, recognizing multiple knowledge traditions, and embedding IK within formal curricula would support a more inclusive and contextually grounded science education system.

## 7. Limitations of the study

The researcher opted for qualitative open-ended questionnaires, which were distributed to participants and completed via Google Form platform. This

collection instrument was time-efficient and enabled convenient access to the participants' responses. However, a methodological limitation was that several of the participants' responses were brief and concise, and the questionnaire format did not provide the researcher with an opportunity to follow up and probe further into certain aspects that emerged from the data.

This research does not provide a basis for generalization due to its use of a case-study approach. While the integration of Islamic IK into the teaching of Life Sciences offers various benefits, such as increased content relevance, enhanced learner engagement and participation, and the cultivation of a deep appreciation for both scientific and religious knowledge forms, these results may not necessarily apply to other educational institutions, as different settings could yield different outcomes. However, McMillan and Schumacher (2014) highlight that although qualitative research is frequently criticized for its lack of generalizable findings, case study designs offer context-specific insights that contribute to understanding and pave the way for further research.

The method of sampling employed in this study was purposive sampling, whereby participants were selected according to a specific criterion. The sample consisted of ten Life Sciences teachers based at schools in Johannesburg. It is worth noting that all ten teacher participants belonged to the same racial group, and the sample consisted of predominantly female teachers. Whilst the research offers meaningful insights into teachers' experiences when integrating Islamic IK into teaching Life Sciences, the use of a larger sample, which was more diverse in terms of racial and gender representation, could have yielded more reliable results. However, due to the scope of the study, this could not be extended.

## **8. Recommendations**

The findings highlight two areas that require attention. First, teachers need focused professional development to build confidence in integrating Islamic IK into Life Sciences. Although participants recognized its value, most lacked guidance and relied on isolated, self-designed strategies. Only one teacher had attended training specific to Islamic IK integration, indicating a gap in support. Targeted short learning programmes, practical workshops, and the development of standardized resources would help teachers work more systematically and align their practice with curriculum expectations.

Second, the results show that many teachers overlook the rich knowledge within their own communities. Religious scholars, leaders, and elders hold significant insights that can strengthen culturally grounded instruction, yet they are seldom engaged as partners in the teaching process. Involving these community knowledge holders would deepen the quality of IK integration and ensure that classroom practices are more contextually responsive and inclusive.

## **9. Conflict of interest**

No conflict of interest declared by the authors of this paper.

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