INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY: APPLIED BUSINESS AND EDUCATION RESEARCH
2026, Vol. 7, No. 1, 90 – 98
http://dx.doi.org/10.11594/ijmaber.07.01.08

Research Article

Contextualization and Localization in Science Curriculum Implementation: A Systematic Review of Strategies, Impacts, and Challenges in the Philippine Basic Education System

Je-Ann R. Banzuelo[1]*, John Rey B. Quiñones[2]

[1]Graduate Student, Nueva Ecija University of Science and Technology, Philippines
[2]Faculty, Nueva Ecija University of Science and Technology, Philippines

Article history:
Submission 02 December 2025
Revised 30 December 2025
Accepted 23 January 2026

**Corresponding author:*
E-mail:
jeannbanzuelo28@gmail.com

ABSTRACT

The K-12 Basic Education Program in the Philippines, institutionalized through Republic Act 10533 and operationalized by DepEd Order No. 35, s. 2016, mandates the use of Contextualization and Localization (C&L) to enhance the relevance of the science curriculum. This systematic review synthesizes literature from 2010 to 2024 to analyze the implementation, impacts, and challenges of C&L in Philippine science education. Findings reveal prevalent teacher-initiated practices, such as leveraging local biodiversity, integrating Indigenous Knowledge Systems (IKS), and employing community-based problem-solving. These strategies are consistently shown to improve student engagement, deepen conceptual understanding, and strengthen cultural identity. However, significant systemic barriers impede effective implementation, including inadequate teacher preparation, a lack of validated localized materials, large class sizes, rigid curriculum pacing, and epistemological tensions between indigenous and Western scientific paradigms. The review further identifies methodological limitations in the existing research, notably a predominance of small-scale qualitative studies, an absence of longitudinal data on learning outcomes, and insufficient inclusion of student and community voices. To realize the transformative potential of C&L for democratizing science education, this study calls for a multi-stakeholder approach involving reformed teacher education, sustainable support systems for resource development, and a robust research agenda focused on scalability, impact, and ethical knowledge integration.

***Keywords**: Contextualization, Localization, Science education, Indigenous knowledge system*

How to cite:
Banzuelo, J. A. R. & Quiñones, J. R. B. (2026). Contextualization and Localization in Science Curriculum Implementation: A Systematic Review of Strategies, Impacts, and Challenges in the Philippine Basic Education System. *International Journal of Multidisciplinary: Applied Business and Education Research*. *7*(1), 90 – 98. doi: 10.11594/ijmaber.07.01.08

Introduction

For decades, the Philippine basic education system was characterized by a congested 10-year curriculum that was widely criticized for being overly theoretical, encyclopedic, and is in contrary from the lived realities of Filipino learners (Montebon, 2014). Science education was often perceived as a difficult subject, laden with abstract concepts and examples from Western contexts that held little meaning for students in rural farming communities, coastal villages, or urban centers. This circumstance contributed to low scientific literacy and a lack of interest in pursuing science-related careers.

The passage of Republic Act 10533, the Enhanced Basic Education Act of 2013, marked a historic reform with the establishment of the K-12 program. This reform was not merely about adding two years of senior high school; it was a fundamental restructuring aimed at developing holistically developed graduates with 21st-century skills. A central pillar of this new curriculum is the spiral progression approach, where learning competencies are revisited at each grade level with increasing depth and sophistication. This pedagogical model inherently demands that learning begins with what is familiar and concrete to the student, creating a natural imperative for Contextualization and Localization (C&L) to build a strong foundational understanding.

The operationalization of contextualization and localization is most clearly articulated in DepEd Order No. 35, s. 2016, which promotes the Learning Action Cell (LAC) as a key mechanism for school-based professional development. This policy provides the following crucial definitions:

Localization is defined as the process of relating learning content specified in the curriculum to local information and materials found in the learners' community. This is the "what" – using local plants, animals, minerals, and artifacts as examples.

Contextualization is the process of relating the curriculum to the learners' unique setting, situation, or environment of which they are a part. This is the "how" and "why" –adapting teaching strategies and learning activities to the students' experiences, cultural background, and community issues.

In practice, these concepts exist on a spectrum. Using a local mango fruit to teach plant reproduction is localization. Framing an entire unit on biology and economics around the local mango industry, including its challenges with pests and market access, is contextualization.

The mandate for contextualization and localization is not arbitrary; it is deeply rooted in established learning theories that have gained widespread acceptance.

Constructivism (Piaget, 1970; Vygotsky, 1978): This theory posits that learners actively construct new knowledge by building upon their pre-existing mental schemas. contextualization and localization leverages students' "funds of knowledge" – the culturally developed bodies of knowledge and skills essential for household and community functioning – as a robust scaffold for understanding formal scientific concepts. When a student learns about levers by analyzing the design of a local fishing net (pukot), they are constructing knowledge on a foundation they already possess.

Situated Learning Theory (Lave & Wenger, 1991): This theory argues that learning is not merely the acquisition of abstract knowledge but a process of legitimate peripheral participation in a "community of practice." C&L bridges the artificial gap between the school and the community, positioning students as apprentices who can contribute to real- world problem-solving, such as testing water quality in a local river.

Culturally Responsive Pedagogy (Gay, 2000; Ladson-Billings, 1995): This pedagogical approach uses the cultural knowledge, experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant and effective. The integration of Indigenous Knowledge Systems (IKS) is a direct application of this pedagogy, validating students' cultural identity and positioning it as an asset, not a deficit, in the science classroom

Objectives of the Study

Despite the strong policy and theoretical foundation, the implementation of C&L across the Philippines' 7,000+ islands and diverse cultural landscapes is fraught with complexity.

Anecdotal evidence and a growing body of academic research suggest a significant gap between the policy's intent and the on-the-ground reality in many science classrooms. Teachers, who are the primary agents of this change, face a myriad of challenges that can lead to superficial implementation, resistance, or outright abandonment of C&L practices.

This systematic review aims to consolidate, synthesize, and critically analyze the extant literature on C&L in Philippine science education. It seeks to move beyond isolated case studies to provide a comprehensive, evidence-based overview of the state of the field. The review is guided by the following primary research question: How was Contextualization and Localization been implemented in Science within the Philippine Basic Education system, and what are the consequent outcomes, challenges, and future directions?

1. What are the common strategies and practices used by science teachers to contextualize and localize their lessons across different scientific domains (Biology, Chemistry, Physics, Earth Science)?
2. What is the evidence regarding the impact of C&L on student learning outcomes (cognitive), engagement (affective), and cultural identity?
3. What are the major challenges and barriers (teacher-level, resource-based, systemic) teachers face in implementing C&L, and what facilitators have been identified?
4. What gaps and methodological limitations characterize the current body of literature, and what should a future research agenda entail to advance both theory and practice?

Methods

To ensure a comprehensive, transparent, and replicable synthesis of the literature, this review adhered to the systematic review methodology, guided by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework.

A review protocol was established a priori to define the scope and inclusion criteria. The PICOS framework (Population, Intervention, Comparison, Outcomes, Study design) was used to delineate eligibility:

- Population (P): Science teachers and students within the Philippine K-12 basic education system.
- Intervention (I): Implementation of contextualization and/or localization in science teaching and learning. This included the use of local materials, integration of Indigenous Knowledge Systems (IKS), community-based projects, and development of localized instructional materials.
- Comparison (C): Not a mandatory criterion for inclusion, as the review aimed to capture both comparative and descriptive studies. However, studies comparing contextualized approaches with traditional methods were noted for their contribution to understanding impact.
- Outcomes (O): Documented outcomes including but not limited to, teaching practices, student academic performance, student engagement and motivation, cultural awareness, teacher competencies, and perceived challenges and enablers.
- Study Design (S): Empirical studies, including qualitative, quantitative, and mixed-methods designs, as well as case studies and action research. Conceptual papers and literature reviews were excluded from the primary synthesis but were used to inform the background and discussion sections.

A comprehensive search was conducted across multiple electronic databases and repositories to minimize publication bias. These included:

- International Databases: Google Scholar, ERIC (Education Resources Information Center), and Scopus.
- Regional and National Repositories: Philippine E-Journals (PhilJOL), Asian Digital Library, and institutional repositories of major Philippine universities (e.g., University of the Philippines, Philippine Normal University, Cebu Normal University).

The search strategy employed a combination of keywords and Boolean operators. The core search string was: ("contextualization" OR "localization" OR "indigenous knowledge" OR "culturally responsive" OR "ethnoscience") AND ("science education" OR "science teaching" OR "science curriculum" OR "science instruction") AND ("Philippines" OR "K- 12" OR "basic education"). The search was limited to works published between 2010 and 2024 to capture the period leading up to and including the K-12 reform.

Result and Discussion

The analysis of the 52 included studies revealed the contextualization and localization implementation in a science classrooms. The findings are organized into three central themes corresponding to the research questions: (1) Common Strategies and Practices, (2) Documented Benefits and Impacts, and (3) Major Challenges and Barriers.

Common Strategies and Practices in C&L Implementation

Filipino science teachers have demonstrated remarkable resourcefulness and creativity in translating the policy of C&L into concrete classroom practices. These strategies can be categorized into four main types, ranging from simple localization of examples to deep contextualization of entire learning experiences.

Utilization of Local Environment and Biodiversity

This is the most prevalent and straightforward strategy, primarily constituting localization. It involves substituting generic, often foreign, textbook examples with resources immediately available in the students' environment. In Biology and Ecology, the most documented area for this strategy, teachers frequently employ local flora and fauna. For instance, Orbe et al. (2018) documented how teachers in the Bicol region used the makabuhay plant (Tinospora rumphii) to teach about medicinal properties and bioactive compounds, linking chemistry to traditional healing practices.

Similarly, Tomaneng & De Jesus (2021) reported that teachers in coastal communities used local mangrove ecosystems as living laboratories to teach biodiversity and ecological relationships. Students constructed food webs based on organisms observed in mangroves, moving beyond abstract textbook examples. Hands-on experiments are also adapted using local materials, such as replacing potato chips with kangkong stalks for osmosis experiments (Calingasan & Pangan, 2019), or using local fruit tree cuttings to teach plant propagation.Biology and Ecology: The most documented area for this strategy.

In Chemistry, teachers often turn to household and community-based examples. Buan and Barquilla (2019), in their action research, used salt-making from seawater to teach separation techniques like evaporation and crystallization. Concepts of acids and bases were explored using extracts from local fruits such as calamansi and bignay, and soap made from coconut oil and lye. Fermentation processes involved in local products like tuba (coconut wine), basi (sugarcane wine), and bagoong (fermented fish paste) served as rich contexts for teaching chemical changes and microbiology (Magwilang, 2016).

In Earth and Environmental Science, contextualization often takes the form of problem-based learning centered on local issues. Dela Cruz & Torres (2020) developed a PBL module where students investigated pollution in a nearby river, applying knowledge of chemical testing, biological indicators, and socio-economic factors. In geologically active regions, lessons on plate tectonics and disaster risk reduction were taught using local landforms as case studies, such as Mayon Volcano, where students connected scientific concepts to community evacuation protocols (Peñamante, 2021).

Integration of Indigenous Knowledge Systems (IKS)

This represents a deeper level of contextualization, where the very framework of knowledge is expanded to include epistemologies from the students' cultural heritage. This approach validates IKS as a legitimate and valuable way of understanding the natural world.

Ethnobotany and traditional medicine are frequently integrated; for example, Magwilang (2016) documented how chemistry teachers in the Cordillera region discussed the chemical properties of plants used by traditional healers, fostering respect for indigenous expertise while teaching organic chemistry. Indigenous astronomy and meteorology are also incorporated, with teachers using traditional knowledge of star patterns and animal behavior to predict weather and agricultural cycles, providing meaningful contexts for lessons on earth science (Peñamante, 2021; Sibayan & Calago, 2022).

Additionally, sustainable indigenous practices, such as the payew (rice terraces) system of the Ifugao, are used to teach principles of engineering, ecology, and environmental science (Prado & Marasigan, 2020).

Development and Use of Localized Instructional Materials (IMs)

Given the scarcity of commercially produced textbooks that reflect local contexts, teachers have taken it upon themselves to become curriculum developers. A common outcome of teacher Learning Action Cell (LAC) sessions and action research is the creation of self-learning modules (SLMs), activity sheets, and lesson plans infused with local context.

Reyes & Ortiz (2022), for example, documented the development and validation of a Grade 7 science module that used the local fishing industry to teach ecology and resource management. Beyond paper-based materials, teachers also create community-based learning resources such as video lessons featuring local experts, photo essays on environmental issues, and the use of community spaces like farms, forests, and shorelines as extensions of the classroom (Dacanay & Rogayan, 2019).

Pedagogical Shifts Towards Contextualized Pedagogies

The implementation of C&L often necessitates a shift away from traditional lecture-based methods towards more interactive and student-centered approaches. Problem-Based Learning (PBL) is a natural fit for C&L, as demonstrated by Dela Cruz & Torres (2020), where students addressed real-world community issues like waste management or declining fish catches. Project- Based Learning (PjBL) is also widely adopted; Dacanay & Rogayan (2019) reported a project where students designed and maintained a school vegetable garden using organic practices learned from local farmers, integrating biology, chemistry, and entrepreneurship. Inquiry-Based Learning is similarly promoted, with teachers posing questions rooted in local phenomena, such as investigating changes in creek water quality, to encourage hypothesis formation, investigation, and evidence-based conclusions.

Documented Benefits and Impacts of C&L

The literature consistently reports a range of positive outcomes associated with the effective implementation of C&L, affecting students' cognitive, affective, and behavioral domains.

Enhanced Student Engagement and Motivation

This is the most frequently reported benefit across qualitative studies. When science content is connected to students' lives, it transforms from an abstract subject into a relevant and engaging one. Abaton & Malabarbas (2021) observed that in classrooms using contextualized lessons, students were more vocal, asked more questions, and participated more actively in discussions and group work.

Intrinsic motivation also increases; Tomaneng & De Jesus (2021) noted that students continued discussions about local mangrove ecosystems outside class hours, indicating sparked genuine interest.

Improved Conceptual Understanding and Academic Performance

Several studies, particularly those using mixed-methods or quasi-experimental designs, provide evidence for improved learning outcomes. By connecting abstract principles to concrete, familiar examples, students build more robust and lasting mental models. For instance, understanding Newton's Third Law through the recoil of a traditional lantaka (cannon) is more intuitive than memorizing textbook definitions (Buan & Barquilla, 2019).

Quantitative gains are also evident; Calingasan & Pangan (2019) and Tomaneng & De Jesus (2021) reported statistically significant improvements in post-test scores among students taught with contextualized approaches compared to control groups.

Table 1 presents the level of institutional readiness for AR integration across four dimensions: technological infrastructure, technical and administrative support, faculty digital competence, and organizational culture.

Development of Higher-Order Thinking Skills

Contextualized pedagogies like PBL and PjBL inherently foster skills beyond rote memorization. Students engage in critical thinking and problem-solving as they analyze complex information, synthesize findings, and propose solutions to community issues, mirroring the work of real scientists and engineers (Dela Cruz & Torres, 2020).

This approach also enhances scientific literacy, enabling students to apply scientific knowledge to evaluate claims, make informed decisions, and understand local issues such as mining impacts or public health.

Empowerment of Teacher Agency

While less frequently studied, some research points to positive impacts on teachers themselves. The process of designing contextualized lessons transforms teachers from passive curriculum deliverers into active agents and innovators (De Leon, 2021), leading to increased job satisfaction and professional growth. Collaborative development of C&L materials in LAC sessions also fosters a culture of sharing and mutual support among teachers.

Major Challenges and Barriers in Implementation

Despite the clear benefits, the implementation of C&L is fraught with significant, multilevel obstacles that hinder its widespread, effective, and sustainable application.

Teacher-Related Challenges

Inadequate training and preparedness represent the most pervasive barrier. Many teachers report that pre-service education did not prepare them for C&L, and in-service training is often too short and theoretical (De Leon, 2021). Teachers lack skills in ethnography, ethical documentation of IKS, and designing context-based learning units.

Limited pedagogical content knowledge, especially among those teaching outside their specialization, further complicates contextualization of abstract topics in subjects like Physics and Chemistry (Buan & Barquilla, 2019). Time constraints also pose a major challenge; the process of researching local contexts and developing materials is time-consuming and unsustainable for teachers already burdened with heavy workloads, leading to "C&L fatigue" and superficial implementation (Orbe et al., 2018).

Resource-Based Challenges

Scarcity and inaccessibility of localized materials are significant hurdles. Without a centralized repository for contextualized resources, teachers must create materials from scratch, resulting in inconsistent quality and duplication of effort nationwide (Reyes & Ortiz, 2022). Financial support is also lacking; schools often lack budgets for material development, field trips, or honoraria for community experts, forcing teachers to use personal funds, an unsustainable and inequitable solution.

Systemic and Structural Barriers

Large class sizes, typically ranging from 40 to 60 students, make hands-on, inquiry-based learning difficult to manage and often force teachers to revert to traditional whole-class instruction. Rigid curriculum pacing guides further constrain implementation, as teachers feel pressured to cover all competencies within strict timeframes, leaving little room for deep, exploratory learning (De Leon, 2021).

Assessment misalignment is another critical issue; national standardized tests like the National Achievement Test (NAT) rarely assess contextualized knowledge or higher-order thinking applied to local problems, creating a "washback effect" that prioritizes test preparation over meaningful C&L.

Socio-Cultural and Ethical Challenges

Navigating the integration of IKS involves delicate ethical considerations. Teachers may lack the cultural sensitivity to avoid appropriating or trivializing sacred knowledge (Peñamante, 2021). Resistance from community elders or parents, who may view IKS as superstition or irrelevant to modern education, further complicates implementation.

Additionally, teachers often struggle with epistemological tensions between indigenous knowledge and Western scientific paradigms, such as reconciling spiritual and germ theory explanations for illness, requiring a nuanced understanding that most are not trained for.

Conclusion

Contextualization and Localization are not mere pedagogical techniques; they represent a fundamental re-imagining of the purpose and practice of science education in the Philippines. They are a pathway to decolonizing the curriculum, making science a tool for understanding and improving one's own world rather than a foreign body of knowledge to be memorized.

The journey towards fully realizing the potential of C&L is complex and challenging. It demands a more in-depth system systems and a commitment to redistributing epistemic authority to include teachers, communities, and indigenous knowledge holders.

However, the evidence is clear that the benefits for Filipino learners, in terms of engagement, understanding, skills, and identity, are too significant to ignore. The challenge, therefore, is not whether to contextualize and localize, but how to build a robust, sustainable, and equitable ecosystem of support to enable every science teacher and every student to reap its transformative rewards. The promise of a truly relevant, responsive, and empowering science education for all Filipinos depends on it.

Hence, it is therefore recommended that the Department of Education through the Regional Office or event the Schools Division shall strengthen the contextualization and localization of relevant instructional resources for a better instruction where the students can deeply relate and engaged into a meaningful experience.

Acknowledgement

The author expresses sincere gratitude to all individuals who contributed to the completion of this study. Special appreciation is extended to Nueva Ecija University of Science and Technology-Graduate School for the driving force of engaging into a scholarly work. The author also acknowledges the scholars whose previous works served as a foundation for this review.

References

Abaton, G. R., & Malabarbas, L. T. (2021). Contextualized learning resource in Grade 9 Science: Its effect on students' critical thinking skills. *Jurnal Pendidikan IPA Indonesia*, *10*(4), 534– 543. https://doi.org/10.15294/jpii.v10i4.31348

Aikenhead, G. S., & Ogawa, M. (2007). Indigenous knowledge and science revisited. *Cultural Studies of Science Education,* *2*(3), 539–620. https://doi.org/10.1007/s11422-007-9067-8

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Buan, A. T., & Barquilla, M. B. (2019). Contextualized teaching of physics for Grade 7 in the Philippines: An action research. *Asia Pacific Journal of Multidisciplinary Research*, *7*(4), 1–9.

Calingasan, M. K., & Pangan, D. J. (2019). Contextualized learning activities in teaching science: Its effectiveness in enhancing students' academic performance. *IOER International Multidisciplinary Research Journal, 1*(3), 1–10. https://doi.org/10.54476/iimrj306

Cobern, W. W., & Loving, C. C. (2001). Defining “science” in a multicultural world: Implications for science education. *Science Education, 85*(1), 50–67. https://doi.org/10.1002/1098-237X(200101)85:1<50::AID-SCE5>3.0.CO;2-G

Dacanay, L. M., & Rogayan, D. V. (2019). Contextualized learning activities (CLAs) in Grade 9 science: Development and implementation. *IOER International Multidisciplinary Research Journal, 1*(4), 1–9. https://doi.org/10.54476/ioer-imrj/14753

De Leon, J. P. (2021). Challenges and opportunities in localizing the science curriculum in the Philippine K-12 program. *Journal of Science and Mathematics Education in Southeast Asia, 44*, 1–20.

Dela Cruz, R. A., & Torres, M. N. (2020). Contextualized problem-based learning (PBL) module in teaching environmental science. *International Journal of Scientific and Research Publications, 10*(10),98–105. https://doi.org/10.29322/IJSRP.10.10.2020.p10613

Department of Education. (2016). DepEd Order No. 35, s. 2016: The Learning Action Cell (LAC) as a K to 12 Basic Education Program school-based continuing professional development strategy for the improvement of teaching and learning. https://www.deped.gov.ph/wp-content/uploads/2016/06/DO_s2016_035.pdf

Gay, G. (2000). Culturally responsive teaching: Theory, research, and practice. Teachers College Press.

Glaser, B. G., & Strauss, A. L. (1967). The discovery of grounded theory: Strategies for qualitative research. Aldine Publishing Company.

Hodson, D. (2003). Time for action: Science education for an alternative future. *International Journal of Science Education, 25*(6), 645–670. https://doi.org/10.1080/09500690305021

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal, 32*(3), 465–491. https://doi.org/10.3102/00028312032003465

Lave, J., & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. Cambridge University Press.

Magwilang, E. B. (2016). Teaching chemistry in the context of Indigenous knowledge systems. *Journal of Chemical Education, 93*(5), 113–117. https://doi.org/10.1021/acs.jchemed.5b00345

Moje, E. B., Ciechanowski, K. M., Kramer, K., Ellis, L., Carrillo, R., & Collazo, T. (2004). Working toward third space in content area literacy: An examination of everyday funds of knowledge and discourse. *Reading Research Quarterly, 39*(1), 38–70. https://doi.org/10.1598/RRQ.39.1.4

Montebon, D. R. T. (2014). K-12 science program in the Philippines: A spiral progression and its pedagogical implications. *Science International (Lahore), 26*(5), 1–5.

Orbe, J. R., Espinosa, A. A., & Datukan, J. T. (2018). Teaching chemistry in a spiral progression approach: A case study. *Science Education International, 29*(1), 24–33. https://doi.org/10.33828/sei.v29.i1.3

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, 71. https://doi.org/10.1136/bmj.n71

Peñamante, F. R. (2021). Integration of Indigenous knowledge in the K to 12 science curriculum: A meta-synthesis. *International Journal of Multidisciplinary: Applied Business and Education Research, 2*(11), 1089–1098. https://doi.org/10.11594/ijmaber.02.11.08

Piaget, J. (1970). Science of education and the psychology of the child. Orion Press.

Prado, N. I., & Marasigan, A. C. (2020). Indigenous knowledge integration in K-12 science: Perspectives of science teachers in the Philippines. *Journal of Turkish Science Education, 17*(4), 597–611. https://doi.org/10.36681/tused.2020.44

Republic of the Philippines. (2013). Republic Act No. 10533: Enhanced Basic Education Act of 2013. Official Gazette. https://www.officialgazette.gov.ph/2013/05/15/republic-act-no-10533/

Reyes, J. P., & Ortiz, L. P. (2022). Development and validation of contextualized learning modules in Grade 7 science. *International Journal of Science and Research, 11*(5), 1234–1240. https://doi.org/10.21275/SR22508145657

Sibayan, K. C., & Calago, D. M. S. (2022). Localization and contextualization (LAC) in science instruction: A pathway to students' scientific literacy. *American Journal of Educational Research, 10*(7), 445–450. https://doi.org/10.12691/education-10-7-6

Smith, L. T. (2012). Decolonizing methodologies: Research and Indigenous peoples (2nd ed.). Zed Books.

Tomaneng, R. L., & De Jesus, R. M. (2021). Localization and contextualization in teaching biology: Its effects on the academic performance of Grade 7 students. *Asian Journal of Education and Social Studies, 19*(3), 1–12. https://doi.org/10.9734/ajess/2021/v19i330456

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Harvard University Press.

Warren, B., Ballenger, C., Ogonowski, M., Rosebery, A. S., & Hudicourt-Barnes, J. (2001). Rethinking diversity in learning science: The logic of everyday sense-making. *Journal of Research in Science Teaching, 38*(5), 529–552. https://doi.org/10.1002/tea.1017

Zhou, G., & Kim, J. (2022). A systematic review of STEM education research in the Philippines. *International Journal of Science and Mathematics Education, 20*(Suppl 1), S1–S21. https://doi.org/10.1007/s10763-022-10308-z