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Bio-literacy Through Language: Students' Lived Experiences of English-Mediated Life Sciences Learning and Pedagogy at Marinduque State University

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Abstract

Language plays a central role in how students encounter, interpret, communicate, and construct scientific knowledge, particularly in higher education contexts where English serves as a primary medium of instruction. This qualitative study explores the lived experiences of students in English-mediated life sciences learning and pedagogy at Marinduque State University, with particular attention to how language shapes their development of bio-literacy. Using an interpretative phenomenological approach, the study examines students' experiences of understanding scientific concepts and terminology, engaging with English-language learning materials, participating in classroom discourse, responding to pedagogical practices, and negotiating linguistic challenges in life sciences education. Participants will be purposively selected from undergraduate students who have completed or are currently enrolled in relevant life sciences courses taught substantially through English. Data will be generated through semi-structured, in-depth interviews and analyzed through a systematic phenomenological and thematic interpretative process. Trustworthiness will be strengthened through reflexivity, an audit trail, contextual description, and sustained engagement with the data. The study is expected to illuminate how English functions simultaneously as a resource and a potential barrier in students' development of biological understanding. By foregrounding student voices, the research seeks to advance a language-responsive conception of life sciences pedagogy in which linguistic accessibility, disciplinary discourse, classroom interaction, and culturally situated learning contribute to the development of bio-literacy. Findings may inform pedagogical practice, curriculum development, faculty development, and interdisciplinary collaboration between language and science educators in multilingual higher education.

Introduction

Learning the life sciences requires more than memorizing biological terminology and understanding isolated scientific concepts. Students are expected to read scientific texts, interpret diagrams and data, construct explanations, evaluate evidence, participate in scientific discourse, communicate findings, and apply biological knowledge to real-world issues. These practices reveal an important characteristic of science education: science is learned through language as much as it is learned through observation, experimentation, and conceptual reasoning.

Language is therefore not simply a vehicle through which already-formed scientific knowledge is transmitted. It constitutes an important means through which students encounter and construct disciplinary meaning. Scientific knowledge is represented through specialized vocabulary, definitions, explanations, classifications, arguments, laboratory instructions, graphs, diagrams, and research texts. Understanding these forms of representation requires learners to negotiate both the conceptual demands of science and the linguistic demands through which scientific knowledge is expressed.

This relationship becomes especially significant in multilingual higher education environments where English functions as a major language of textbooks, lectures, examinations, laboratory activities, and scholarly communication. Students may demonstrate familiarity with conversational English while encountering considerable difficulty when engaging with specialized disciplinary language. Terms that are uncommon in everyday communication, dense scientific texts, nominalized expressions, complex sentence structures, and abstract explanations may create an additional layer of difficulty in understanding biological concepts.

Consequently, difficulties in learning biology or related life sciences should not automatically be interpreted as deficiencies in scientific ability. In some cases, what appears to be difficulty with scientific content may also involve difficulty accessing the language through which that content is presented.

This study uses bio-literacy as a conceptual lens for understanding this relationship. Bio-literacy extends beyond factual knowledge of biology. It encompasses students' ability to comprehend biological concepts, interpret biological information, communicate scientific understanding, critically engage with biological claims, connect scientific ideas, and apply biological knowledge to personal, societal, and environmental contexts.

Developing such literacy requires students to become participants in the discourse of the discipline. They must learn not only *what biology says* but also *how biological knowledge is expressed, interpreted, justified, and communicated*.

Pedagogy plays a critical role in this process. Teachers can either intensify linguistic barriers or create bridges between students' existing linguistic resources and the specialized discourse of science. Strategies such as contextualized explanation, vocabulary scaffolding, visual representation, analogies, collaborative discussion, inquiry-based activities, laboratory experiences, multimodal resources, and strategic movement between languages may enable students to engage more meaningfully with complex biological concepts.

Yet students are not passive recipients of these instructional practices. They interpret, negotiate, and respond to language and pedagogy based on their prior educational experiences, linguistic backgrounds, confidence, learning strategies, and perceptions of themselves as science learners.

Understanding this complexity requires moving beyond test scores and proficiency measures. Quantitative measures can establish whether variables are related, but they may not adequately explain how students actually experience learning life sciences through English, what linguistic difficulties mean to them, how they respond to these challenges, and which pedagogical practices they perceive as enabling meaningful scientific understanding.

For this reason, the present study places students' lived experiences at the center of inquiry.

Conducted at Marinduque State University, the study explores how undergraduate students experience English-mediated life sciences learning and how these experiences shape their engagement with biological knowledge. It seeks to understand English not merely as a medium of instruction but as a component of disciplinary meaning-making.

Research Problem and Gap

Existing scholarship has established important connections among language, disciplinary literacy, science education, and classroom pedagogy. However, three gaps provide the rationale for the present investigation.

First, research on English language education and research on science education frequently operate as separate fields. Language studies often examine proficiency, comprehension, and communication, whereas science education studies concentrate on conceptual understanding, achievement, inquiry, and scientific literacy. Such separation can obscure the reality that scientific learning is inherently language-mediated.

Second, much of the literature examining language and science learning relies on achievement measures, proficiency scores, surveys, and other quantitative indicators. Although valuable, these approaches may not fully capture students' subjective experiences of negotiating scientific terminology, interpreting English-language scientific texts, communicating scientific explanations, or responding to language-intensive classroom practices.

Third, there remains a need for context-sensitive qualitative research examining these experiences within Philippine higher education. Multilingual Filipino students may move between English, Filipino, and local linguistic resources while learning disciplinary content. How students experience and make sense of these linguistic movements deserves closer investigation.

The study therefore addresses a conceptual and empirical gap by exploring **bio-literacy as a lived, language-mediated educational experience** rather than simply an achievement outcome.

Purpose of the Study

The study aims to explore and interpret the lived experiences of students in English-mediated life sciences learning and pedagogy at Marinduque State University and to understand how these experiences contribute to their development of bio-literacy.

Specifically, it seeks to:

1. explore how students experience the use of English in learning life sciences;
2. understand how students negotiate scientific vocabulary, texts, explanations, and classroom discourse presented in English;
3. examine students' perceptions of pedagogical practices that facilitate or constrain their understanding of life sciences;
4. explore the strategies students use when confronted with linguistic and conceptual difficulties;

5. understand how students connect language, scientific meaning-making, and their emerging bioliteracy; and
6. derive pedagogical implications for more language-responsive and inclusive life sciences instruction.

Sociocultural Theory

The study is informed by Vygotsky's sociocultural perspective, which views learning as mediated through language, social interaction, cultural tools, and participation in meaningful activities.

From this perspective, learning biology is not an isolated cognitive process. Students construct understanding through interaction with instructors, classmates, scientific texts, laboratory activities, disciplinary representations, and language.

Language therefore operates as a **mediational tool**. It enables learners to organize thought, negotiate meaning, articulate understanding, and participate in disciplinary practices.

Disciplinary Literacy

Disciplinary literacy provides a second conceptual foundation. Different academic disciplines develop specialized ways of reading, reasoning, representing knowledge, and communicating claims.

Life sciences students must learn how to interpret biological terminology, scientific explanations, diagrams, tables, evidence, experimental procedures, and arguments.

Consequently, bioliteracy involves not only biological knowledge but participation in the distinctive literacy practices through which biological knowledge is produced and communicated.

Language-Responsive Pedagogy

Language-responsive pedagogy recognizes that all disciplinary teaching has linguistic dimensions. Rather than assuming that students automatically possess the language required to understand science, language-responsive instruction makes disciplinary language visible and accessible.

In life sciences classrooms, this may involve explaining technical terminology, unpacking complex scientific statements, using visual representations, connecting everyday and scientific language, encouraging collaborative meaning-making, and allowing students to strategically mobilize their available linguistic resources.

Methodology

The study will employ a qualitative interpretative phenomenological approach to explore how students experience and make meaning of learning life sciences through English at Marinduque State University, as this design is appropriate for examining the meaning and structure of experiences among individuals who have directly encountered the phenomenon. Participants will be selected through purposive criterion sampling and will include undergraduate students who are currently enrolled in or have completed English-mediated life sciences courses and are capable of providing rich, experience-based accounts; recruitment will be guided by the specificity of the participant group, depth and richness of the narratives, analytic adequacy, and information power rather than by a fixed numerical target. Data will be generated primarily through semi-structured, in-depth interviews focusing on students' encounters with scientific terminology, English-language texts, lectures, laboratory instructions, classroom interactions, assessments, pedagogical practices, linguistic challenges, and strategies for constructing biological meaning. With informed consent, interviews will be audio-recorded and transcribed verbatim. Data analysis will emphasize the meaning of participants' experiences rather than the frequency of responses and will involve repeated reading of transcripts, identification and coding of significant experiential statements, organization of codes into interpretative patterns, development and refinement of emergent themes, and examination of both convergent and divergent experiences to preserve the complexity of individual accounts. The analysis will integrate descriptive and interpretative dimensions by examining what students experienced, how they experienced it, and what these experiences meant for their development of bio-literacy. To ensure the trustworthiness and reflexivity of the inquiry, credibility will be strengthened through sustained engagement with the data and iterative interpretation; dependability will be supported through a detailed audit trail documenting recruitment, interview procedures, coding decisions, theme development, and methodological adjustments; confirmability will be enhanced through reflexive journaling that critically examines researchers' assumptions regarding English proficiency, science achievement, language use, and pedagogy; and transferability will be promoted through thick description of the participants, institutional setting, linguistic context, courses, and instructional environment. Ethical approval will be obtained from the appropriate institutional review body prior to data collection, while informed consent, voluntary participation, confidentiality, pseudonymization, secure data management, and participants' right to withdraw at any point will be upheld throughout the research process.

Results: Recommended Scopus-Oriented Presentation

The final themes must emerge from the actual interview data. The following structure illustrates how the Results section may eventually be organized and must not be treated as empirical findings before analysis.

Results and Discussion

The phenomenological analysis may be organized around five interrelated themes that illuminate how students experience English-mediated life sciences education: (1) Entering the Language of Life Sciences, (2) English as Both Gateway and Barrier, (3) Teachers as Linguistic and Scientific Mediators, (4) Building Meaning Across Languages and Representations, and (5) From Understanding Biology to Becoming Bio-literate. Collectively, these themes position language not as a peripheral component of science education but as a central mechanism through which students access, negotiate, construct, communicate, and eventually apply biological knowledge.

Theme 1. Entering the Language of Life Sciences

The first theme captures students' initial encounters with the specialized linguistic world of the life sciences. Learning biology requires students to enter a disciplinary discourse characterized by technical terminology, unfamiliar word formations, abstract descriptions, complex scientific texts, and specialized meanings that differ substantially from everyday English. Students may therefore experience life sciences learning as a simultaneous process of learning scientific concepts and the language through which those concepts are represented.

A particularly important distinction emerges between knowing a scientific term and understanding the biological phenomenon represented by that term. Students may memorize definitions of terms such as *homeostasis*, *osmosis*, *cellular respiration*, *gene expression*, or *biodiversity* without necessarily developing a conceptual understanding of the biological processes involved.

Participant Responses

One participant may describe the experience as follows:

"Sometimes I know the definition because I memorized it, but when the teacher asks me to explain what actually happens in the process, that is when I realize that I do not fully understand it."- *Participant 03, illustrative quotation*

Another student may explain:

"The difficult part is not always biology itself. Sometimes it is the scientific English. There are words that I have never encountered before, so before I understand the lesson, I first have to understand the words."- *Participant 07*

A third participant may emphasize the difficulty associated with scientific readings:

"When I read the textbook, sometimes one paragraph contains many unfamiliar terms. I have to read it several times and search for the meanings before I understand what the paragraph is explaining."- *Participant 11*

These experiences suggest that disciplinary learning imposes a dual cognitive-linguistic demand. Students are not merely required to understand biological phenomena; they must simultaneously decode the specialized language in which those phenomena are described.

The distinction between lexical recognition and conceptual understanding is particularly significant. Memorizing the definition of *photosynthesis*, for example, is fundamentally different from being able to explain the relationships among light energy, chlorophyll, carbon dioxide, water, glucose, and oxygen within the process.

Thus, difficulty with biological concepts may sometimes originate not exclusively from conceptual complexity but from restricted linguistic access to disciplinary knowledge.

This interpretation is consistent with research on English-medium instruction. A 2021 study published in *System* found that students' English proficiency was significantly associated with the academic language-related challenges they experienced in English-medium university education; students with higher proficiency generally experienced fewer language-related academic difficulties. The study further indicated that linguistic demands may vary across academic disciplines.

A recent systematic review of English-medium instruction in higher education likewise synthesized 196 empirical studies published between 2016 and 2023 and identified language and content-learning issues as continuing concerns within EMI research.

The present theme therefore reinforces the conceptual argument that scientific terminology should not be treated simply as vocabulary to memorize. It constitutes an entry point into disciplinary meaning.

Theme 2. English as Both Gateway and Barrier

The second theme captures an important paradox in students' experiences: English may simultaneously facilitate and constrain their engagement with the life sciences.

On one hand, English provides access to textbooks, scientific journals, online databases, educational videos, research publications, and other international scientific resources. Students may recognize that developing competence in English expands their access to scientific knowledge beyond the classroom.

On the other hand, the same language may become a barrier when students must simultaneously process unfamiliar vocabulary, comprehend complex concepts, and formulate academically appropriate responses.

English therefore emerges neither as inherently beneficial nor inherently restrictive. Rather, it functions as a negotiated disciplinary resource whose value depends partly on students' linguistic backgrounds, learning experiences, and available pedagogical support.

Participant Responses

An illustrative participant statement may be:

"English is important because most of the references I find about biology are in English. If I understand English, I can search for more information and not depend only on what is in our module."-*Participant 05*

However, another participant may describe the opposite dimension:

"Sometimes I already find the topic difficult, and then I also have to think about the English. It feels like I am solving two problems at the same time."- *Participant 09*

Another student may explain the tension between comprehension and classroom participation:

"I understand some of the lesson, but when the teacher asks me to explain it in English, I become nervous because I am thinking about whether my grammar is correct instead of focusing only on the science."- *Participant 14*

These accounts reveal the double-edged nature of English-mediated science learning. English creates epistemic access by connecting students to a broad scientific knowledge base, yet it may simultaneously create additional processing demands.

Of particular significance is the distinction between scientific understanding and the ability to demonstrate scientific understanding in English. A student may possess an emerging conceptual understanding but experience difficulty articulating it through the expected academic language.

This distinction has important implications for assessment. If a student's scientific response is evaluated predominantly through linguistic accuracy, an assessment may inadvertently measure both science knowledge and English-language performance.

Language anxiety may further complicate this relationship. When students concentrate heavily on grammar, pronunciation, or the possibility of making mistakes, cognitive attention may be diverted from scientific reasoning and classroom interaction.

A 2025 qualitative study of 85 students in English-medium tertiary programs reported this same duality. Students perceived EMI as beneficial for language development, career preparation, and access to academic resources, but also experienced comprehension difficulties, inconsistent instructional approaches, and reduced participation associated with language anxiety. The authors consequently emphasized supplementary language support, context-sensitive implementation, and teacher preparation.

The findings of the 2021 *System* study similarly demonstrate that academic language-related challenges in EMI are meaningfully connected to students' language proficiency.

The theme therefore positions English as a gateway whose accessibility depends on linguistic and pedagogical mediation rather than simply as a neutral medium of instruction.

Theme 3. Teachers as Linguistic and Scientific Mediators

The third theme shifts attention from the learner to the instructional environment. Students' experiences may reveal that teachers play a critical role in bridging the gap between specialized scientific discourse and students' existing linguistic and conceptual resources.

Students may particularly value instructors who explain difficult terminology, provide familiar examples, use analogies, visualize abstract processes, connect concepts to everyday situations, strategically use more than one language, and create opportunities for questions and discussion.

The teacher therefore functions not simply as a transmitter of scientific information but as a linguistic and disciplinary mediator.

Participant Responses

One student may explain:

"When the teacher gives an example from everyday life, the difficult term becomes easier to understand. I remember the example first, and then I can connect it to the scientific term."- *Participant 02, illustrative quotation*

Another may state:

"Our teacher sometimes explains the concept in English first and then explains the difficult part in Filipino. After that, when she returns to English, I understand it better."- *Participant 08, illustrative quotation*

A participant may also emphasize visualization:

"There are biological processes that are difficult to imagine just by listening. When the teacher uses a diagram or animation and explains each step, it becomes much clearer."- *Participant 16, illustrative quotation*

Finally, students may value psychologically safe classrooms:

"I learn more when I am not afraid to ask. If the teacher makes us feel that it is okay not to understand immediately, I am more willing to participate."- *Participant 12, illustrative quotation*

The accounts position effective pedagogy as an act of mediation between scientific complexity and learner accessibility.

Simplification in this context should not mean reducing the intellectual rigor of science. Instead, effective teachers may progressively scaffold learners from familiar language and experiences toward increasingly specialized disciplinary discourse.

The movement may be represented as:

Familiar experience → Accessible explanation → Scientific terminology → Conceptual understanding → Scientific communication

Analogies, diagrams, examples, questioning, and strategic multilingual explanation therefore function as scaffolds. Their purpose is not to replace scientific language but to help students eventually participate in it independently.

The theme also demonstrates that linguistic accessibility has an affective dimension. Students may be more willing to articulate incomplete scientific ideas when the classroom treats mistakes as opportunities for learning rather than deficiencies.

The 2025 EMI study cited above specifically identified pedagogical strategies and faculty preparation as important considerations for supporting learners facing linguistic and academic challenges. It concluded that context-sensitive approaches and targeted instructional support are necessary for more inclusive EMI environments.

The broader 2026 systematic review of EMI higher education further demonstrates why language and content cannot be treated as completely separate issues in English-mediated university instruction.

These studies support the interpretation that the effectiveness of English-mediated life sciences education depends not simply on which language the teacher uses, but on how the teacher makes disciplinary meaning accessible through that language.

Theme 4. Building Meaning Across Languages and Representations

The fourth theme captures students' active strategies for constructing scientific meaning. When English explanations are insufficient, students may not simply stop learning. Instead, they mobilize multiple resources: Filipino, local languages, dictionaries, diagrams, videos, animations, gestures, peer explanations, online resources, and their own prior experiences.

This process suggests that students' bio-literacy develops through a **multilingual and multimodal ecology of learning**.

Participant Responses

One participant may state:

"I read the explanation in English, but if I still do not understand it, I try to explain it to myself in Filipino. After I understand the idea, I go back to the English terms."- *Participant 01*

Another may describe peer interaction:

"Sometimes my classmate explains the concept using simpler words. We mix English and Filipino when we discuss, but when we finally understand it, we can explain the scientific term better.- *Participant 10*

A visually oriented learner may explain:

"For processes like mitosis, I understand the diagram faster than a long paragraph. After seeing what happens in the picture, the explanation in the book makes more sense."- *Participant 06*

Another participant may describe digital resources:

"If I cannot understand the textbook, I search for a video. Seeing the process while someone explains it helps me connect the words to what is actually happening."- *Participant 13*

These experiences challenge a deficit interpretation of multilingual learning. Switching languages, seeking visual explanations, or asking peers to reformulate concepts should not automatically be viewed as evidence that students are incapable of learning through English.

Instead, these behaviors can represent **strategic meaning-making**.

The student moves between representational systems until conceptual coherence is achieved:

English text ↔ Filipino/local language ↔ diagram ↔ video ↔ peer explanation ↔ scientific concept

The critical outcome is therefore not rigid adherence to a single linguistic mode during the learning process but the student's eventual capacity to understand and communicate disciplinary meaning accurately.

The theme also highlights the multimodal nature of biological knowledge. Biology cannot be fully represented through verbal language alone. Cell structures, biochemical pathways, anatomical relationships, ecosystems, genetics, and evolutionary relationships are frequently communicated through combinations of text, diagrams, symbols, models, graphs, and visual sequences.

Consequently, multimodal literacy becomes part of bio-literacy. Research on multimodal scientific representations recognizes that science diagrams combine multiple expressive resources and relationships rather than functioning as decorative additions to written text. Studies of science diagrams have demonstrated the complex integration of verbal, visual, and relational elements in communicating scientific meaning.

More broadly, current scholarship on inclusive science education emphasizes that scientific literacy should be accessible to learners with diverse backgrounds and that teachers need to recognize barriers to participation and provide multiple avenues for engagement.

Within the present study, the use of multiple languages and representations can therefore be interpreted as a productive resource for disciplinary learning rather than merely a compensatory strategy.

Theme 5. From Understanding Biology to Becoming Bioliterate

The fifth and culminating theme captures the transformation from acquiring biological information to using biological knowledge as a resource for understanding and acting in the world.

Students may initially associate success in biology with remembering terminology, identifying structures, or passing examinations. However, deeper experiences may reveal a transition toward applying biological concepts to health decisions, environmental concerns, biodiversity, disease, nutrition, genetics, conservation, and other societal issues.

This transition represents the movement from knowing biology to becoming bio-literate.

Participant Responses

A student may describe this transformation:

"Before, I thought biology was mostly about memorizing parts and definitions. Now, when I hear something about disease or health online, I think about whether the explanation makes scientific sense." - *Participant 04*

Another may connect biological learning with environmental awareness:

"When we studied ecosystems and biodiversity, I started looking differently at environmental problems in our community. I realized that what happens to one species can affect many other organisms."- *Participant 15*

A participant may emphasize evaluation of information:

"There is so much information on social media about health. Biology helped me understand that I should not believe everything immediately. I need to look at the evidence and the source."- *Participant 17*

Another may describe communication:

"I know I understand the lesson better when I can explain it to another person using my own words and connect it to something that happens in real life."-*Participant 18*

These accounts represent an important epistemic shift. Students move from viewing biological knowledge as information to be reproduced toward understanding it as knowledge to be interpreted, evaluated, communicated, and applied.

Bio-literacy can therefore be understood as involving at least four interconnected capacities:

Comprehension - understanding biological concepts and processes;

Interpretation - making meaning from scientific texts, data, representations, and evidence;

Evaluation - critically examining biological and health-related claims; and

Application - using biological knowledge to understand and respond to real-world situations.

This conception moves beyond traditional content mastery.

A student who can define *biodiversity* has acquired biological vocabulary. A student who can explain how biodiversity contributes to ecosystem stability demonstrates conceptual understanding. A student who can use this understanding to evaluate a local conservation problem and construct an evidence-informed position demonstrates a more developed form of **bio-literacy**.

Connection with Related Studies

This interpretation is strongly supported by contemporary work on socio-scientific learning. A 2024 systematic review covering 61 studies found that environmental socio-scientific issues have been used to develop dimensions of scientific literacy, with argumentation and decision-making among the most frequently targeted competencies. The review also highlighted the importance of cultural values and locally relevant socio-scientific contexts.

Similarly, Tran and colleagues' 2024 study of undergraduate biology students found that incorporating social issues into biology courses helped students connect scientific content with society and personal experience. Students particularly valued reflection activities that enabled them to relate biological knowledge to real-world social issues.

The overarching phenomenon may therefore be conceptualized as:

"Negotiating Scientific Meaning Through Language"

This central phenomenon suggests that bio-literacy is not acquired merely through exposure to biological content. Rather, it emerges through a continuing process in which students **encounter, neg**otiate, mediate, construct, communicate, and apply scientific meaning through linguistic and multimodal resources.

The relationship may be represented as:

Linguistic Access → Pedagogical Mediation → Multilingual/Multimodal Meaning-Making → Conceptual Understanding → Critical Application → Bio-literacy

The central interpretation of the study can consequently be expressed as follows:

Bio-literacy develops when language ceases to function merely as the medium through which biology is delivered and becomes a resource through which students actively construct, communicate, critically evaluate, and apply biological knowledge.

This interpretation also provides an important pedagogical implication for Marinduque State University. The central challenge may not simply be whether life sciences should be taught in English. A more consequential question is how English-mediated life sciences instruction can be made linguistically accessible, pedagogically responsive, multimodally supported, and sufficiently connected to students' lived realities to enable meaningful participation in scientific discourse.

Such a perspective shifts the instructional paradigm from English as a Medium of Instruction toward Language-Responsive Bio-literacy Pedagogy, where language, scientific knowledge, pedagogy, and student experience are treated as interconnected dimensions of disciplinary learning.

Discussion

The Discussion should connect the empirical themes to the broader argument that bio-literacy is language-mediated.

If students describe English as both an enabling resource and a source of difficulty, the findings would complicate simplistic assumptions that English-medium instruction is inherently advantageous or disadvantageous. Its educational value may depend substantially on how language is pedagogically mediated.

Similarly, if students report using Filipino, local languages, peer explanations, visual materials, or digital resources to make sense of English scientific content, these practices may reveal a broader repertoire of meaning-making resources. Rather than viewing movement between languages as failure to operate exclusively in English, it may be understood as strategic mediation of disciplinary knowledge.

Pedagogical practices would consequently assume considerable importance. An instructor who explicitly unpacks terminology, connects technical language to familiar experiences, integrates diagrams with verbal explanations, encourages questions, and provides opportunities for students to articulate scientific ideas may reduce the distance between language and conceptual understanding.

The findings may therefore support a shift from English-medium life sciences instruction toward language-responsive life sciences pedagogy.

The distinction is significant. English-medium instruction describes the language through which content is delivered. Language-responsive pedagogy concerns how instructors actively recognize and address the linguistic demands embedded within disciplinary learning.

14. Pedagogical Implications

The study may provide several practical implications.

Life sciences instructors should consider scientific vocabulary not merely as terminology students must memorize but as part of conceptual development. Technical words should be introduced in meaningful contexts and connected to processes, representations, examples, and prior knowledge.

Complex scientific texts may require guided reading rather than assuming students automatically possess disciplinary reading strategies.

Students should also be given opportunities to **talk science**. Pair discussions, collaborative explanations, oral presentations, concept mapping, argumentation, and peer teaching can enable learners to rehearse scientific language while developing conceptual understanding.

Multimodal resources are equally important. Biological processes that are difficult to explain linguistically may become accessible through diagrams, models, animations, laboratory demonstrations, and other representations.

Most importantly, instructors may recognize students' existing linguistic resources as potential bridges rather than obstacles to learning.

Conclusion

The proposed study reframes the relationship between English and life sciences education by positioning language as an integral dimension of disciplinary learning. Through students' lived experiences at Marinduque State University, it seeks to illuminate how biological knowledge is accessed, negotiated, constructed, communicated, and applied through language.

Its potential contribution lies in moving beyond the question of whether students are sufficiently proficient in English to learn science. A more productive question is how linguistic resources and pedagogical practices can be organized so that students are able to participate meaningfully in scientific ways of knowing.

From this perspective, bio-literacy is not merely knowledge about living systems. It represents the ability to enter the discourse of life sciences, construct meaning from scientific information, communicate biological understanding, critically engage with evidence, and apply such understanding to meaningful contexts.

Listening to students' experiences may therefore provide an important basis for transforming English-mediated instruction into a more accessible, responsive, and intellectually meaningful form of life sciences education.

Limitations and Future Research

As a phenomenological inquiry situated within a single university, the study will prioritize depth and contextual understanding rather than statistical generalizability. Participants' accounts will reflect particular educational, linguistic, disciplinary, and institutional experiences.

Interview data are also retrospective and interpretative. They represent how participants understand and narrate their experiences rather than direct observations of classroom practice.

Future studies may therefore combine interviews with classroom observations, instructional artifact analysis, student scientific writing, or longitudinal approaches. Comparative studies across universities, disciplines, and linguistic contexts may further examine how language-responsive science pedagogy operates in diverse Philippine higher education settings.

Ethical Statements

Ethics Approval: Ethical clearance will be obtained from the appropriate institutional research ethics committee before participant recruitment.

Informed Consent: Written informed consent will be secured from all participants.

Confidentiality: Identifying information will be removed from transcripts and pseudonyms or participant codes will be used in publications.

Voluntary Participation: Participants may refuse to answer questions or withdraw from the study without academic consequences.

Data Management: Audio recordings, transcripts, consent documentation, and analytic files will be securely stored according to institutional research-data policies.

Conflict of Interest: The authors will disclose any actual or potential conflicts of interest.

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