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Integration of Indigenous Knowledge Systems and Practices for Improved Performance in Secondary Science Education in Southern Nueva Vizcaya

Lennie O. Ligmayo
Teacher III, Carolotan High School, Carolotan Dupax Del Sur Nueva Vizcaya, Philippines, *lennie.ligmayo@deped.gov.ph*

Jonathan P. Pasion
Assoc. Prof., Nueva Vizcaya State University, Nueva Vizcaya, Philippines, *jppasion@nvsu.edu.ph*

This study explored the integration of Indigenous Knowledge Systems and Practices (IKSP) in Secondary Science Education, examined the perceptions, practices, challenges, and strategies of science teachers. Additionally, it evaluated students' Science performance and investigated the relationships between these factors. Grounded in the context of culturally responsive teaching, this research emphasized the importance of incorporating IKSP to enhance learning outcomes and promote cross-cultural understanding. The study utilized a descriptive-correlational research design, involving 41 Secondary Science 10 teachers and their respective students. Data were gathered through surveys and performance assessments. The findings revealed that teachers strongly agree on the importance of IKSP in fostering scientific innovation, environmental awareness, and cultural inclusivity, as reflected by a high mean perception score of 3.53. However, the extent of IKSP integration in Science teaching practices remained limited, with an overall mean of 3.49, indicated a need for improvement in areas such as community involvement and use of indigenous knowledge articles. Challenges in IKSP integration, rated as "Moderate" with a mean score of 2.14, included limited resources, lack of training, and time constraints. Despite these challenges, teachers "Often" employed strategies to integrate IKSP, achieved a mean score of 3.09. These strategies include the use of culturally inclusive materials and fostered curiosity through environmental perspectives. The students' average Science performance of 85.49 fell under the "Very Satisfactory" category, with most students demonstrated competency in their Science studies. However, no significant relationship was found between students' performance and teachers' perceptions, practices, challenges, or strategies in integrating IKSP.

Keywords: indigenous knowledge systems and practices, teaching strategies, challenges, science education, science performance

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INTRODUCTION

Learning serves as a compass towards societal progress, guiding individuals through the discovery and application of knowledge to address critical needs. In Science, understanding historical backgrounds and the integration of diverse knowledge systems play a crucial role in fostering scientific innovation and technological advancement. Science, as a structured process, is one of the most challenging areas of learning that a student encounters in Secondary High School due to the complex and abstract concepts with numerous operations of Mathematics and grammatical abstractions in English. The challenge of making Science Education more accessible and inclusive aligns with Sustainable Development Goal (SDG) 4: Quality Education, which emphasizes equitable and inclusive learning opportunities that integrate diverse knowledge systems to ensure relevant and effective education for all.

Indigenous Knowledge Systems and Practices (IKSP), rooted in generations of ecological wisdom, offer invaluable insights into sustainable resource management, environmental stewardship, and traditional practices. However, the dominance of Western Science paradigms in education has marginalized indigenous knowledge, limiting its integration into mainstream curricula. This was supported by Mamung (2022), who reported that the adoption of Western practices and the expansion of foreign cultural influences contribute to a knowledge gap. This gap in instruction not only disregards the cultural heritage of indigenous communities, but also hampers students' ability to relate scientific concepts to real-world experiences.

Given the diverse cultural landscapes of secondary classrooms having more than one ethnic groups, integrating IKSP into Science instruction has the potential to enhance educational inclusivity, foster cross-cultural understanding, and promote environmental awareness, aligning with Goal SDG 10: Reduced Inequalities, SDG 13: Climate Action and SDG 15: Life on Land. This is consistent with the Department of Education's mission to provide culture-based and contextualized education, as well as the Republic Act No. 10533, which mandates that the curriculum be gender- and culture-sensitive, flexible, and localized. By embedding IKSP into science education, educators can create learning environments that validate students' lived experiences while contributing to sustainable and inclusive development.

Given the diverse cultural landscapes of secondary classrooms, integrating IKSP into science instruction holds immense potential to engage students, fosters cross-cultural understanding, and promoted environmental stewardship. This is supported by the primary mission of the Department of Education- "to protect and promote the rights of every Filipino to quality, culture-based, and complete basic education…" By acknowledging and incorporating indigenous perspectives, educators can create inclusive learning environments that validate students' lived experiences and promote cultural diversity. This is also aligned to the Republic Act of 10533 sec 10 which states that "curriculum shall be gender- and culture-sensitive", "…contextualized and global", and "…flexible enough to enable and allow schools to localize, indigenize, and enhance (the curriculum) based on their respective educational and social context."

The characteristics of the Most Essential Learning Competencies (MELCS) is aligned with national standard or frameworks which are applicable to real-life situations. Field implementers or science teachers are encouraged to contextualize the MELCS in order to accommodate the varying contexts of learners, teachers, learning environment and support structures. Through contextualization, the culture of the students can be brought to the school and be integrated in the concepts taught in the Science learning area. This will allow the students to become aware on the processes happening around them/ where they can connect what they have learned from school. Linking school culture with home culture and incorporating culturally relevant teaching skills/ are critically important for the Filipino learners.

The application of different strategies to cater the needs of the learners as they explore more about science is vital to the teaching-learning process. The Philippine Professional Standard for Teachers (PPST) has details that encloses procedures that measures teacher's performance throughout the next school years. Among the 37 indicators presented in the DepEd Memorandum #23, s. 2023, the objective to deliver a contextualized lesson is given importance as reflected in KRA 2, objective 7 which prompt teachers to "Establish a learner-centered culture by using teaching strategies that respond to their linguistic, cultural, socio-economic, and religious backgrounds." (PPST 3.3.3) This is also consistent with the one in objective 8 which says, "Adapted and used culturally appropriate teaching strategies to address the needs of learners from indigenous groups." (PPST 3.5.2).

The integration of Indigenous Knowledge Systems and Practices (IKSP) has been a longstanding practice in various subjects such as Music, Arts and Physical Education (MAPEH), Filipino, Science, and Araling Panlipunan. In the realm of Science, connections to History and Philosophy have always been evident, with the development of numerous observations, theories, and factual insights. Educators and a majority of students have demonstrated that the incorporation of technology is integral to the advancement of Science and Technology (S&T) education. However, it is crucial not to overlook indigenous knowledge which covers the local knowledge, skills, and practices developed by indigenous or local communities for over many generations within these subject areas, as it forms the foundation for scientific progress and innovation. This knowledge based on experience, tradition, and close interaction with the environment plays a role in the teaching-learning process to make it more relevant, meaningful and culturally responsive to learners.

The primary objective of educators is to facilitate meaningful learning experiences for their students. Achieving this objective involves employing pedagogical approaches that align with the specific context in which the curriculum is being delivered (Okebukola, 2020; Oladejo et al., 2021). However, it is observed that despite students grasping the taught concepts to some extent, they often struggle with retaining this knowledge over time, sometimes due to low retention levels, personal oversight, or difficulty internalizing the material. This challenge extends to the application of learned concepts across different subjects such as Biology, Physics, and Agricultural Science, where students encounter difficulty in connecting the principles learned in chemistry (Adebayo et al., 2022). Hence, effective learning involves not only comprehension but also the

ability to retain acquired knowledge, as this retention serves as a foundation for building upon previous learning and advancing to new concepts (Abdulhadi et al., 2022). The teacher's perception about the integration of IKSP is crucial since it is one of the key factors in shaping their instructional practices. When these perceptions are being applied or implemented in the classroom context, challenges can emerge specially at a school context with diverse students. These could prompt the teachers to develop strategies on how to deliver the competencies that could cater the different background of the learners. The outcomes of these strategies shape the teacher's perception and could support improvement in the teaching-learning process.

Thus, the study explored the integration of Indigenous Knowledge Systems and Practices (IKSP) in secondary science education. Specifically, it also aimed to assess the perceptions, practices, challenges, and strategies of science teachers regarding the incorporation of IKSP into their teaching. To add, the study sought to evaluate the level of science performance among students and determine whether there was a significant relationship between these factors and the students' academic performance. By examining these elements, the study aimed to provide insights into the effectiveness of integrating IKSP in Science education and its impact on both teaching practices and student learning outcomes.

METHOD

This study employed a descriptive–correlational research design. The descriptive component examined teachers' perceptions, practices, challenges, strategies, and students' performance in integrating Indigenous Knowledge Systems and Practices (IKSP) into Science instruction. The correlational component assessed the relationships among these variables.

The respondents were secondary Science teachers from the Southern Cluster of Nueva Vizcaya. A multi-stage sampling technique was applied, targeting Science 10 teachers in junior high school. The sample is composed of 41 Science 10 teachers from Integrated School (N=2), small school (N=8), medium school (N=14), large school (N=14), and mega school (N=3). Most of the small (students population= less than 500) and medium school (students population=500 – 1000) categories were located at the upland while large (students population=1000-3000) and mega schools (students population=more than 3000) were located at the lowland. One teacher representative was drawn from the small and medium schools, two for large schools and three (3) from large school. For student performance, one class per school with at least 40 students was selected.

A researcher-developed questionnaire was used to measure teacher perceptions, practices, challenges, and strategies related to IKSP integration. The instrument underwent expert validation by five specialists in Science and Education and was pilot-tested with 34 teachers. Reliability coefficients indicated high internal consistency (Cronbach's $\alpha = .881–.900$).

The instrument consisted of four subscales:

Perceptions – measured teachers' agreement with IKSP integration (1.00–1.85 = Strongly Disagree; 3.01–4.00 = Strongly Agree)

Practices – assessed extent of IKSP use (1.00–1.85 = Very Low Extent; 3.01–4.00 = Very Great Extent).

Challenges – determined the degree of difficulty encountered (1.00–1.85 = Low; 3.01–4.00 = Very High).

Strategies – gauged frequency of implementing teaching strategies (1.00–1.85 = Never; 3.01–4.00 = Always).

Students' performance in Science was measured using final grades for School Year 2023–2024, recorded in DepEd Form 138-A/School Form 9. Grades were categorized as Outstanding (90–100), Very Satisfactory (85–89), Satisfactory (80–84), Fairly Satisfactory (75–79), and Did Not Meet Expectations (below 75).

The following statistical tools were applied:

Weighted Mean – to determine levels of perceptions, practices, challenges, strategies, and performance.

Standard Deviation – to assess variability of responses.

Pearson Product–Moment Correlation – to test relationships among teacher perceptions, practices, challenges, strategies, and student performance.

FINDINGS AND DISCUSSIONS

Table 1
Science Teachers' Level of Perceptions of Indigenous Knowledge Systems and Practices (IKSP) in Science

Perception in IKSP	Mean	SD	Description
IKSP has substantial contributions to scientific innovations.	3.06	0.90	Agree
IKSP is important in understanding concepts in science.	3.64	0.49	Strongly Agree
IKSP gives a unique environmental perspective and can benefit science education by promoting cultural understanding, sustainability, and holistic learning.	3.67	0.48	Strongly Agree
IKSP can spark curiosity about environmental challenges.	3.55	0.51	Strongly Agree
With IKSP, there will be greater opportunities to science discoveries and innovations.	3.52	0.57	Strongly Agree
Indigenous perspectives can pave the way to promote culturally inclusive scientific approaches.	3.64	0.49	Strongly Agree
Sharing Indigenous Knowledge within and across branches of science can help enhance cross-cultural understanding and promote the cultural dimension of development as well as help learners grasp a better understanding of the lessons.	3.64	0.49	Strongly Agree
Overall Mean	3.53	0.39	Strongly Agree

Findings revealed strong agreement on the importance of Indigenous Knowledge Systems and Practices (IKSP) in Science education. Respondents rated IKSP's provision of unique environmental perspectives highest (M = 3.67, SD = 0.48), emphasizing its role in promoting cultural understanding, sustainability, and holistic learning. They also agreed that indigenous perspectives enrich scientific inquiry by enhancing comprehension and inclusivity (M = 3.64, SD = 0.49), making abstract

concepts more relatable and fostering empathy and cultural awareness. IKSP was further perceived as a catalyst for discovery and innovation (M = 3.52, SD = 0.56), with respondents recognizing the potential of blending traditional and modern perspectives to support creative problem-solving. Although perceptions of IKSP's direct contribution to innovation were more moderate (M = 3.06, SD = 0.90), the findings underscore its complementary role in advancing scientific research and sustainable practices.

This showed a strong belief that the incorporation of indigenous knowledge promoted not only scientific understanding but also empathy and cultural awareness. It supported the idea that educational experiences rooted in IKSP could engage students more meaningfully and help them better relate to their studies. This demonstrated that many saw IKSP as crucial for bridging the gap between theoretical science and practical application. Such perspectives pointed to the potential benefits of integrating indigenous insights into science education to facilitate deeper comprehension and connection to real-world scenarios. The perception of IKSP as integral to scientific innovation had key educational implications. Integrating IKSP into the curriculum supported more comprehensive learning and helped students see the direct application of scientific principles in their communities.

These results are consistent with the contextualized learning rooted in indigenous and local wisdom strengthens environmental literacy and scientific comprehension. Lubis, Suryadarma, Paidi, and Yanto (2022) reported that *"*problem-based learning oriented to local wisdom and socio-scientific issues significantly improved students' environmental literacy and conceptual understanding compared to conventional approaches. Embedding indigenous perspectives in science education helped learners connect abstract concepts with real-life contexts, thereby enhancing engagement and comprehension". This supports the present study's finding that contextualizing Science through IKSP—such as teaching Chemistry through indigenous practices like soap-making or plant-based medicine—strengthens student engagement, knowledge retention, and real-world application.

Overall, the findings highlight that integrating IKSP into the curriculum not only enriches academic learning but also equips learners with cultural awareness, environmental responsibility, and problem-solving skills necessary for innovation and holistic education. This is aligned with studies emphasizing indigenous knowledge as vital for addressing sustainability challenges (Siambombe et al., 2018; Okebukola, 2020; Abdulhadi et al., 2022).

Table 2
Extent of Practices of Science Teachers Regarding the Integration of Indigenous Knowledge Systems and Practices in Science

Practices in integrating IKSP	Mean	SD	Description
Immerse learners with nature while discussing science concepts.	3.61	0.50	Great Extent
Supplements learning with culturally responsive materials.	3.52	0.57	Great Extent
Use indigenous knowledge articles to teach science concepts.	3.39	0.56	Low Extent
Use local games/plays as springboard in introducing lessons.	3.36	0.60	Low Extent
Allows learners to explore local materials themselves to design and test their own fair experiment.	3.52	0.57	Great Extent
Engage learners in hands-on experiences like community-based research and documenting cultural practices.	3.58	0.50	Great Extent
Consider available resources inside and outside the school and how students can involve community in their research or as an audience for their final presentation.	3.45	0.62	Low Extent
Overall Mean	3.49	0.41	Low Extent

Findings showed that immersing learners in nature while teaching Science concepts was widely practiced (M = 3.61, SD = 0.50), highlighting the value of experiential learning and direct observation. This suggested that educators recognized the importance of connecting students with their natural environment – studying plants, insects, traditional farming methods, tree planting, waste management, weather patterns, landscapes, medicinal plants – to enhance their understanding of scientific concepts through direct observation and experiential learning. Hands-on activities such as community-based research and cultural documentation were also applied to a great extent (M = 3.58, SD = 0.50), reflecting educators' efforts to link classroom learning with real-world and cultural contexts.

In contrast, the use of indigenous knowledge articles (M = 3.39, SD = 0.56) and local games or plays (M = 3.36, SD = 0.60) were implemented to a lesser extent, suggesting barriers such as limited access to materials or lack of training. The overall mean score (M = 3.49, SD = 0.41) indicated only a low extent of IKSP integration, revealing a gap between its perceived value and actual classroom practice. These findings emphasized opportunities for strengthening these practices by addressing barriers, increasing the availability of culturally relevant teaching resources, and encouraging broader community participation. Exposing the learners to culturally relevant materials such as local stories and folktales, traditional farming, fishing or healing practices, problems using local markets, farming tools, traditional weather indicators, and use of stones, soil, water, leaves or clays for simple science investigations could help learners understand Science as part of their daily lives and not just an abstract idea. Such enhancements could lead to more comprehensive integration of IKSP that would foster an environment where students benefit from culturally informed and interactive Science Education. This limited integration could hinder the development of a fully inclusive and engaging science curriculum that would reflect the diverse backgrounds of learners.

These results underscore the need for greater institutional support, resource development, and professional training to maximize IKSP integration. Literature

affirms that engaging learners in culturally rooted and community-based practices enhances sustainability awareness, cross-generational learning, and scientific literacy (Siambombe, Mutale, & Muzingili, 2018). Strengthening IKSP practices in the curriculum could therefore foster more inclusive, contextualized, and holistic Science education.

Table 3
Challenges Faced by Science Teachers in Integrating Indigenous Knowledge Systems and Practices in Science

Challenges in integrating IKSP	Mean	SD	Description
I find it difficult to integrate IKSP in science concepts with ease.	2.12	0.49	Moderate
I have limited knowledge and exposure regarding indigenous knowledge systems of the indigenous communities.	2.18	0.47	Moderate
I have inadequate time to prepare contextualized teaching materials.	2.12	0.70	Moderate
I hardly connect into the learner's culture with ddiverse native languages.	2.06	0.75	Moderate
I am indifferent to the idea of contextualization and localization.	2.00	0.71	Moderate
6. Limited sources of IKSPs in books, internet and libraries.	2.36	0.65	Moderate
Lack of seminars on contextualization/indigenization.	2.21	0.74	Moderate
Absence of agreement in recognizing the role of indigenous knowledge, innovation and practices in realizing a successful and practical educational change that addresses needs of learners and communities.	2.06	0.61	Moderate
I don't have enough time to research IKS for use as reference materials in any lessons.	2.15	0.76	Moderate
Overall Mean	2.14	0.43	Moderate

Teachers encountered moderate challenges in integrating Indigenous Knowledge Systems and Practices (IKSP) into Science education, with the most significant being limited access to reliable IKSP resources (M = 2.36, SD = 0.65). Other barriers included language and cultural diversity (M = 2.06, SD = 0.61–0.65), insufficient contextualization (M = 2.00, SD = 0.71), and lack of training opportunities (M = 2.21, SD = 0.74). These findings suggest that while educators recognize the value of IKSP, gaps in resources, professional development, and culturally responsive pedagogy constrain its consistent application. This indicates that there were still some educators who does not fully embrace or understand the value of integrating indigenous perspectives. The moderate challenges in knowledge and exposure indicated that teachers are not sufficiently trained or informed about indigenous practices and their relevance to Science Education. This knowledge gap limit teachers' confidence and willingness to incorporate IKSP, suggesting a need for professional development programs focused on indigenous knowledge and contextual teaching practices.

Addressing these challenges through systemic support and teacher training could strengthen IKSP integration, fostering inclusive and contextually relevant Science education (Abah, Mashebe, & Denuga, 2015; Oladejo et al., 2021).

Table 4
Strategies Employed by Science Teachers to Overcome Challenges in Integrating Indigenous Knowledge Systems and Practices in Science

Strategies in integrating IKSP	Mean	SD	Description
IKSP has substantial contributions to scientific innovations.	3.09	0.72	Often
IKSP is important in understanding concepts in science.	3.21	0.60	Often
IKSP gives a unique environmental perspective and can benefit science education by promoting cultural understanding, sustainability, and holistic learning.	3.03	0.64	Often
IKSP can spark curiosity about environmental challenges.	3.15	0.62	Often
With IKSP, there will be greater opportunities to science discoveries and innovations.	3.00	0.66	Often
Indigenous perspectives can pave the way to promote culturally inclusive scientific approaches.	2.91	0.84	Often
Sharing Indigenous Knowledge within and across branches of science can help enhance cross-cultural understanding and promote the cultural dimension of development as well as help learners grasp a better understanding of the lessons.	3.07	0.53	Often
Overall Mean	3.09	0.29	Often

Teachers strongly recognized the importance of Indigenous Knowledge Systems and Practices (IKSP) in Science education, particularly in providing environmental perspectives (M = 3.67, SD = 0.48), enhancing cultural understanding, and promoting sustainability. IKSP was also seen as enriching scientific inquiry (M = 3.64, SD = 0.49) and fostering creativity (M = 3.52, SD = 0.56), though its perceived role in driving innovation was more moderate (M = 3.06, SD = 0.90).

In practice, IKSP strategies were applied at a moderate level (M = 3.09, SD = 0.29), with greater emphasis on supporting conceptual understanding (M = 3.21, SD = 0.60) and sparking environmental curiosity (M = 3.15, SD = 0.62). Less focus was placed on promoting inclusivity (M = 2.91, SD = 0.84) and innovation (M = 3.00, SD = 0.66), reflecting uneven integration despite positive perceptions. This is noted in studies that teachers' recognition of IKSP's value but challenges in translating it into classroom practice (McKinley & Stewart, 2017; Bishop, 2018; Ritchie & Rau, 2019).

The results shows that teachers generally recognized the importance of IKSP in Science education, as evidenced by the high mean scores for the various strategies. Teachers acknowledge that IKSP contribute to scientific innovation, provide a unique environmental perspective, and enhance cultural understanding. Furthermore, while the benefits of IKSP integration were recognized, the practical implementation of these strategies were not fully realized across all teaching practices. It also suggested that while some teachers frequently use IKSP to promote sustainability and cross-cultural understanding, others do not prioritize it as a strategy.

Lubis et al. (2022) showed that embedding local wisdom in problem-based learning improved students' environmental literacy and conceptual understanding, while Macaspac and Prudente (2025) highlighted limited dialogic practices in Filipino science classrooms, pointing to structural and pedagogical barriers. Together, these findings

suggest that meaningful IKSP integration requires not only teacher recognition but also curriculum design, professional development, and resource support.

In conclusion, IKSP enhances engagement, cultural awareness, and sustainability-focused learning. To move from recognition to consistent practice, systemic support is essential—equipping teachers with dialogic strategies, culturally responsive pedagogy, and contextualized curriculum materials to realize IKSP's full potential in Science education.

Table 5
Level of Science Performance of Students

Range	Description	Frequency	Percentage
90-100	Outstanding	1	3.03
85-89	Very Satisfactory	20	60.61
80-84	Fairly Satisfactory	12	36.36
75-79	Beginning	0	0.00
74 below	Did Not Meet Expectations	0	0.00
Average		85.49	Very Satisfactory

Most students performed in the Very Satisfactory range (85–89), accounting for 60.61%, followed by 36.36% in the Satisfactory range (80–84). Only 3.03% achieved Outstanding performance (90–100), while no students scored below satisfactory. The overall mean of 85.49 indicates a very satisfactory performance of the students in science.

These results indicate generally strong outcomes in Science, with all students meeting or exceeding expectations. However, the limited proportion of Outstanding performers suggests a need for differentiated instruction and enrichment strategies to help more students progress from satisfactory achievement toward higher levels of excellence.

Table 6
Relationship between and among the Teacher's Perception, Practices, Challenges, and Strategies on IKSP and Science Performance of the Students

	Science Performance	
	r	p-value
Perception on IKSP	0.32	0.07
Practices in Integrating IKSP	0.07	0.69
Challenges in Integrating IKSP	0.16	0.38
Strategies in Integrating IKSP	0.08	0.66

Teachers' perceptions, practices, challenges, and strategies in integrating IKSP had no significant relationship with students' Science performance ($p > 0.05$), suggesting that while IKSP integration supports culturally responsive teaching, it does not directly translate into short-term performance gains. Instead, external factors such as curriculum alignment, student motivation, and assessment methods may exert greater influence. However, significant positive correlations were observed among teachers' perceptions, practices, and strategies ($r = 0.44$, $p = 0.01$), indicating that positive attitudes toward IKSP promote its classroom adoption. These findings highlight a misalignment between IKSP integration and measurable learning outcomes, supporting prior studies (Mamung,

2022; Abdulhadi et al., 2022) that emphasize systemic barriers, resource gaps, and the dominance of Western paradigms. To maximize IKSP's potential, integration must be systematically aligned with the Most Essential Learning Competencies (MELCs), supported by contextualized instructional materials, performance-oriented assessments, and sustained professional development as outlined in the PPST and DepEd Memorandum #23 (s. 2023). Moreover, partnerships with indigenous communities and interdisciplinary linkages can strengthen relevance, while rethinking assessment frameworks could better capture IKSP's long-term benefits, such as critical thinking, cultural awareness, and problem-solving skills.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The findings of this study provided valuable insights into the integration of Indigenous Knowledge Systems and Practices (IKSP) in Science education, accentuating key aspects of teacher perceptions, practices, challenges, and strategies, as well as their impact on student performance. The data revealed a strong appreciation among teachers for the significance of IKSP in fostering scientific innovation, environmental awareness, and cultural understanding. However, the extent of IKSP integration in classroom practices remained limited, constrained by various challenges such as resource availability and lack of training. Despite these hurdles, teachers employed a range of strategies to incorporate IKSP, with varying levels of effectiveness. The Science performance of students reflected an overall positive outcome, though opportunities for improvement remain. Furthermore, significant relationships between teacher-related variables, such as perceptions, practices, and strategies, underscored the interconnected nature of these factors in shaping educational experiences.

CONCLUSIONS

The conclusions drawn from this study emphasized the crucial role of Indigenous Knowledge Systems and Practices (IKSP) in Science education, as well as the need for enhanced integration and support.

1. Teachers strongly recognized the significance of Indigenous Knowledge Systems and Practices (IKSP) in Science education. They acknowledge its potential to contribute to scientific innovations, environmental awareness, and cross-cultural understanding, highlighting their belief in its value for fostering holistic and inclusive educational approaches.

2. Despite positive perceptions, teachers integrated IKSP into their teaching only to a "Low Extent." While they effectively employ hands-on activities, culturally responsive materials, and community-based research, less emphasis on indigenous knowledge articles, local games, and community involvement suggested that practical application remained limited and required improvement.

3. Teachers faced moderate challenges in integrating IKSP into Science education. These included insufficient resources, lack of training, limited exposure to indigenous knowledge, and inadequate preparation time. The absence of a unified framework for

recognizing IKSP further complicated its effective implementation in teaching practices.

4. Teachers frequently used strategies to incorporate IKSP, including immersing learners in nature, using culturally responsive materials, and fostering curiosity about environmental issues. However, strategies such as incorporating indigenous articles required further emphasis to achieve more comprehensive integration of IKSP in Science education.

5. Students demonstrate an overall "Very Satisfactory" level of science performance, with most achieving this category. However, only a small percentage reach the "Outstanding" level which suggested room for improvement. No students fell below expectations, indicating a generally positive outcome in science education.

6. Significant relationships existed between teachers' perceptions, practices, and strategies in integrating IKSP, highlighting those positive perceptions influence practices and strategies. However, the lack of a significant relationship between IKSP-related factors and student performance suggested that additional factors, such as curriculum design and resource availability, played a critical role in student outcomes. Addressing these mediating factors could further enhance the impact of IKSP integration.

RECOMMENDATIONS

Based on the findings and conclusions of this study, several recommendations were proposed to further enhance the integration of Indigenous Knowledge Systems and Practices (IKSP) in science education.

1. Since teachers strongly agree on the importance of IKSP in Science education, institutions should capitalize on this positive perception by providing more structured opportunities to integrate IKSP. Organizing workshops, conferences, and seminars on the role of IKSP in science education can further reinforce its value and provide functional frameworks for implementation.

2. To enhance the extent of IKSP integration, schools and educators should incorporate more diverse teaching methods, including indigenous knowledge articles, local games, and community involvement. Developing a repository of culturally relevant teaching materials and encouraging collaboration with indigenous communities can provide teachers with accessible resources and practical examples.

3. Addressing the challenges in integrating IKSP requires a multipronged approach:

-Provide targeted training programs on contextualizing and localizing science education using IKSP.

-Develop a centralized platform for teachers to access IKSP-related resources, such as books, digital materials, and lesson plans.

-Allocate sufficient time and support for teachers to prepare contextualized materials by revisiting workload distributions and ensuring proper funding for IKSP integration.

4. While teachers often use various strategies, there is a need to emphasize underutilized ones, such as indigenous articles and localized approaches. Schools should encourage the development and sharing of best practices among educators to expand the range of effective strategies. Establishing partnerships with local cultural institutions can further enhance the repertoire of available methods.

5. To improve student performance, particularly in raising the number of students achieving "Outstanding" results, curriculum planners should consider integrating more engaging and contextualized activities using IKSP. Enrichment programs, science fairs showcasing IKSP, and targeted remedial classes for students at the lower performance spectrum can bridge the gap in learning outcomes.

6. Given the significant relationship between teachers' perceptions, practices, and strategies, school administrators should focus on aligning teacher training and support systems to reinforce this synergy. Strengthening the link between these factors through professional development programs can help maximize their impact.

7. Investigating other variables influencing student performance, such as teaching quality, student engagement, and resource availability, can provide a more holistic approach to improving outcomes. Additionally, increasing the number of science teacher-respondents and area of study can also be included since the area of study is limited and the number of respondents is small.

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