

Identification of a Grade 9 Biology Learning Competency in Need of Contextualization as Basis for the Development of a Contextualized Learning Material

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Abstract

Contextualized instruction enhances science learning by linking concepts to learners' cultural and real-life experiences; however, its application in Biology remains limited due to insufficient localized materials, limited teacher training, and challenges in integrating Indigenous knowledge. This study aimed to identify a Grade 9 Biology learning competency in need of contextualization as a basis for the development of a Contextualized Learning Material (CLM) and to examine teachers' perspectives on contextualized instruction. This study employed a Research and Development (R&D) design guided by the Successive Approximation Model (SAM) and focused on the needs assessment phase. It was conducted in an IPED-implementing secondary school in Mapurog, Bonifacio, Misamis Occidental, where both Subanen and non-Subanen learners are enrolled. Participants included Science teachers with at least five years of teaching experience. Data were collected through interview assessment questionnaires and semi-structured interviews and analyzed using weighted mean and qualitative content analysis. Findings revealed that teachers actively integrate contextualization through real-life, environmental, and cultural connections in Biology instruction. The learning competency "describing the biotic and abiotic features of tropical rainforests, swamps, estuaries, mangrove forests, and coral reefs" was identified as most in need of contextualization. Four themes emerged: real-life and cultural integration, priority areas for contextualization, instructional support, and implementation challenges. Teachers emphasized the need for localized materials, training, and community partnerships. The study concludes that effective contextualized Biology instruction requires sustained institutional support and culturally grounded resources. The identified competency provides a strong basis for developing a Contextualized Learning Material that promotes culturally responsive, relevant, and meaningful science learning.

Keywords: Contextualization, biology education, teacher perspectives, qualitative content analysis

1. Introduction

Contextualized instruction has been widely recognized as an effective approach to enhancing science learning and academic performance across educational levels. Contextualization refers to the instructional process of connecting academic content to learners' real-life experiences, cultural background, and community environment, allowing knowledge to become more meaningful and applicable. In science education, Contextualized Learning Materials (CLMs) are instructional resources that situate scientific concepts within familiar contexts, enabling learners to construct understanding through experiences they already know. This aligns with constructivist learning theory, which emphasizes that learners build knowledge by linking new information with prior experiences (Picardal & Sanchez, 2022). Studies have consistently shown that contextualized instruction improves students' knowledge, comprehension, engagement, and academic performance by making lessons more relevant and easier to understand (Dohinog et al., 2025).

In Biology, contextualization is particularly important because many of its concepts are directly connected to learners' environment and daily life. Topics such as ecosystems, biodiversity, classification of organisms, heredity, and ecological relationships can be linked to real-world phenomena observed in agriculture, fishing, household practices, and environmental interactions. Contextualized learning emphasizes connecting scientific concepts to authentic situations and learners' lived experiences, making learning more meaningful and relevant (Giamellaro, 2025). Research in science education has shown that contextualized and context-based approaches help learners develop conceptual understanding by relating scientific knowledge to familiar environments and real-life applications (van Vorst & Aydogmus, 2021). Furthermore, science learning experiences grounded in authentic and experiential contexts have been found to enhance student engagement and support deeper understanding of scientific concepts (Wörner et al., 2022). Consequently, Biology is highly suitable for the development of contextualized instructional materials that bridge scientific concepts and learners' everyday realities.

Despite these benefits, several challenges persist in science education that limit effective contextualization. Teachers often struggle in designing lessons that are both academically aligned and culturally or locally relevant, particularly due to limited access to appropriate resources and lack of training in contextualized instruction (Bello et al., 2023). In many cases, science instruction remains largely textbook-based and detached from learners' experiences. Additionally, the persistence of viewing local or Indigenous knowledge as inferior to Western scientific knowledge further limits meaningful integration in classrooms (da Silva et al., 2024). In the Philippine context, although contextualization is encouraged, its implementation in Biology instruction is still uneven and often superficial, resulting in limited impact on learners' understanding and engagement (Tolentino et al., 2022). Teachers also report difficulties in identifying appropriate local contexts for science lessons due to limited familiarity with community-based knowledge systems and lack of supporting materials (Tica-a & Wangdali, 2023). Moreover, the scarcity of developed and validated contextualized instructional resources remains a major constraint in improving science teaching practices (Pepano, 2019).

These challenges highlight the need for stronger alignment between curriculum competencies and contextualized instruction. Although contextualization is mandated in national education policies, its implementation often lacks a systematic basis for determining which specific learning competencies require contextualization. As a result, instructional adaptation is frequently dependent on teacher discretion rather than evidence-based identification of learning difficulties. Establishing a clear basis for identifying competencies that require contextualization is therefore essential in ensuring that instructional materials are purposefully designed and effectively address learners' needs.

This need is supported by key policy frameworks in Philippine education. Republic Act No. 10533 or the Enhanced Basic Education Act of 2013 emphasizes the principles of contextualization, localization, and indigenization in curriculum implementation. Likewise, Republic Act No. 8371 or the Indigenous Peoples' Rights Act of 1997 recognizes the right of Indigenous Peoples to culturally appropriate education systems that respect their identity and knowledge systems. The Department of Education's Indigenous Peoples Education (IPEd) Framework further strengthens this mandate by promoting culturally responsive teaching that integrates learners' contexts into instruction (Department of Education, 2011). Internationally, the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) affirms the right of Indigenous communities to access education that respects their cultural identity and knowledge systems (United Nations, 2007).

In response to these gaps, this study aims to identify a Grade 9 Biology learning competency that is in need of contextualization and use this as the basis for developing a Contextualized Learning Material (CLM). Specifically, it seeks to determine the Biology competency perceived by teachers as requiring contextualization, develop a CLM based on the identified competency, and validate the developed material through expert evaluation. By systematically identifying the learning competency before material development, this study ensures that contextualization efforts are evidence-based, targeted, and aligned with actual instructional needs.

Ultimately, this study contributes to improving Biology instruction by strengthening the connection between curriculum competencies and learners' lived experiences. It promotes more meaningful science learning by ensuring that instructional materials are grounded in real contexts, thereby enhancing conceptual understanding and student engagement in Biology education.

2. Methodology

2.1 Research Design

This study employed a Research and Development (R&D) design to identify a Grade 9 Biology learning competency in need of contextualization and to serve as the basis for the development of a Contextualized Learning Material (CLM). Richey and Klein (2007) described R&D as a systematic process for designing, developing, and evaluating educational products to address instructional needs and improve teaching and learning outcomes. The research phase focused on determining the need for contextualization in Grade 9 Biology through interviews with Biology teachers. Teachers served as key informants due to their direct experience in curriculum implementation and familiarity with students' learning difficulties. Through semi-structured interviews, they identified Biology competencies that were difficult to teach and learn using existing instructional resources and that could benefit from contextualization. The interview data were analyzed to determine the competency most in need of contextualization, which served as the basis for the proposed instructional material. This study primarily focused on the research phase of the R&D process. The development phase will involve designing a Contextualized Learning Material based on the identified competency. The material will undergo expert validation, and recommendations from the validators will be incorporated to refine and improve its quality and alignment with curriculum standards.

2.2 Research Setting and Participants

The study was conducted in Mapurog, Bonifacio, Misamis Occidental, an area associated with the Subanen community and characterized by a rich local ecosystem. A nearby secondary school implementing the Indigenous Peoples Education (IPEd) program served as the study site, where both Subanen and non-Subanen learners were enrolled. The

respondents were five (5) Science teachers with at least five years of teaching experience. Using a semi-structured interview guide, the teachers identified the Grade 9 Biology learning competency that needed contextualization and shared their experiences and insights regarding contextualized instruction. The interviews were conducted in English, Filipino, or Cebuano, depending on the participants' preference, and were audio-recorded with their consent. The responses were transcribed and analyzed thematically to identify the competency most in need of contextualization.

2.3 Research Instrument

This study utilized a researcher-made Interview Assessment Questionnaire (Appendix D) to identify Grade 9 Biology competency requiring contextualization. The instrument was administered to Science teachers to determine their understanding of contextualization and to identify Biology competencies that needed contextualization. The information gathered served as the basis for identifying the competency most in need of contextualization and will guide the future development of the Contextualized Learning Material (CLM).

2.4. Data Gathering Procedure

This study employed the Successive Approximation Model (SAM) as its guiding framework; however, the present phase focused specifically on the needs assessment of Science teachers as the basis for the future development of a Contextualized Learning Material (CLM) in Grade 9 Biology. Ethical procedures were strictly observed throughout the study. Approval to conduct the research was first secured from the Schools Division Superintendent. Upon approval, a formal request letter and the approved permit were submitted to the school principal. Informed consent was then obtained from the participating teachers prior to data collection. Confidentiality and voluntary participation were ensured throughout the study, in accordance with the ethical guidelines of the Department of Education and the participating school.

Aligned with the Preparation Phase of the Successive Approximation Model (SAM), data were gathered to identify the need for contextualization in Grade 9 Biology. This involved determining the learning competency perceived by Science teachers as most in need of contextualization, as well as exploring their experiences, challenges, and insights regarding contextualized instruction. Data were collected through a validated Interview Assessment Questionnaire and supplemented by semi-structured interviews to obtain deeper insights. The findings of this needs assessment served as the basis for identifying the competency that will guide the future development of a Contextualized Learning Material (CLM).

2.5 Data Analysis

Qualitative data gathered from the interview assessment questionnaires were analyzed using Qualitative Content Analysis (QCA). This method is a systematic and objective approach for describing and interpreting the meaning of qualitative data through the identification of patterns, categories, and themes (Elo & Kyngäs, 2008). Following the framework proposed by Elo and Kyngäs (2008), the analysis was conducted in three phases: preparation, organizing, and reporting. During the preparation phase, the responses were read repeatedly to gain familiarity with the data and identify meaningful units of analysis. In the organizing phase, the data were coded and grouped into categories, which were then synthesized into broader themes based on recurring patterns and relationships. Finally, in the reporting phase, the identified themes and categories were described and interpreted to present a coherent account of the participants' perspectives and experiences. The trustworthiness of the analysis was enhanced through a systematic coding and categorization process, which is a key feature of qualitative content analysis (Elo et al.,

2014). This approach enabled the researcher to provide deeper insights into the findings and complement the quantitative results with rich descriptive data.

3. Results and Discussion

This section presents and discusses the findings of the study on identifying a Grade 9 Biology learning competency in need of contextualization as a basis for the development of a Contextualized Learning Material (CLM). The results revealed that teachers possess adequate knowledge and experience in contextualized instruction and actively integrate real-life, environmental, and cultural connections into Biology teaching. The competency on “describing the biotic and abiotic features of tropical rainforests, swamps, estuaries, mangrove forests, and coral reefs” was identified as the learning competency most in need of contextualization. The findings further highlighted the Biology topics prioritized for contextualization, the support systems needed for effective implementation, the challenges encountered by teachers, and the perceived value of a Contextualized Learning Material. To provide a comprehensive understanding of these findings, the discussion is organized into the following sections: teachers’ understanding and practices of contextualization, Biology topics identified for contextualization, support needs and implementation challenges, strategies for connecting Biology to learners’ experiences and cultural contexts, and teachers’ perceptions of the proposed CLM.

3.1 Learning Competency that Needs Contextualization

Table 1. Ranking of Learning Competency that Needs Contextualization Learning Competencies

	Learning Competencies	Mean	Rank
1.	use models and labeled diagrams to represent the double helix structure of DNA (deoxyribonucleic acid);	8.8	9
2.	explain the role of DNA, genes, and chromosomes in the transmission of traits;	6.8	6
3.	describe mutations as changes in DNA or chromosomes and discuss some of the factors that cause mutations, such as infectious agents, radiation, and chemicals;	8.0	8
4.	use information from secondary sources to explain the beneficial, harmful, and neutral effects of mutations;	7.6	7
5.	explain the advantage of high biodiversity in maintaining the stability of an ecosystem during difficult conditions, such as food shortages, disease, and climate change;	4.8	3
6.	use information from secondary resources to classify animals and plants of the Philippines as critically endangered, endangered, or vulnerable species;	6.0	5
7.	discuss as a class how threats to biodiversity can lead to species extinction;	5.2	4
8.	use information from secondary sources to research how to protect and conserve endangered and/or economically important species in the local community;	6.0	3
9.	describe using labeled diagrams the biotic and abiotic features of tropical rainforests, swamps, estuaries, mangrove forests, and coral reefs;	2.0	1
10.	use information from secondary sources to describe the possible effects of human activities, such as deforestation, pollution, and introduction of invasive species, on living things in an ecosystem; and	2.4	2
11.	plan to conduct a survey to explore the possibilities for minimizing the negative impacts of human activities on an ecosystem.	8.0	8

The ranking of Grade 9 Science learning competencies was determined using the weighted mean, with competencies arranged from Rank 1 to Rank 11 based on ascending mean scores from five science teachers. The learning competency with the lowest mean score was assigned Rank 1, indicating it as the competency most in need of contextualization, while the competency with the highest mean score was assigned Rank 11, indicating the least need for contextualization among the identified competencies. The remaining competencies were ranked sequentially according to their computed mean scores, from lowest to highest. The learning competency “describe using labeled diagrams the biotic and abiotic features of tropical rainforests, swamps, estuaries, mangrove forests, and coral reefs” obtained the lowest mean score and was therefore ranked first, indicating that teachers perceived it as the learning competency most in need of contextualization among the Grade 9 Science competencies assessed.

3.2. Implementation of Contextualization in Biology Teaching

Table 2. Teachers' Responses on the Application of Contextualization and Localization Strategies in Biology Teaching in terms of Content

Question	Utterances	Mentions	Category	Theme
Do you apply contextualization or localization strategies in teaching Biology? If yes, please describe how you implement them in your lessons?	Yes, I apply contextualization (T1,T2,T3,T4,T5)	5	Application of Contextualization and Localization Strategies	Enhancing Biology Content through Contextualization and Real-life Connections
	Relating lessons to learners' real-life experience and culture (T1,T2,T3,T4,T5)	4	Real-life Connection and Cultural Integration	
	Using local examples and materials (T1) locally-raised crops and livestock (T2) Community practices (T3) Community practices into Biology lessons (T5)	4	Use of Local and Community-Based Example	

Table 2 shows that all five respondents implemented contextualization and localization strategies in their Biology instruction, demonstrating learner-centered and context-based teaching practices. Teachers connected lessons to students' experiences, cultural backgrounds, and local environments through community practices, familiar

materials, and agricultural activities. They also reported moderate to high familiarity with these strategies, although some expressed a need for further professional development. The theme "Enhancing Biology Content through Contextualization and Real-life Connections" underscores the value of linking Biology concepts to learners' everyday experiences and local contexts. By integrating culturally relevant examples and community-based resources, teachers help students develop deeper conceptual understanding and greater engagement. These findings support previous studies indicating that contextualized and localized instruction improves students' understanding, engagement, and academic performance by making scientific concepts more meaningful and relevant to their lived experiences (Picardal & Sanchez, 2022; Montero & Geducos, 2022; Barrun & Cajurao, 2025).

3.3. Contextualizable Biology Topics

Table 3. Teachers' Responses on the Biology Topics They Plan to Contextualize or Localize in the Future

Question	Utterances	Mentions	Category	Theme
Which Biology topics or lessons are you planning to contextualize or localize in the future, and why?	Asexual Reproduction in Plants and Energy Flow in an Ecosystem (T1)	2	Environment-Based Biology Topics	Prioritized Biology Topics for Future Contextualization and Localization
	Ecosystems, biodiversity, and ecological relationships are contextualized (T5)			
	Genetic Diversity in Native Populations, incorporating Local Genetic Research or breeding programs and discussing Ethical Considerations around Genetics (T2)	2	Genetics-Related Topics	Prioritized Biology Topics for Future Contextualization and Localization
	Mutation topics in genetics (T4)			

Table 3 shows that teachers intend to contextualize Biology topics closely related to students' environment and everyday experiences. Environment-based topics such as ecosystems, biodiversity, ecological relationships, and energy flow were identified by T1 and T5, while T2 and T4 highlighted genetics-related topics, including genetic diversity, mutation, and inherited traits. These findings indicate that teachers prioritize topics that can be linked to local contexts and real-world applications, making learning more meaningful and relevant. The theme "Prioritized Biology Topics for Future Contextualization and Localization" reflects teachers' preference for environment-based and genetics-related topics due to their strong connection to learners' daily lives, community experiences, and local surroundings. These findings support studies showing that contextualized instruction enhances conceptual understanding and engagement by connecting scientific concepts to familiar and authentic contexts (Montero & Geducos, 2022).

3.5 Support and Needs

Table 4. Teachers' Responses on the Support, Training, and Instructional Resources Needed to Improve Contextualization and Localization in Biology Teaching

Question	Utterances	Mentions	Category	Theme
What forms of support, training, or instructional resources would help you improve the contextualization and localization of Biology lessons?	Access to Localized Teaching Materials(T1)	3	Provision of Localized Learning Resources	
	Access to localized instructional materials, contextualized modules, and teaching guides(T5)			
	Access to Local Biodiversity databases(T2)			
	Training on culturally responsive teaching (T3)	3	Professional Development and Specialized Training	Empowering Teachers through Instructional Resources and Professional Capacity Building
	Specialized Training and workshops (T4)			
	Professional development trainings focused on contextualized and culture-responsive teaching strategies (T5)			
	Support from the school and community(T1)	5	Stakeholder Collaboration and Community Partnerships	Empowering Teachers through Instructional Resources and Professional Capacity Building
	Support from community(T3)			
	Partnerships with community experts and indigenous knowledge holders (T2)			
	collaborative support from experienced contextual teachers(T4)			
	collaboration with fellow teachers, IPED coordinators, and community elders(T5)			

Table 4 shows that teachers identified three key supports needed for effective contextualization of Biology lessons: localized learning resources, professional development, and stakeholder collaboration. Respondents emphasized the need for contextualized modules, teaching guides, and local biodiversity resources, as well as training on culturally responsive teaching strategies. All teachers also highlighted the importance of collaboration with schools, communities, IPED coordinators, and local knowledge holders. These findings align with studies showing that effective

contextualized instruction requires adequate resources, continuous teacher training, and strong school-community partnerships (Caingcoy, 2023). The theme "Empowering Teachers through Instructional Resources and Professional Capacity Building" underscores the importance of providing teachers with appropriate materials, training, and collaborative support to strengthen contextualized instruction. Research suggests that these supports enhance teachers' capacity to implement culturally responsive teaching and improve student learning outcomes (Sancar et al., 2021; Lucas & Villegas, 2002; UNESCO, 2021).

3.6. Challenges in Contextualizing Biology Lessons

Table 5. Teachers' Responses on the Challenges Encountered in Contextualizing and Localizing Biology Topics

Questions	Utterances	Mentions	Category	Theme
What challenges or limitations do you encounter or anticipate encountering when contextualizing or localizing Biology topics?	Limited Localized Material (T1) Limited teaching materials(T3) Availability of resources (T4) Limited availability of localized instructional materials and references (T5)	4	Scarcity of Localized Instructional Resources	
What challenges or limitations do you encounter or anticipate encountering when contextualizing or localizing Biology topics?	Difficulty Aligning Learning Contents with curriculum standards while meeting learning competencies(T1) Difficulty Balancing localized examples with standardized testing requirements (T2) Balance curriculum requirements with localized content(T5)	3	Curriculum Alignment and Standardization Pressure	Strengthening Localized Pedagogy through Material Resources, Professional Capacity Building, Stakeholder Engagement
What challenges or limitations do you encounter or anticipate encountering when contextualizing or localizing Biology topics?	Lack of Training in Culturally Responsive Pedagogy (T2) Lack of training in culturally responsive method (T3) Need for sufficient training and guidance(T5)	3	Lack of Training and Professional Preparation	Strengthening Localized Pedagogy through Material Resources, Professional Capacity Building, Stakeholder Engagement

Questions	Utterances	Mentions	Category	Theme
What challenges or limitations do you encounter or anticipate encountering when contextualizing or localizing Biology topics?	Time constraints for adopting standardized curricula (T2) Time constraints in lesson preparation(T5)	2	Time Constraints in Implementation	Strengthening Localized Pedagogy through Material Resources, Professional Capacity Building, Stakeholder Engagement
What challenges or limitations do you encounter or anticipate encountering when contextualizing or localizing Biology topics?	Adapting lesson to students diverse culture (T3) Contextualized examples remain scientifically accurate while being culturally appropriate. (T5)	2	Cultural and Contextual Adaptation Concerns	Strengthening Localized Pedagogy through Material Resources, Professional Capacity Building, Stakeholder Engagement
What challenges or limitations do you encounter or anticipate encountering when contextualizing or localizing Biology topics?	Nature of subject itself (T4)	1	Complexity of Biology Topics	Strengthening Localized Pedagogy through Material Resources, Professional Capacity Building, Stakeholder Engagement

Table 5 shows that teachers encountered several challenges in contextualizing and localizing Biology topics. The most common issues were the scarcity of localized instructional resources, difficulties aligning localized content with curriculum standards, and limited training on contextualized and culturally responsive teaching. Teachers also cited time constraints, cultural adaptation concerns, and the complexity of some Biology topics. These findings are consistent with studies identifying limited resources, insufficient training, and curriculum demands as major barriers to effective contextualization (Caingcoy, 2023). The theme "Strengthening Localized Pedagogy through Material Resources, Professional Capacity Building, and Stakeholder Engagement" highlights the need for adequate instructional materials, continuous professional development, and stronger collaboration with communities and other stakeholders. Addressing these challenges can enhance teachers' capacity to implement contextualized instruction and improve learning experiences in Biology (Lucas & Villegas, 2002; Sancar et al., 2021; UNESCO, 2021).

3.7 Contextualized Teaching Practices and Activities

Table 6. Teachers' Responses on Classroom Activities Used to Connect Biology Lessons to Students' Real-Life Experiences

Questions	Utterances	Mentions	Category	Theme
What specific examples or classroom activities do you use to connect Biology lessons to your students' real-life experiences?	share personal experiences related to the lessons (T1)	3	Student-centered and Familial Trait Investigations	Contextualized and Experiential Biology Learning through Indigenous Knowledge, Community Inquiry, and Learner-Centered Environmental Exploration
	Investigate heredity using students' own family traits(T2)			
	observe their classmates personal traits/features (T4)			
	Conducting investigations and observing scenarios at home (T1)	2	Localized Ecological and Home-based Fieldc5)	Contextualized and Experiential Biology Learning through Indigenous Knowledge, Community Inquiry, and Learner-Centered Environmental Exploration
	Identify local plants and animals in their community, observe their interactions(T5)			
	Subanen traditional farming and medicinal practices (T3)	2	Integration of Indigenous Knowledge System and Cultural Practices	Contextualized and Experiential Biology Learning through Indigenous Knowledge, Community Inquiry, and Learner-Centered Environmental Exploration
	traditional Subanen practices, such as sustainable farming and forest conservation(T5)			
	"charts of community nutrition" (T3)	2	Community Health Dynaics and Environmenta list	Contextualized and Experiential Biology Learning through Indigenous Knowledge, Community Inquiry, and Learner-Centered Environmental Exploration
	"discuss their roles in sustaining the environment" (T5)			

Table 6 shows that teachers use various strategies to connect Biology lessons to students' real-life experiences, including family trait investigations, local ecological activities, Indigenous knowledge integration, and community health and environmental activities. Through these approaches, students explore local biodiversity, community issues, and cultural practices, making Biology concepts more meaningful and relevant. These findings support studies showing that contextualized and culturally responsive instruction enhances student engagement and conceptual understanding by linking science concepts to learners' everyday experiences and local environments (Montero & Geducos, 2022; Rasmawan et al., 2025). The theme highlights the value of experiential, community-based, and culturally relevant learning in Biology. By connecting lessons to learners' home, community, and cultural contexts, teachers promote deeper understanding, engagement, and appreciation of scientific concepts (Kolb & Kolb, 2021).

3.8 Integration of Cultural and Local Knowledge

Table 7 shows that teachers incorporate students' cultural backgrounds, Indigenous knowledge, local resources, and environmental contexts into Biology instruction. The most common practice was integrating students' cultural experiences into lessons, followed by the use of Indigenous practices, such as Subanen farming and medicinal knowledge, and community-based examples.

Table 7. Teachers' Responses on the Incorporation of Students' Cultural Backgrounds, Traditions, and Local Contexts in Biology Teaching

Questions	Utterances	Mentions	Category	Theme
How do you incorporate or plan to incorporate students' cultural backgrounds, traditions, or local contexts into your Biology teaching? Please give examples if applicable.	Relating lessons to learners' culture(T1)	3	Integration of Students' Cultural Backgrounds and Practices	Culturally Sustaining and Contextually Responsive Biology Pedagogy through the Integration of Indigenous Knowledge Systems, Local Resources, and Environmental Contexts
	Using examples from their culture and Subanen practices(T3)			
How do you incorporate or plan to incorporate students' cultural backgrounds, traditions, or local contexts into your Biology teaching? Please give examples if applicable.	Integrate students' cultural background" (T5)	3	Integration of Students' Cultural Backgrounds and Practices	Culturally Sustaining and Contextually Responsive Biology Pedagogy through the Integration of Indigenous Knowledge Systems, Local Resources, and Environmental Contexts
	Relating lessons to learners' culture (T1)			
	Using examples from their culture and Subanen practices" (T3)	2	Use of Indigenous Knowledge and Traditional Practices	Culturally Sustaining and Contextually Responsive Biology Pedagogy through the Integration of Indigenous Knowledge Systems, Local Resources, and Environmental Contexts
	Integrate students' cultural background" (T5)			
	Subanen traditional farming and medicinal practices (T3) Traditional practices of the Subanen community, such as sustainable farming and forest conservation" (T5)	2	Use of Local Materials and Community Examples	Culturally Sustaining and Contextually Responsive Biology Pedagogy through the Integration of Indigenous Knowledge Systems, Local Resources, and Environmental Contexts
	Using local examples and materials (T1) locally available materials, community-based examples(T5)			
	Identify local plants and animals in their community(T5)	1	Integration of Local Environmental Context	Culturally Sustaining and Contextually Responsive Biology Pedagogy through the Integration of Indigenous Knowledge Systems, Local Resources, and Environmental Contexts

Some teachers also utilized local plants, animals, and environmental issues to make lessons more relevant and meaningful. The theme "Culturally Sustaining and Contextualized Biology Instruction through Indigenous Knowledge Systems, Local Resources, and Environmental Integration" highlights teachers' efforts to connect Biology concepts to learners' cultural and community contexts. By integrating Indigenous knowledge, local resources, and environmental experiences, teachers make learning more relevant, engaging, and accessible while promoting deeper conceptual understanding (Paris & Alim, 2017).

3.9 Perceived Effectiveness of the Contextualized Ethnoscience Learning Module (CLM)

Table 8. Teachers' Responses on How a Contextualized Ethnoscience Learning Module (CLM) Could Improve Biology Instruction On Content

Questions	Utterances	Mentions	Category	Theme
How do you think the development of a Contextualized Ethnoscience Learning Module (CLM) could help address these challenges and improve your Biology instruction?	Supports Experiential Learning (T1) Making concepts easier to teach and relate to students lives (T3) Ready-to-use examples, activities, and references (T5)	3	Improved Teaching and Learning Experiences	Enhancing Instructional Effectiveness and Cultural Responsiveness through the Contextualized Ethnoscience Learning Module
	Promote Cultural Appreciation (T1) Integrate local culture and indigenous knowledge (T3) Integrate indigenous knowledge, local ecosystems, and community practices(T5)	3	Integration of Culture and Indigenous Knowledge	Enhancing Instructional Effectiveness and Cultural Responsiveness through the Contextualized Ethnoscience Learning Module
	Reduce Preparation Time (T1) Reducing the time and effort needed to contextualize lessons (T5)	2	Reduced Preparation Time and Teacher Workload	Enhancing Instructional Effectiveness and Cultural Responsiveness through the Contextualized Ethnoscience Learning Module
	Bridge the gap between standardized curriculum and local relevance (T2) Aligns with the K to 12 curriculum (T5)	2	Alignment of Localization with Curriculum Standards	Enhancing Instructional Effectiveness and Cultural Responsiveness through the Contextualized Ethnoscience Learning Module
	Improve not just the teaching and learning outcomes but also the students academic performance(T4)	1	Improved Student Learning Outcomes	Enhancing Instructional Effectiveness and Cultural Responsiveness through the Contextualized Ethnoscience Learning Module
	The classroom would become conducive for learning (T4)	1	Positive Classroom Learning Environment	Enhancing Instructional Effectiveness and Cultural Responsiveness through the Contextualized Ethnoscience Learning Module
	Improve not just the teaching and learning outcomes but also the students academic performance(T4)	1	Improved Student Learning Outcomes	Enhancing Instructional Effectiveness and Cultural Responsiveness through the Contextualized Ethnoscience Learning Module

Questions	Utterances	Mentions	Category	Theme
	The classroom would become conducive for learning (T4)	1	Positive Classroom Learning Environment	Enhancing Instructional Effectiveness and Cultural Responsiveness through the Contextualized Ethnoscience Learning Module

Table 8 shows that teachers viewed the proposed Contextualized Learning Material (CLM) as a valuable tool for improving Biology instruction. They believed that the CLM could make Biology concepts more relevant and easier to understand through contextualized activities, examples, and references. Teachers also highlighted its potential to integrate local culture, community practices, and environmental contexts while reducing preparation time and supporting curriculum alignment. These findings are consistent with studies showing that contextualized learning materials enhance conceptual understanding, engagement, and meaningful learning by connecting scientific concepts to learners' experiences and local contexts (Montero & Geducos, 2022; Rodríguez-Izquierdo, 2022). The theme "Enhancing Instructional Effectiveness and Cultural Responsiveness through the Contextualized Learning Material" reflects teachers' perceptions of the CLM as a resource that can support contextualized and culturally responsive Biology instruction. By providing relevant, curriculum-aligned, and locally grounded content, the CLM is expected to improve teaching effectiveness, student engagement, and the overall learning experience (Arriagada et al., 2024; Rodríguez-Izquierdo, 2022).

4. Conclusion

This study identified the Grade 9 Biology learning competency most in need of contextualization as the competency requiring learners to "describe the biotic and abiotic features of tropical rainforests, swamps, estuaries, mangrove forests, and coral reefs". The findings indicate that Science teachers recognize the importance of contextualization in making Biology concepts more meaningful, relevant, and accessible to learners. Teachers reported integrating contextualization and localization strategies through the use of real-life experiences, community-based examples, Indigenous knowledge, and local environmental contexts to enhance student engagement and conceptual understanding. The results further revealed that environment-based and genetics-related topics were perceived as the most suitable areas for contextualization due to their direct connection to learners' daily experiences and local realities. However, teachers also identified several challenges that hinder the effective implementation of contextualized instruction, including the limited availability of localized instructional materials, insufficient professional development opportunities, curriculum alignment concerns, and time constraints. These findings underscore the need for institutional support, capacity-building initiatives, and stronger collaboration among schools, communities, and other stakeholders to strengthen contextualized Biology instruction. Despite these challenges, teachers expressed positive perceptions regarding the development of a Contextualized Learning Material (CLM), recognizing its potential to provide relevant, curriculum-aligned, and culturally responsive learning experiences. The findings suggest that a well-designed CLM can serve as an effective instructional resource that supports meaningful learning, promotes learner engagement, and strengthens the connection between scientific concepts and students' lived experiences. Overall, the study provides empirical support for the development of contextualized instructional materials and highlights the importance of contextualization as a strategy for improving the relevance and quality of Biology education.

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