Examining learners' academic performance on the indigenous knowledge assessment tasks in physical science in Endola circuit, Ohangwena region

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Abstract
In science education, learners often grapple to distinguish between colloquial language and scientific terminology. This differentiation largely relies on their Current Knowledge Zone (CKZ), which poses challenges for those with limited exposure to both indigenous and Western knowledge. To facilitate this transition, teachers must employ Cross-Fertilization of Ideas (CFI) as a strategic teaching approach, bridging indigenous knowledge with conventional scientific concepts. The paper used positivism paradigm and quantitative research approach was used. The Social constructivism theory was used to be able to understand how the learners were constructing their understanding during the text. Recent research in Namibia, South Africa, and Zimbabwe has demonstrated the positive impact of integrating indigenous knowledge (IK) into science education. This study focused on Grade 10 physical science test questions, assessing learners' academic performance when IK was integrated. Through the lens of social constructivism, which views reality, knowledge, and learning as socially constructed, the study analysed the data looking the reality, knowledge construction. 26 learners took part in the research by writing the test for physical science. Employing a quantitative approach the study examined learners' academic performance in Physics tests where IK was integrated. Results revealed learners showed lack of indigenous knowledge and established scientific principles, leading to poor performance among many learners. Notably, learners struggled to link their indigenous knowledge with conventional scientific understanding, often resorting to everyday language. To address these challenges, the study suggest that science teachers adopt the role of "knowledge brokers" to effectively mediate between indigenous and scientific knowledge realms, thereby enhancing learners' comprehension and performance in science education.

Keywords: *science teachers, physical science, indigenous knowledge, indigenous knowledge systems, scientific concepts*

Introduction and background

In recent years, there has been a growing scholarly interest in the integration of Indigenous Knowledge Systems (IKS) into formal science education, particularly within African contexts. This integration aligns with a broader call for decolonizing the curriculum and promoting epistemic justice in education (Le Grange, 2018; Kaya & Seleti, 2013). In Namibia, the inclusion of Indigenous Knowledge (IK) in the physical science curriculum provides an avenue for contextualized teaching and learning that resonates with learners lived experiences and communities. This study examines the academic performance of Grade 10 learners in physical science tests and examinations that feature Indigenous Knowledge-based assessment tasks within the Endola circuit of the Ohangwena region. The test was from different past question paper for physical science, particularly in the form of *alternative-to-practical* questions, encourage learners to apply theoretical knowledge to practical or contextualized scenarios often rooted in traditional practices and local materials. Such a format serves a pivotal role in bridging learners' everyday understanding with formal scientific concepts (Ogunniyi, 2023). By focusing on how learners perform on these IK-integrated tasks, this study explores whether the curriculum's intention to value both indigenous and scientific epistemologies translate into improved learner engagement and conceptual understanding.

Through a quantitative approach combining give the insights from learner responses and on the performance of the learners, the study provides a deeper understanding of how IK-inclusive assessments influence performance and comprehension. Ultimately, it aims to highlight ways in which the educational system can better incorporate Indigenous Knowledge to make science learning more inclusive, relevant, and responsive to local realities. The integration of Indigenous Knowledge into school curricula has increasingly been recognized as a strategy to enhance cultural relevance and learner identity in science education across sub-Saharan Africa. Historically, formal science education in Namibia and many other post-colonial nations has been rooted in Western epistemologies, which often marginalize local knowledge systems (Heleta, 2016; Shizha, 2022). The Namibian curriculum's emphasis on the inclusion of IK in physical science represents an important policy initiative aimed at validating indigenous worldviews while promoting scientific literacy. Assessment practices play a critical role in this process. By embedding IK into examination questions such as through alternative-to-practical formats learners are encouraged to reason scientifically within familiar contexts (Rambuda & Fraser, 2004). These assessments move beyond rote memorization, allowing learners to engage conceptually by relating abstract scientific ideas to indigenous practices involving, for example, local technologies, weather forecasting, or traditional medicinal preparations.

However, the successful implementation and impact of such IK-oriented assessment strategies depend on several factors, including teachers' pedagogical content knowledge, learners' exposure to indigenous practices, and the extent to which classroom instruction bridges the divide between scientific and indigenous epistemologies (de Beer et al., 2022; Mavuru & Ramnarain, 2020). Research suggests that when learners' indigenous experiences are validated in the science classroom, they are better able to navigate between different ways of knowing enhancing both conceptual understanding and academic performance. Thus, this study's examined learners' academic performance on IK-based examination provides critical insights into the effectiveness and challenges of educational transformation efforts aimed at fostering culturally responsive science education in Namibia. To address this, the following sub-questions were utilized to provide comprehensive insights into the topic:

1. In what ways do Grade 10 physical science learners make use of their IK when answering questions that include both IK and conventional science?
2. How do Grade 10 physical science learners link their IK to western science when answering assessment questions?

Statement of the problem

Learners in physical science classroom find it difficult to connect classroom Discourse and the practical activities that is done at home or communities (Simasiku, 2022). Thus, this research was followed up on the research done on the challenges and complexity of integration Indigenous knowledge and the integration of IK in final examination Grade 10 in Ohangwena region. The motivation behind this study stemmed from the observed absence of local knowledge integration within the Physics classroom and examination settings. Mukwambo et al. (2014) advocate for the Africanization of science curriculum, emphasizing the importance of integrating indigenous into science education. Examination of previous question papers revealed historical inclusion of indigenous knowledge (IK) in assessments. However, discrepancies in learners' performance, as highlighted in examiners' reports, prompted further investigation. To explore this phenomenon, we compiled question papers for Grade 10 Physics learners, focusing on topics where learners' IK was prominently featured.

Significance of the study

By examining learners' performance when IK is incorporated into examinations, this study provides teachers and examiners with a comprehensive understanding of the significance of IK in science education within the Namibian curriculum. It outlines the importance of integrating IK into the curriculum and syllabus to enhance learners' comprehension of various topics in Physics and Chemistry from Grade 8 to 12, thus paving the way for further research and exploration in the field of science education. This research contributes to ongoing efforts to bridge the gap between indigenous knowledge and conventional scientific principles, promoting a more inclusive and holistic approach to science education in Namibia.

Literature review

Namibian curriculum on learner-centred education (LCE)

In the Namibian education system, the term 'curriculum' encompasses the official policy guiding teaching, learning, and assessment processes. It serves as a roadmap for planning, organizing, and executing educational activities (The National Curriculum for Basic Education (NCBE), 2010). Curriculum delineates the knowledge and skills learners are expected to acquire, encompassing learning standards or objectives, instructional units and lessons, assignments, materials, and assessment methods. Following Namibia's independence in 1990, efforts were made to overhaul the education system inherited from colonial times. In 1993, the education system transitioned from a teacher-centred approach (TCE) to a learner-centred approach (LCE). Nyambe (2008) identifies LCE as rooted in constructivism, progressivism, and the Freirean model of education, with principles and practices derived from these models informing its implementation. To effectuate this transformation, the Ministry of Education established the National Institute for Education Development (NIED) to design and supervise the adoption of the new curriculum.

The policy for LCE, as outlined by NIED (Ministry of Education, Arts and Culture, 1999), emphasizes an approach in which teachers place learners' needs at the centre of classroom practice, rather than enforcing predetermined expectations. Instruction begins with an assessment of learners' prior knowledge, skills, and understanding of the subject. Teachers then design learning activities that build on and extend what learners already know. This underscores the significance of starting from learners' existing knowledge and abilities, fostering the acquisition of new knowledge in relevant and meaningful ways, and encouraging creative and innovative application of knowledge (Ministry of Education, 2018). Consequently, LCE advocates for the integration of learners' everyday knowledge, sourced from home or the environment, including indigenous/local or traditional knowledge and prior everyday experiences.

Integrating indigenous knowledge in physics examination

The integration of Indigenous Knowledge (IK) into Physics examinations has gained significant attention worldwide, with scholars arguing that it enhances scientific learning by contextualizing concepts within cultural settings (Zidny et al., 2020). Research indicates that IK provides alternative explanations for physical phenomena, enriching learners' understanding of mechanics, thermodynamics, and electromagnetism (Sithole, 2017). By incorporating IK, teachers create inclusive learning environments that bridge the gap between Western science and indigenous ways of knowing, thus fostering deeper engagement (Govender & Mudzamiri, 2022). Studies suggest that recognizing indigenous epistemologies contributes to the decolonization of science education, making curricula more accessible and relatable (Baquete et al., 2016).

Across Africa, scholars advocate for the integration of African Indigenous Knowledge Systems (AIKS) in Physics education to align scientific principles with traditional experiences (Sithole, 2016). Research conducted in Zimbabwe and Mozambique demonstrates that elders possess valuable knowledge related to thermal physics, mechanics, and energy conservation, which can complement formal education (Baquete et al., 2016). The philosophy of *Ubuntu*, which emphasizes interconnectedness, supports this approach by linking scientific concepts to social and environmental contexts (Govender & Mudzamiri, 2022). AIKS contain practical applications of Physics, such as traditional weather forecasting methods and structural engineering, which can be utilized to enhance examination content and improve student performance (Sithole, 2017).

Meanwhile, in Namibia, efforts to integrate IK into Physics examinations have focused on acknowledging the importance of Ethno-Science within formal education (Utete et al., 2016). Studies conducted in the Zambezi region highlight indigenous communities' understanding of Physics principles, such as energy generation and structural stability, which provide alternative perspectives to conventional scientific theories (Utete et al., 2016). The University of Namibia has explored culturally responsive teaching approaches to integrate IK into science curricula, emphasizing its potential to improve student engagement and comprehension (Govender & Mudzamiri, 2022). Researchers argue that by embedding IK in Physics examinations, educators can make scientific concepts more relatable, thereby increasing students' interest and performance (Sithole, 2016).

Indigenous knowledge in teaching physical science

Teachers play a pivotal role in leveraging the knowledge learners bring from previous grades or their home environments, especially through interactions with more knowledgeable individuals. This fusion of both indigenous knowledge (IK) and conventional subject matter is essential in Physics education, facilitating learners' reconnection with their surroundings. Research on culturally responsive and Indigenous knowledge-integrated teaching indicates that when curricula and learning activities connect with learners' own cultural knowledge and Indigenous knowledge systems, learners' engagement and participation increase because the content becomes more meaningful, relatable, and relevant to their lived experiences (Gay, 2018). Mukwambo et al. (2014) in alignment with Kibirige and van Rooyen (2006), posit that Local Knowledge (LK) embodies a legacy of wisdom and skills unique to specific indigenous communities, passed down through generations via a trial-and-error approach.

However, the effective incorporation of IK into lessons necessitates educators' adeptness in utilizing it to enhance learners' comprehension, bridging the gap between local and western scientific perspectives. Failure to do so could detrimentally impact both learners and the teaching-learning process. Ogunniyi and Ogawa (2008) highlight that African indigenous communities traditionally classify soil based on criteria such as colour, texture, and structure. Even before formal science education, many African learners possess holistic knowledge about their environment, including plant and animal classification, weather patterns, soil types, seasonal changes, wildlife tracking, conservation methods, and traditional medicine (Ogunniyi & Ogawa, 2008). Integrating this rich local knowledge into the curriculum not only enhances learners' cognitive development but also fosters a deeper understanding of subject matter. The synergy between LK and subject content proves invaluable, particularly in areas like agriculture, pest management, and soil science, where local communities often possess extensive expertise.

Practical work

Practical work in science education is widely recognized for its multifaceted benefits. Woodley (2009) and Hodson (1990) underscore its pivotal role in engaging learners, fostering skill development, nurturing scientific inquiry, and facilitating conceptual understanding. Woodley (2009) emphasizes the significance of effective practical activities in bridging the gap between tangible experiences and abstract scientific concepts, stressing the importance of explicit connections between observation and theory. Indigenous knowledge, as noted by Liveve (2017), Nikodemus (2017), Shifafure (2014), and Uushona (2013), is inherently practical, often transmitted through hands-on activities deeply rooted in community traditions. For instance, Liveve (2017) illustrates the teaching of sound and waves using drums and songs, while Nikodemus (2017) incorporates the making of *Oshikundu* to elucidate the concept of reaction rates. Similarly, Shifafure (2014) and Uushona (2013) utilize the brewing of *Kachipembe* and *Ombike* to teach distillation, respectively, reflecting the practical nature of indigenous knowledge.

Akbar (2012) further emphasizes the motivational and experiential value of practical work, highlighting its ability to stimulate curiosity and connect personal experiences with scientific phenomena. Practical work not only enhances learners' science-related skills but also bridges the gap between theory and application (Akbar, 2012). Millar (2001) underscores the challenges of conveying abstract concepts solely through theory, advocating for inquiry-based approaches that encourage independence and self-reliance among learners. However, practical work in science education is not without its challenges. Guerra-Ramos et al. (2011), Abrahams and Millar (2008), and Millar (2004) highlight issues such as teacher perceptions, learner attitudes, and the disconnection between practical activities and learning outcomes, underscoring the need for thoughtful design and implementation to maximize its effectiveness.

Theoretical framework

Social constructivism

Vygotsky's (1978) theory of social constructivism underscores the collaborative nature of learning, highlighting the crucial roles of teachers, parents, peers, and community members in facilitating learners' educational journey (Kundi & Nawaz, 2010). This perspective advocates for the incorporation of knowledge gained from home and community settings into the science classroom, viewing the classroom as a social unit where various stakeholders work together to educate learners. Stear and Gobal (2010) emphasize the significance of indigenous knowledge within the learning environment, recognizing it as a valuable resource embedded in diverse cultural practices and beliefs. In alignment with social constructivism, Chuang (2021) accentuates the importance of culture and context in shaping individuals' understanding and construction of knowledge within society. This viewpoint resonates with developmental theories by Vygotsky, Bruner, and Bandura, emphasizing that learning transcends the confines of the classroom and occurs within the broader societal context. Kundi and Nawaz (2010) stress the influence of culture on learning design and development models, asserting that learners assimilate information from teachers while integrating it with indigenous knowledge acquired from their society. Chuang (2021) further elucidates that meaningful learning unfolds through social interactions, emphasizing the role of social processes in shaping individuals' cognition and understanding.

Social constructivism, as Chuang (2021) delineates, posits specific assumptions about reality, knowledge, and learning. It asserts that reality is socially constructed through human activity, knowledge is a product of social and cultural interactions, and learning is a dynamic social process facilitated by meaningful engagement in social activities. This theoretical framework guided our analysis of data obtained from Grade 10 learners' tests, illuminating how learners' indigenous knowledge interacts with western scientific concepts. By examining questions from previous papers that incorporated indigenous knowledge, we gained insights into learners' proficiency in integrating western and indigenous knowledge systems.

Research methods

This paper employed positivism research paradigm which allow the use of quantitative research approach), which allowed us to collect the data on the performance of learners in physical science test when learners' IK is used. This research analysed the answers from learners' examination question paper. Twenty-six (26) learners were involved in this study and took part in the test that was used to collect quantitative data. All learners in grade 10 were involved and their parents signed the consent form which allowed the learners to take part in the research. This research also involved three paradigms: ontology, epistemology, methodology. Ontology is the view of how one perceives a reality, epistemology is the beliefs on the way to generate, understand and use the knowledge that are deemed to be acceptable and valid, while methodology is the strategy or plan of action which lies behind the choice of the particular methods used to collect data (Scotland, 2012; Wahyuni, 2012). As researchers we kept all three paradigms for us to be able to know how the research was going. The test was done in one school in Ohangwena region to collect quantitative data. This enables the researchers to understand how the learners could perform in the examination when the IK is used. This yielded quantitative data that we analysed and represented in this research.

Quantitative data came from the marks obtained by the learners who took part in this research. The questions were from the previous question papers written by grade 10 from 2019 to 2024 that included IK. School was purposive sampling (Bertram & Christiansen, 2014; Maree & Pietersen, 2016). The school was selected because science teacher was willing to administer the tests at school. The teacher was provided with the test question papers and marking were done by the researchers to have consistence across all the scripts. Learners were allowed to use their nicknames or pseudonyms.

Physical science test

The tests covered the topics from physical science, including sound and waves (Liveve, 2017), rate of reaction (Nikodemus, 2017), and concepts related to force, work done, and materials. These assessments were structured to consist of 10 marks from multiple-choice questions and 30 marks from structured (cognitive) questions that required learners to calculate, explain, or provide reasons. In total, the tests carried 40 marks. Cohen et al. (2018) defined a test as a thorough examination aimed at identifying specific strengths, weaknesses, and challenges experienced by learners. Weak performance by learners might stem from misconceptions about Indigenous Knowledge (IK) and Western science, as well as the connections learners can draw between IK and Western science during the test. Conversely, strengths could be influenced by how teachers incorporate IK into their lessons, leveraging learners' prior everyday knowledge (Roschelle, 1999; Kambeyo, 2012; Khulane, 2011). The decision to administer the test was informed by the coverage of the syllabus in Grade 10, allowing teachers to gauge comprehension without the opportunity for re-teaching. The integration of IK into the science classroom aimed to provide insight into how teachers facilitate a unified perspective, where IK and Western science are seen as complementary worldviews.

Learners were notified in advance about the test topics, enabling them to prepare accordingly. Learners' performances were classified into four groups: below achiever ($0 \leq m < 11$), achiever ($11 \leq m < 21$), and middle achiever ($21 \leq m < 31$), and above achiever ($31 \leq m < 41$), where 'm' represents the marks obtained. This categorization facilitated the creation of a bar graph to depict the findings of the test administered at a school in the Ohangwena region. The symbols $\leq$ and $<$ denote inclusion and exclusion in mathematical terms, respectively.

Data analysis

Data collected from 26 scripts from physical science tests were analysed quantitative descriptive methods of data analysis. We used inductive process of organizing the data into categories and identified the patterns among the categories (Bertram & Christiansen, 2014). The categories, themes and patterns emerged from the data were used to generate themes. Quantitative research builds its premises on deductive reasoning (Williams, 2017). Data were analysed using descriptive and numerical that were obtained from the results of the test given to the learners.

Data from the physical science test

The paper follow are quantitative research methods where the results from the physical science test were analysed and presented.

Physical science test results

Twenty-six (26) Grade 10 learners from one school in Ohangwena region wrote the test. During the time of the test, learners were preparing for their final examination and they have covered all the topics that were included in the test. The table below shows the results of learners who took part in the research.

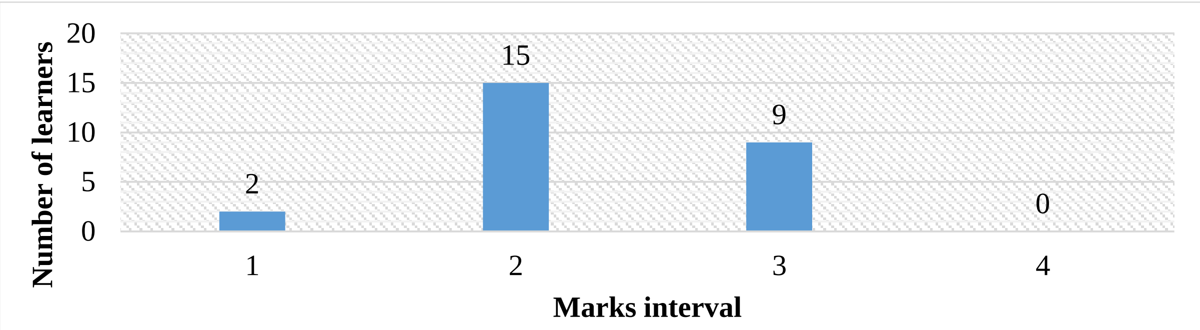

Figure 1: Distribution of learners marks obtained during test

After marking the learners' scripts, marks were grouped into four categories as achievers, achievers, middle achievers and above achievers. Two learners obtained below achievers that represented 8%, *Selmah* obtained 10 marks and *Rauna* obtained 7 marks (Table 1). Most of the learners were achievers that represented 58% of the learners obtaining between 11-20 marks. This was the best category where learners obtained marks, and these learners could not reach 50% as a pass rate of D symbols on Namibian Grading system. In this test, nine learners were able to pass the test by obtaining between 21-30 marks. This represents 35% of the learners obtain D or better symbols. None of the learners could be able to reach the above achiever, as it seems to be not reachable at this school. These learners were preparing for their final examination and there could be no excuse for them not to achieve that category. Physical science teacher was done with the syllabus, and revision was done with the learners. Despite IK being included in the intended science curriculum and recognized worldwide as a knowledge system, recognition and validation of IK is still causing tension amongst learners, teachers and scientist (Cronje et al., 2015). The tension was observed during marking of scripts for learners that they could not connect their IK to western science (WS) during the test. Thus, no learners could achieve the marks of above achievers as indicated in figure 1. In line with this Simasiku (2016) found that IK were not part of the examination; thus, teachers were not willing to integrate IK it in the lessons. They felt it was time wasting to include IK in science lessons. In support of this, Nyika (2017) attested that in Zimbabwe teachers indicated that they cannot include IK in their science lessons because it was not examined during examination. The results clearly indicate that most learners were unable to link the local knowledge they acquire at home with the Western science concepts taught in the school curriculum. Learners who fell into the achiever category were able to make connections between what was taught during science lessons and practices they were familiar with at home. Kambeyo (2012) similarly notes that learners often experience difficulty in relating their home-based knowledge to what is taught in science classrooms. Most of the test questions were presented using pictures that depicted everyday activities commonly occurring at home. Further clarification of these results is provided through an analysis of learners' performance on each question or sub-question, with particular attention to the Indigenous Knowledge (IK) embedded in the test items. The scores obtained by individual learners at School A are presented below.

Table 1: Individual learners' marks

		Structured questions or cognitive questions									
Pseudonyms names of their choice	**Multiple choice questions 1-10**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**	**%**
	10	4	2	4	2	5	3	7	3	**40**	**100**
Codo-Gawa	3	4	2	3	0	4	2	7	2	**27**	**68**
Selmah	3	4	0	0	1	0	2	0	0	**10**	**25**
Rauna	3	3	0	1	0	0	0	0	0	**7**	**18**
Onepandaulo United	6	4	1	3	2	3	2	6	0	**28**	**70**
Inginah	4	4	2	1	2	2	0	3	0	**20**	**50**
Nevermind	2	4	2	1	0	1	3	2	0	**15**	**38**
Tekko	5	2	1	1	1	1	2	0	0	**13**	**33**
D#tash	5	3	0	2	0	1	0	7	0	**18**	**45**
P^3	3	4	0	1	0	0	2	7	0	**12**	**30**
JR	2	3	1	1	2	2	2	7	1	**22**	**55**
Suzzei Gal	6	3	1	1	0	0	2	7	1	**21**	**53**
Tukala	7	3	2	1	1	2	3	7	1	**27**	**68**
Nkelo	4	3	1	1	0	1	2	1	0	**13**	**33**
Cottah	8	4	1	1	0	0	0	0	1	**15**	**38**
Ashifale	6	4	2	3	0	3	2	7	1	**28**	**70**
Nelly	3	3	2	1	0	0	0	7	0	**16**	**40**
Salriel	5	3	2	1	2	2	3	0	0	**16**	**40**
Nestar	4	4	0	1	2	0	1	2	0	**14**	**35**
Nyakz	2	4	1	3	2	4	2	7	0	**26**	**65**
Kassie	4	4	2	1	1	0	2	1	0	**15**	**38**
Ndeshi	2	2	1	1	0	1	0	7	0	**15**	**38**
Kachox	3	3	0	1	0	1	3	6	0	**17**	**43**
Rosamund	5	3	1	1	0	3	3	7	1	**22**	**55**
Ndapandula	3	3	1	1	0	3	3	3	0	**17**	**43**
Hernandez	4	4	0	1	0	2	0	3	0	**15**	**38**
Pelican	5	3	1	1	0	1	2	3	1	**18**	**45**
Total	**105**	**92**	**29**	**38**	**16**	**39**	**43**	**109**	**9**	**467**	**1174**
Average	**4.0**	**3.5**	**1.1**	**1.5**	**0.6**	**1.5**	**1.7**	**4.2**	**0.3**	**18**	**45.2**

Table 1 illustrates how the learners performed during the physical science test individually. Learners performed differently in each question or part questions as show in Table 1.

The highest learners (*Ashifale and Onepandaulo United*) obtained 28 marks each that represented 70%, which is a B grade in Namibia Grading system. The table below shows how learners performed and the grade they obtained. Learners did not do well in multiple choice question, only 35% (9 learners) that obtained 5 marks and above. The highest learners *Nkelo* obtained 8 marks out of 10, while the lowest learners were *Nevermind, JR*, *Nyakz* and *Ndeshi* who obtained 2 marks each.

Table 2: Number of learners who scored A-U in the test

Grading	0-19	20-29	30-39	40-49	50-59	60-69	70-79	80-100
Symbols	U	G	F	E	D	C	B	A
No of learners	1	1	9	6	4	3	2	0
%	3.8%	3.8%	34.6%	23.1%	15.4%	11.5%	7.7%	0%

Analysing the grading system in Namibia, its vividly indicates that most learners obtain **F** grade with the highest of 34.6%. It was shocking to see that none of the learners obtained between 80-100%. For non-Western learners, interaction between two worldviews often characterizes their school experience, complicating the learning process and potentially resulting in cognitive conflict (Jegede, 1995). Most learners did well when answering question 1 in cognitive questions as this question were well answered. The question involved the use of local materials in building houses as indicated in the picture below.

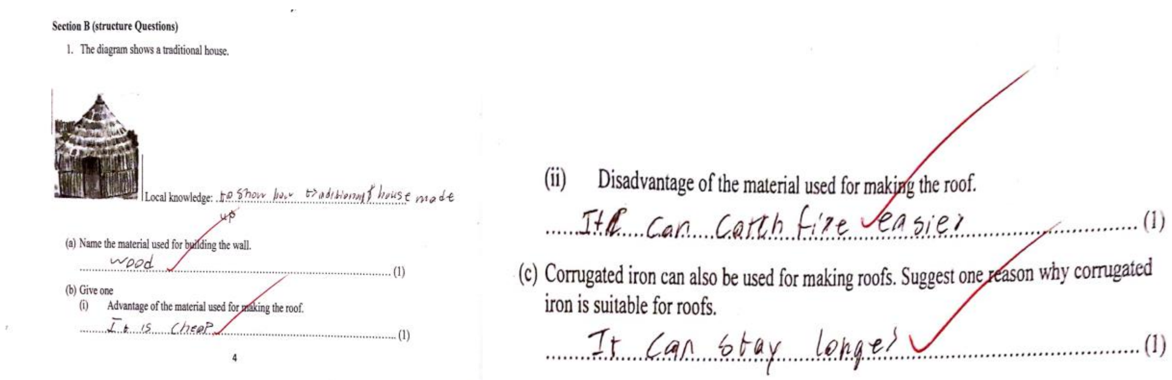

Figure 2: Part of the question that included the thatched house in the question

Learners were able to contextualize the questions and use the indigenous knowledge they gained from local community. Learners did very well in this question and 50% of the learners obtained all the marks. This shows that learners understood the questions and they linked them to their IK they gained when building their houses. The average performance of learners in the question is 3.5 marks. Question 2 involved the use of plough to answer question on friction and weight. Learners were asked to identify the arrow that show weight and friction from the four given arrows Learners in rural communities often have direct experience with agricultural tools and practices such as ploughing, because most households depend on subsistence farming for their livelihoods, and this experiential local knowledge shapes their understanding of agricultural processes outside formal schooling (Kom & Nethengwe, 2024). The performance of learners on this question was worrisome, as 27% of learners scored zero marks in this question.

In question 3, a palm tree with fruits was given for the learners to answer on weight and force. Learners were able to answer question 3 (a) that involved calculation acceleration of the falling fruit, but they could not answer question 3 (b) which required them to explain. Learners could not state the relationship between the upward force and the downward force acting on the palm fruit when falling. This question was poorly performed by all 26 learners. Moreover, question 4 was also poorly answered by most learners, 62% of learners scored 0 marks out 2 available marks. The question was about sound as indicated below.

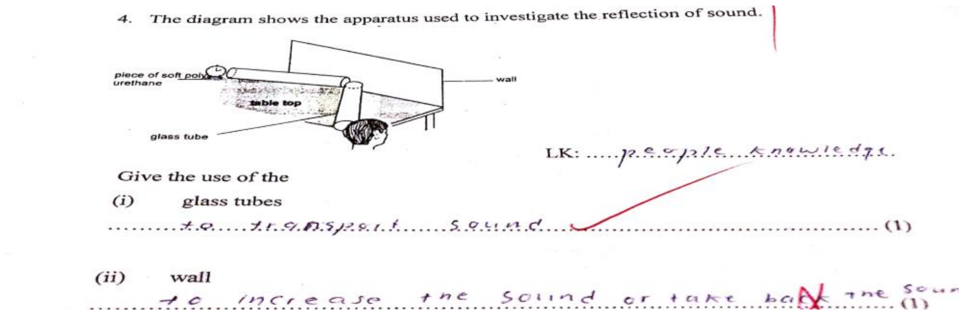

Figure 3: The use of glass tube to transmit sound

Learners experienced difficulty explaining the use of a glass tube and a wall in relation to sound transmission and echo formation. Only six learners (23%) provided correct responses to both items. This indicates limited understanding of sound propagation in different media. In addition, learners were unable to draw on their Indigenous Knowledge of using a string and two cans to make a simple telephone—an activity traditionally played by children at home. This finding suggests that learners struggled to transfer familiar everyday experiences into formal scientific explanations, a challenge widely reported in science education research (Aikenhead, 1996; Jegede, 1995). Question 5 was poorly answered by most learners, as it required the skill of unit conversion prior to calculating work done. Only six learners (23%) scored between three and four marks, no learner obtained full marks, and 30% of learners scored zero. Difficulties with mathematical skills and unit conversion are known to hinder learners' performance in physics-related problem solving (Wellington & Osborne, 2001).

In contrast, Question 6 was well answered by learners. In this question, learners successfully linked the concept of sound echo to experiences familiar from their home environments. A total of 69% of learners scored either two or three marks out of a possible three. This suggests that when scientific concepts align closely with learners' everyday experiences, understanding and performance improve significantly. Moreover, question 7 was the question where 11 learners (42%) scored 7 out of 7 and two learners scored 6 marks. *Codo Gawa, D#tash, P*[3]*, JR, Suzzei Gal, Tukala, Ashufale, Nelly, Nyakz, Ndeshi* and *Rosamund* all scored 7 marks and *Onepandaulo United and Kachox* scored 6 marks respectively. The last question in this test required learners to critically explain sound waves travel from the drum to the performers' ears. This question was poorly answered, as 18 learners (69%) were unable to explain how sound travels from the drum to their ears during traditional dance performances. This difficulty may be attributed to learners' limited proficiency in the Language of Learning and Teaching (LoLT), which may have constrained their ability to express scientific explanations. Alternatively, the poor performance may reflect learners' inability to link their Indigenous Knowledge related to traditional music and dance to Western scientific concepts of sound transmission. Only one learner (Codo-Gawa) attempted to explain the process and obtained two marks. An analysis of learners' average marks clearly indicates which questions were poorly performed, as presented below.

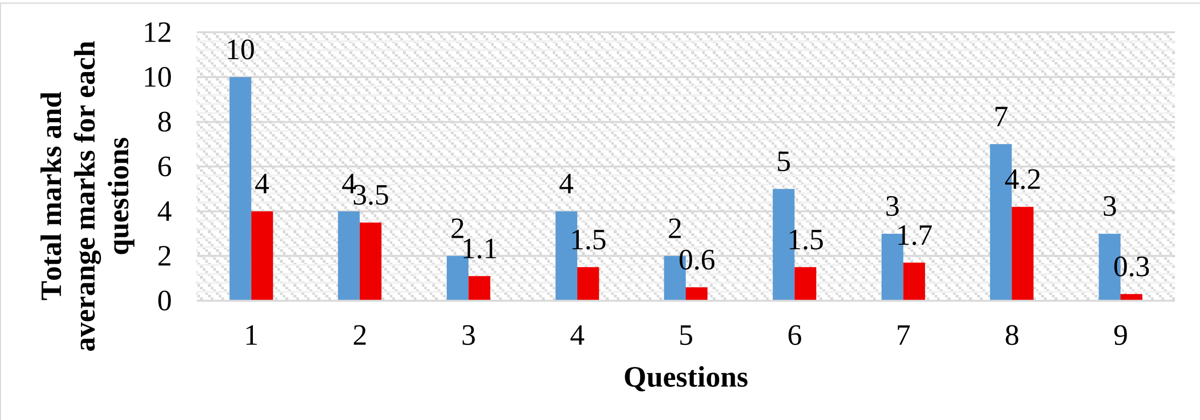

Figure 4: Total marks of questions and the average obtained by the learners

Figure 4 shows total number of questions (blue) and the average scored (red) that learners were able to link their IK to western science in some of the questions in the test, especially question 1 in cognitive questions. Question 1, 2, 6 and 7 were well answered by learners and the worst answered questions were multiple choice, 3, 4, 5 and 8 on cognitive questions. Teachers need to teach science concepts by integrating indigenous knowledge for learners to be able to link the two world views together during the examination. In question 8, learners were required to explain (cognitive question) and learners could not use the cultural dance to explain how sound travel in air. Language played a critical role in learners' performance in this test, as most learners failed to use appropriate scientific terminology to explain how sound travels through air. This lack of relevant vocabulary suggests limited scientific language proficiency, which constrained learners' ability to articulate their conceptual understanding of sound propagation. Research has consistently shown that inadequate mastery of scientific terminology can significantly hinder learners' understanding and communication of scientific concepts (Wellington & Osborne, 2001; Lemke, 1990). There was a need to use vernacular (Probyn, 2009) in science examination when science terminologies are hard to come during examination. The table 5, illustrates the percentage obtained by learners during the test.

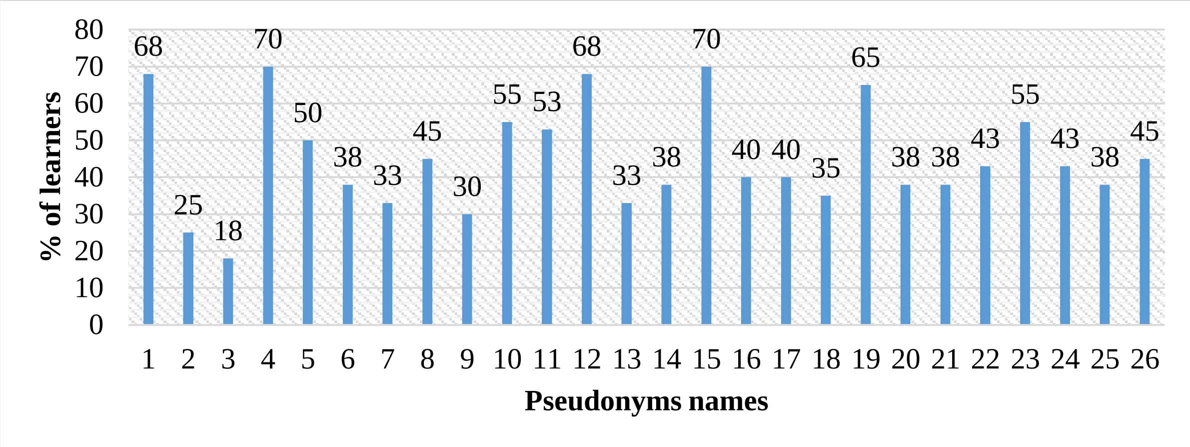

Figure 5: Percentage obtained by individual learners

To analyse the performance of the learners who took part in this test, we looked at their percentage (%) obtain in table 1 and come up with the Figure 5. For example, Codo-Gawa was the first one on the list and was given number 1 with the 68, and Rauna was the third with 18% as the lowest performing learners in the class. The highest were Onepandaulo United and Ashifale who scored 70% in the test. The difference between the highest and the lowest being (70%-18%) = 52%. About 18 learners (69%) who took the test were below the difference between the highest and the lowest. Learners did not do well in this test especially on the questions that required them to explain. Questions like 3(a) (ii), 4 (i), (ii) and question 8 were performed poorly by most learners and this contributed learners not to do well during the test. Most leaners did well in questions that required them to calculate using the formula apart from question 5 (b) (see the question attached).

Some questions were modified to use the local names of people, but the content remained the same. Question 7 and 8 involved the use on names of people known, to the learners. In question 5 and 6 used pseudonyms names that learners are not familiar with and in question 5 not even one learner who got all the marks, in question 6, only six learners scored the total marks. In question 7, the name used was for the teacher at the school and used to train by weightlifting. On this question, 11 learners scored the total marks, while the last question the name was not familiar with the learners, and they did poorly in that question too. An analysis of the level of difficulty of the questions indicates that Questions 5 and 6 were easier for learners, whereas Questions 7 and 8 were more challenging. One unresolved issue is whether the use of teachers' real names influenced the effort learners invested in responding to the items, since assessment contexts that align closely with familiar social cues can affect how learners interpret questions (Heritage, 2010).

It was observed during the test that learners may have drawn on Indigenous Knowledge by relying on their familiarity with the teachers' names and the social roles those teachers perform within the community to construct their responses, consistent with findings that learners interpret science tasks through the lens of everyday experiences and social contexts (Aikenhead, 1996). This suggests that contextual familiarity and socially embedded practices influence meaning-making in academic tasks, and that learners' performance may reflect their ability to mobilize funds of knowledge from home and community settings rather than purely formal scientific understanding (González, et al., 2006). Moreover, research on culturally responsive pedagogy indicates that when assessment language and referents are situated within learners lived experiences; learners may either benefit from increased engagement or, conversely, misinterpret scientific intent if local meanings differ from disciplinary meanings (Gay, 2010).

Discussions

The Namibian curriculum embraces the integration of indigenous knowledge (IK) into science education, allowing science teachers to incorporate local perspectives and practices into their lessons, but it is not clear how teachers could integrate such IK. This integration extends to the external final examinations, where practical questions sourced from previous Grade 10 examinations are utilized to assess learners' performance. However, research conducted by Simasiku (2016) revealed that despite the inclusion of IK in examinations, science teachers often neglected to incorporate it into their teaching of certain science concepts.

Simasiku (2022) emphasized the importance of integrating IK into science lessons, yet the findings of this study indicate a lack of cross-fertilization of ideas between IK and conventional science (Simasiku 2022). Jawahar and Dempster (2013) investigated the lexical density of science terminologies used during lessons, finding that learners frequently lacked the necessary scientific vocabulary to adequately answer questions requiring explanation. This lack of scientific terminology usage during explanation, reflected in low lexical density, indicate a gap in understanding between everyday language and scientific language. Sampson and Blanchard (2012) suggest that promoting learners' engagement in scientific argumentation and the correct use of terminologies can enhance the teaching and learning of science.

In analysing learner responses, it was evident that many struggled to distinguish between everyday language and scientific language. For instance, in Figure 3, learners utilised terminologies such as "transport," "pass through," "bring," and "move" to describe the transmission of sound, which resulted in a lexical density score of 0%. Conversely, some learners like Onepandaulo United demonstrated a higher lexical density (38%) in their explanation, using more scientific language to describe sound reflection. Christodoulou and Osborne (2014) suggest that conceptualizing science as an epistemic practice necessitates engaging learners in different discursive and reasoning practices, yet the research findings indicate a lack of learner involvement during classroom discussions, leading to incorrect use of scientific terminologies. The challenge for science teachers in developing countries, as highlighted by Hewson et al. (2009), lies in teaching science in a manner that is appropriate and accessible to learners. This challenge necessitates the utilization of locally available materials, as advocated by Asheela (2017), to facilitate learning. However, learners encountered difficulty in bridging the gap between IK and scientific knowledge, struggling to incorporate scientific concepts into explanations involving indigenous knowledge.

In conclusion, while the Namibian curriculum encourages the integration of indigenous knowledge into science education, there are evident challenges in effectively bridging IK with conventional science. To address these challenges, it is imperative for science teachers to prioritize the use of scientific terminologies, engage learners in scientific argumentation, and foster a deeper understanding of the connections between IK and scientific knowledge. Moreover, efforts should be made to provide teachers with adequate training and support to effectively integrate IK into their lessons, ultimately enhancing the teaching and learning of science in Namibia.

Conclusion and recommendations

The examination of learners' performance on indigenous knowledge assessment tasks within the realm of Physics at school A in the Ohangwena region, Namibia, has provided valuable insights into the integration of indigenous knowledge (IK) into science education. Through a test covering various topics, including sound, waves, rate of reaction, and fundamental concepts of force and materials, it became evident that learners' performance reflects not only their understanding of scientific principles but also their ability to connect these concepts with Indigenous Knowledge and everyday experiences. The test revealed a spectrum of performance among learners, indicative of varying levels of understanding and engagement with both indigenous knowledge and Western science. Weaknesses in performance often stemmed from misconceptions about indigenous knowledge and its application within scientific contexts, as well as challenges in bridging the gap between IK and Western science. The integration of indigenous knowledge into the science classroom is crucial for fostering a holistic understanding of scientific concepts and promoting cultural relevance in education. By recognizing and incorporating indigenous knowledge systems, educators can create a learning environment that values diverse perspectives and encourages critical thinking across different cultural contexts.

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