
Bridging Culture and Science: Teacher Perceptions of Inclusive and Contextualized Instruction

RUBY THERESE P. BANGUNAN

Graduate School

Holy Cross of Davao College

<https://orcid.org/0009-0005-9459-2098>

ROGAR R. GARCIA, EdD

Master Teacher II, Department of Education – Division of Davao City,

F. Bangoy National High School

<https://orcid.org/009-0001-5947-0184>

Abstract — Learning science is culturally detached. I explored the promotion of cultural sensitivity and inclusivity in teaching Indigenous learners. I used a descriptive qualitative design, interviewed seven purposively selected teachers, and analyzed the data using thematic analysis. I discovered that the use of local tools, redefined teacher roles, respectful rules, community involvement, and collaborative teaching converged into an emerging theme that is a culturally rooted process that fosters meaningful learning, confidence, and a sense of belonging among learners. This process leads to culture-based science education fostering deeper understanding, meaningful application, cultural identity, confidence, active participation, and a strong sense of belonging among Indigenous learners. With this, I highlight localization, facilitating role, dialogue and respect, communitarianism, and collaboration as science education practices. Future studies may use regression and factor analysis to validate key predictors of culture-based science education. Science teachers should localize instruction, act as facilitators, promote respect, collaborate with communities, and share teaching roles.

Keywords: cultural sensitivity, inclusivity, Indigenous learners, science teaching, teachers' perceptions

I. INTRODUCTION

In this chapter, I presented the problem and its setting, the significance of my study, the research questions, the theory and theoretical lens, and my assumptions.

The Problem and Its Scope

I learned that science teaching often fails to meaningfully connect with the cultural realities and knowledge systems of Indigenous learners, resulting in limited inclusivity, reduced engagement, and a disconnect between scientific concepts and students' lived experiences. Globally, science instruction often leans heavily on Western methods, which often overlook Indigenous perspectives and ways of understanding the world (McKinley & Stewart, 2020). As a result, many Indigenous learners may feel alienated when the classroom content doesn't reflect their cultural identities or community practices.

When I further explored, I discovered that other countries have begun addressing this issue through culturally responsive reforms. In New Zealand, the inclusion of Māori knowledge in Science education strengthens students' identity and engagement (Snively & Williams, 2021). In Canada, educators integrate First Nations' ecological perspectives into Science instruction as part of reconciliation efforts (Aikenhead & Michell, 2019). In Australia, culturally inclusive approaches have helped Aboriginal students connect traditional ecological knowledge with modern Science (Carter, 2020). These international efforts show that Science teaching becomes more meaningful when it acknowledges learners' cultural and historical contexts.

Here in my own country, the Philippines, the struggle for inclusivity in Science education remains evident. Although the Department of Education (DepEd, 2015) promotes Indigenous Peoples Education, many Science lessons continue to follow standardized frameworks that overlook local contexts (Salvador & Estacio, 2022). In the Marilog District of Davao City, where the Matigsalug, Ata, and Bagobo communities live, Science teachers face the challenge of bridging formal scientific concepts with Indigenous knowledge. The lack of culturally responsive materials and the dominance of textbook-centered instruction often result in lessons that feel distant from learners' lived experiences.

As a Science teacher and researcher, I view this issue as both professional and moral. When education fails to recognize cultural identity, it risks alienating learners and diminishing their participation in the learning process. Yet, despite efforts toward inclusive education, there is still a limited understanding of how Science teachers experience and navigate the challenge of promoting cultural sensitivity among Indigenous learners. This gap underscores the urgency and relevance of my study—to explore teachers’ lived experiences and to illuminate how they adapt, reflect, and innovate to make Science education more inclusive, respectful, and culturally grounded.

Significance of the Study

I am convinced that my study on cultural sensitivity and inclusivity in science teaching is significant as it supports the United Nations’ Sustainable Development Goal on Quality Education (SDG 4) and aligns with the Philippine Development Plan’s thrust toward inclusive learning. It also upholds the Christian education mission of the Holy Cross of Davao College (HCDC) by promoting faith-inspired, humane, and excellent teaching. By exploring the lived experiences of science teachers handling Indigenous learners, this study seeks to deepen understanding of how cultural awareness and inclusivity are practiced in classrooms, providing valuable insights for teacher education, curriculum development, and policy enhancement toward a more equitable and culturally grounded Science education.

Research Questions

To contribute to human understanding of how Science teaching can become more inclusive and culturally grounded, I explored how Science teachers promote cultural sensitivity and inclusivity when handling Indigenous learners. Specifically, I asked the following questions:

Main Research Question

1. What are the cultural and historical contexts of tools, subject, rules, community, and division of labor that shaped the goals?
2. What are the perceptions of science teachers in turning the goals into outcomes?

Theoretical Lens

The Cultural-Historical Activity Theory (CHAT) developed by Yrjö Engeström conceptualizes human activity as a collective, goal-oriented, and culturally mediated system in which individuals (subjects) interact with their environment through tools and artifacts within a structured context of rules, community, and division of labor. Central to the theory is the idea that all human actions are purposeful and directed toward transforming an “goal” into meaningful outcomes, while cognition and practice are shaped by social, cultural, and historical conditions. Engeström further emphasizes the multi-voiced nature of activity systems, where diverse perspectives coexist and interact, often generating contradictions or tensions that serve as the primary drivers of change and development. These contradictions lead to expansive learning, a process in which participants collectively reflect on and transform their practices, thereby reconstructing the activity system itself. Overall, CHAT asserts that learning and development are not merely individual processes but are deeply embedded in historically evolving, socially mediated, and dynamically interacting systems of activity.

Conceptual Lens

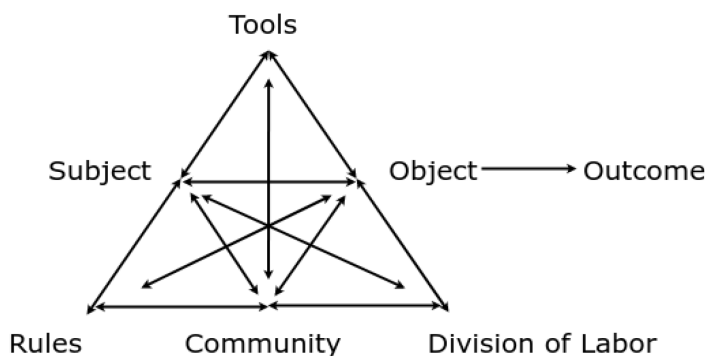


FIGURE 1
PARADIGM OF THE STUDY ON CULTURAL-HISTORICAL ACTIVITY THEORY

Assumptions

In this study, I assumed that my perceptions of cultural sensitivity and inclusivity in science teaching are aligned with the principles of Cultural-Historical Activity Theory (CHAT), particularly in viewing teaching and learning as shaped by social, cultural, and historical contexts. I also assumed that some of the responses of my participants may extend beyond what is asserted in the theory, as their lived experiences as science teachers handling Indigenous learners can reveal unique and context-specific insights. Lastly, I assumed that the themes presented in the theory may be further defined, enriched, or reinterpreted through the perceptions and experiences of my participants, allowing the theoretical constructs to gain deeper meaning within the actual classroom context.

II. METHODOLOGY

In this chapter, I presented the methodological approaches that guided my study. I described the research design, study locale, participants, and sampling technique. I also explained how the data was collected and analyzed, and the steps taken to ensure trustworthiness and ethical standards.

Research Design

I employed a descriptive qualitative design, a qualitative research approach that aims to provide a straightforward, low-inference summary of phenomena using the everyday terms of participants, allowing me to stay close to the data rather than generating theory or deep interpretation (Sandelowski, 2000; Kim et al., 2017). I used this approach to describe the “who,” “what,” and “where” of experiences, perceptions, or events—particularly in areas where little is known or where a clear, practical description is needed to inform practice or policy (Kim et al., 2017; Sandelowski, 2000). One advantage of this design is its flexibility in methods, which enabled me to capture rich and detailed descriptions directly from participants. Additionally, it allowed me to present findings using language and concepts that are accessible to stakeholders, making the results easier to understand and more useful in applied settings.

Research Locale

I conducted this study in Marilog District, Davao City, a geographically remote and mountainous area in Mindanao known for its significant population of Indigenous Peoples, particularly from the Ata, Bagobo, Matigsalug and Manobo community. I selected this locale because it provides a meaningful context for understanding the perceptions, cultural practices, and educational realities of Indigenous groups, whose voices are often underrepresented in research. In this setting, I was able to explore how Indigenous identity, traditions, and socio-economic conditions shape participants' perspectives, making Marilog District an appropriate and relevant site for this study.

Sample and Sampling Techniques

In this study, I reached out to seven (7) Science teachers who work closely with Indigenous Peoples (IP) learners. I knew that these teachers would have the most relevant and insightful experiences to share. Each participant had at least one year of teaching IP learners, and I made sure to include both those who are members of IP communities and those who are not, so that a rich variety of perspectives could be represented. I carefully selected these participants using purposive sampling, a method where participants are chosen intentionally for the specific knowledge and experiences they bring (Stratton, 2024). I chose this approach because it allowed me to focus on teachers who could provide deep, meaningful insights into the challenges and realities of teaching IP learners. One of the greatest strengths of this method is that it captures detailed stories from those directly involved, while also offering flexibility and efficiency in identifying the right people to talk to (Tajik et al., 2024; Stratton, 2024).

Data Gathering Technique

In this study, I chose to gather data through in-depth interviews (IDI), a qualitative approach that allowed me to have one-on-one, open-ended conversations with my participants. These interviews allowed me to explore their experiences, perspectives, and the meanings they attach to their teaching in a detailed and personal way (Rutberg & Bouikidis, 2018; Braun &

Clarke, 2021). I was drawn to this method because it provides a deep understanding of participants' perceptions—especially in situations where personal insights and nuanced reflections are key to answering the research questions (Braun & Clarke, 2021). One of the most valuable aspects of IDI was the richness of the data it produced. It gave me the flexibility to probe deeper into responses and allowed participants to share their thoughts openly, creating a safe space where authentic stories could emerge. This approach ultimately helped me capture comprehensive and meaningful insights into the perspectives of teachers working with Indigenous learners (Rutberg & Bouikidis, 2018; Braun & Clarke, 2021).

Data Analysis

I used thematic analysis to make sense of the data, carefully examining participants' narratives to uncover recurring patterns and meaningful themes (Braun & Clarke, 2006). Reading the transcripts multiple times, I coded significant statements, grouped related ideas, and refined emerging themes to capture the essence of the teachers' experiences (Creswell & Poth, 2018). Guided by Cultural-Historical Activity Theory (CHAT), I explored how teachers used their tools, interactions, and reflections to connect Science education with Indigenous worldviews. By triangulating insights across participants and supporting documents, I ensured the findings developed rich, contextually grounded themes that revealed how teachers enacted inclusive and culturally responsive practices.

Trustworthiness

In my study, I ensured trustworthiness by applying the four core elements of credibility, transferability, dependability, and confirmability as outlined by Lincoln and Guba (1985). I conducted member checking and triangulation, provided rich, detailed context, maintained an audit trail of all research decisions, engaged in reflexive journaling and peer debriefing for confirmability. Finally, I upheld ethical rigor by securing approval from the Society of Moral Integrity and Legal Ethics (SMILE) for research standards.

III. RESULTS

In this chapter, I presented the findings from my thematic analysis of the data I gathered, organizing the results based on the perceptions of my study participants, whose responses deeply resonated with me.

Cultural and Historical Contexts of Tools for Learning

In exploring the Cultural and Historical Contexts of Tools for Learning, I came to understand how teachers intentionally use culturally grounded and locally available tools that connect Science concepts to Indigenous learners' lived experiences. I noticed how these tools are deeply rooted in culture and history, making learning more meaningful and relatable.

Participant C emphasized localized experimentation through the statement,

"Imbis nga mogamit mi og clay ug mga materyales nga mapalit sa supermarket, mud (lapok) ang among gigamit, unya gidugangan namo og uban pang sangkap sama sa suka ug baking soda. Usa gyud to ka 'aha' moment para sa mga estudyante, kay pinaagi ato nga eksperimento, nakita gyud nila kung unsaon paglihok sa magma sa usa ka volcanic eruption." (IDI-TC, p. 8, lines 5–7)

"Instead of using clay and materials bought from the supermarket, we used mud, then added other ingredients such as vinegar and baking soda. It was truly an 'aha' moment for the students because through that experiment, they were able to see how magma behaves during a volcanic eruption." (IDI-TC, p. 8, lines 5–7)

Showing how simple and local materials can spark understanding. I also noticed the richness of culture in Participant E's response:

"Pananglitan, diri sa Marilog, ang mga Matigsalug ug Obu-Manuvu nga komunidad naga gamit og mga basket ug hinimo nga materyales gikan sa kalasangan sama sa rattan ug uban pang tanom. Pwede kaayo ni gamiton sa pagtudlo sa mga konsepto sama sa porma, pattern, ug relasyon sa espasyo.. Kung gamiton ang mga materyales nga pamilyar sa mga estudyante, mas dali ra gyud nila masabtan ug mas dali pud sila maengganyo sa pagkat-

on. Kay kabalo naman sila ani nga mga butang, makadala pud sila og daan nilang kahibalo nga makatabang sa mas lawom nga pagsabot sa klase.” (IDI-TE, p. 8, lines 11–13)

“For example, here in Marilog, the Matigsalug and Obu-Manuvu communities use baskets and handmade materials from the forest, such as rattan and other plants. These can be effectively used to teach concepts such as shape, pattern, and spatial relationships. When familiar materials are used, students can understand the lesson more easily and become more engaged in learning. Since they are already familiar with these materials, they can bring their prior knowledge, which helps deepen their understanding of the lesson.” (IDI-TE, p. 8, lines 11–13)

Likewise, I felt inspired by Participant B, who explained,

“Sa Grade 8 lesson nako about plant transport system, originally textbook diagram lang unta sa xylem ug phloem akong gamiton, pero naka-realize ko nga murag abstract siya para sa akong Indigenous learners. So gi-adapt nako ang lesson pinaagi sa paggamit og local plants ug colored water aron makita gyud nila unsaon paglihok sa water gikan sa roots padulong sa stems ug leaves. Mas naging hands-on ug relatable ang activity, kay na-connect nila ang concept sa mga tanom nga ila nang nakita ug ginagamit sa ilang komunidad.” (IDI-TB, p. 9, lines 1–3)

“In my Grade 8 lesson on the plant transport system, I originally planned to use a textbook diagram of xylem and phloem, but I realized that it might feel abstract for my Indigenous learners. So, I adapted the lesson by using local plants and colored water so they could clearly see how water moves from the roots to the stems and leaves. The activity became more hands-on and relatable, as they were able to connect the concept to plants they have already seen and use in their community.” (IDI-TB, p. 9, lines 1–3)

Through these voices, I realized that when teachers use culturally and historically rooted tools, Science becomes not only understandable but also deeply connected to students’ identities and everyday life.

Cultural and Historical Contexts of Subjects involved in learning

In examining the Cultural and Historical Contexts of Subjects Involved in Learning, I realized that the role of the teacher (subject) is deeply shaped by the cultural realities of Indigenous learners, shifting from a traditional knowledge-giver to a facilitator, contextualizer, and cultural bridge. I felt how meaningful this transformation is as I heard the participants describe their roles not just as instructional, but relational and culturally grounded.

I noticed how Participant C emphasized this shift, saying,

“I really make sure nga every time magtudlo ko og topic, i-contextualize gyud nako siya sa ilang level. Mangita ko og examples nga dali ra nila masabtan ug familiar sa ilaha, mao nang ginabuhat namo duol ra sa school. As a facilitator, I make sure to localize everything.” (IDI-TC, p. 1, lines 10–14)

“I really make sure that every time I teach a topic, I truly contextualize it to their level. I look for examples that are easy for them to understand and familiar to them—those that we usually do near the school. As a facilitator, I make sure to localize everything.” (IDI-TC, p. 1, lines 10–14)

It reflects a move toward culturally responsive teaching, and I was struck by the depth of Participant F’s perspective:

“Isip usa ka Science teacher sa IP community sa bukid, dili lang ko tighatag og leksyon kundi usa pud ko ka facilitator ug cultural bridge sa Western ug indigenous knowledge. Ginaangay nako ang leksyon sa ilang kinabuhi ug palibot, ug ginahimo nako nga respetado ug luwas ang classroom para sa ilang kultura. Para nako, importante nga ang pagtudlo dili makapahina sa ilang kultura, kundi makapalig-on niini.” (IDI-TF, p. 1, lines 18–22)

“As a Science teacher in an Indigenous Peoples (IP) community in the mountains, I am not just someone who delivers lessons, but also a facilitator and a cultural bridge between Western and Indigenous knowledge. I adapt my lessons to their lives and environment, and I make sure that the classroom is a respectful and safe space for their culture. For me, it is

important that teaching does not weaken their culture, but instead strengthens it.” (IDI-TF, p. 1, lines 18–22)

I also felt the sincerity and responsibility in Participant G’s voice:

“Pananglitan, sa science investigatory project, gipapili nako ang mga estudyante og topic nga konektado sa ilang komunidad. Ang uban Indigenous students nagtuon og environmental issues sa ilang lugar, mao nga mas na-connect nila ang science sa ilang tinuod nga kinabuhi ug mas nahimong meaningful ang ilang pagkat-on.” (IDI-TG, p. 2, lines 1–6)

“For example, in a science investigatory project, I let the students choose topics that are connected to their community. Some Indigenous students studied environmental issues in their area, which helped them connect science to their real-life experiences and made their learning more meaningful.” (IDI-TG, p. 2, lines 1–6)

Through their voices, I realized that the subject in learning is culturally and historically situated, where teaching is not only about delivering content but about honoring identity, fostering respect, and making learning meaningful within the learners’ cultural world.

Cultural and Historical Contexts of Rules for Learning

In exploring the Cultural and Historical Contexts of Rules for Learning, I realized that rules are not just formal policies but are shaped by respect, inclusivity, and cultural sensitivity within the classroom. I felt how these rules serve as guiding frameworks that allow teachers to balance scientific knowledge with Indigenous beliefs and practices.

I noticed how Participant C shared,

“Kung naay sensitive nga cultural belief, ginabuhat nako nga respectful ang approach. Giexplain nako ang science, pero gin-acknowledge pud nako ilang beliefs. Ginasulti nako nga ang science based sa evidence, pero importante gihapon ang respeto sa lain-laing

panan-aw. Pinaagi sa open discussion, mas komportable ang students mu-share nga walay kahadlok ma-judge.” (IDI-TC, p. 12, lines 6–10)

“When there are sensitive cultural beliefs, I make sure to approach them respectfully. I explain the scientific perspective, but I also acknowledge their beliefs. I tell them that science is based on evidence, but it is still important to respect different perspectives. Through open discussion, students become more comfortable sharing their thoughts without fear of being judged.” (IDI-TC, p. 12, lines 6–10)

It shows how rules are navigated through respect and dialogue. I also saw how Participant F emphasized collaboration and sensitivity,

“Ginaduol nako ang ing-ani nga sitwasyon nga naay sensitivity ug open dialogue. Kung naay concerns, mokonsulta ko sa elders ug parents una mag-implement og activities. Gisiguro nako nga ang lessons respectful sa cultural norms samtang natuman gihapon ang curriculum. Importante kaayo ang transparency ug communication.” (IDI-TF, p. 12, lines 15–18)

“I approach situations like this, especially those with sensitivity, through open dialogue. When there are concerns, I consult elders and parents before implementing activities. I make sure that the lessons are respectful of cultural norms while still meeting the curriculum requirements. Transparency and communication are very important.” (IDI-TF, p. 12, lines 15–18)

I felt the grounded perspective of Participant G, who stated,

“Kung naay kalainan sa scientific explanation ug cultural beliefs, ginahandle nako ni nga may respeto. Giexplain nako ang science samtang gi-acknowledge pud ang cultural perspective. Tungod ani, mas masabtan sa students ang Science nga dili nila mabati nga gi-disregard ilang kultura.” (IDI-TG, p. 12, lines 19–21)

“When there is a difference between scientific explanations and cultural beliefs, I handle it with respect. I explain the science while also acknowledging the cultural perspective. Because of this, students can understand Science better without feeling that their culture is being disregarded.” (IDI-TG, p. 12, lines 19–21)

Through these voices, I realized that learning rules are culturally and historically situated, where policies and classroom practices are guided not only by curriculum standards but by mutual respect, cultural understanding, and the need to create a safe space for Indigenous learners.

Cultural and Historical Contexts of the Learning Community

In examining the Cultural and Historical Contexts of the Learning Community, I realized that learning is deeply enriched through the active involvement of parents, elders, and the wider Indigenous community, where knowledge is shared collectively and rooted in lived experiences. I felt how meaningful these connections are as I heard the participants describe how community engagement strengthens both cultural identity and scientific understanding.

I noticed how Participant F shared,

“Nakig-communicate ko sa parents during meetings, gina-explain nako how their knowledge can support classroom learning. Gina-invite pud namo ang elders to share their traditional ecological practices. Usahay, naga-conduct mi og community-based projects like tree planting or school gardening. Tungod ani, mas nag-strong ang trust between school ug community.” (IDI-TF, p. 10, lines 10–13)

“I communicate with parents during meetings, where I explain how their knowledge can support classroom learning. We also invite elders to share their traditional ecological practices. Sometimes, we conduct community-based projects such as tree planting or school gardening. Because of this, the trust between the school and the community becomes stronger.” (IDI-TF, p. 10, lines 10–13)

It shows how community members become co-educators in the learning process. I also felt the depth of Participant G's experience:

"Kung mahimo, aumh... gina-encourage nako ang mga estudyante nga makig-istorya sa ilang ginikanan o elders... bahin sa tradisyonal nga praktis. Usahay... gahatag ko og assignment nga mag-interview sila sa ilang pamilya... kabahin sa lokal nga kahibalo, sama sa herbal medicine ug farming. Pinaagi ani... mas molalom ang ilang pagkat-on... ug mas mapalig-on ang koneksyon sa eskwelahan ug komunidad." (IDI-TG, p. 10, lines 14–17)

"If possible, I encourage students to talk with their parents or elders about traditional practices. Sometimes, I give assignments where they interview their family members about local knowledge, such as herbal medicine and farming. Through this, their learning becomes deeper, and the connection between the school and the community is strengthened."(IDI-TG, p. 10, lines 14–17)

Through these voices, I realized that the learning community is culturally and historically grounded, where collaboration with families and elders transforms learning into a shared, meaningful experience that connects Science to culture and everyday life.

Cultural and Historical Contexts of Division of Labor for Learning

In examining the Cultural and Historical Contexts of Division of Labor for Learning, I realized that teaching Indigenous learners is not the sole responsibility of one teacher but a shared effort among colleagues, administrators, and the community, shaped by cultural understanding and collaboration. I noticed how roles are distributed based on experience, cultural knowledge, and mutual support, making learning more responsive and inclusive. I felt the importance of this shared responsibility when Participant A shared,

"Maayo pud kay... aumh... naa koy mga kauban nga part sa tribe, sila jud ang naka-experience firsthand... ug kasagaran sila ang naga-initiate... ako pud, aumh... daghan kog natun-an gikan nila." (IDI-TA, p. 13, lines 2–4)

“It is also good because I have colleagues who are part of the tribe; they have firsthand experience, and they are usually the ones who take the initiative. As for me, I have learned a lot from them.” (IDI-TA, p. 13, lines 2–4)

It shows how cultural insiders play a vital role in guiding teaching practices. I also saw the strength of collaboration in Participant F’s response:

“Mag-collaborate mi sa lesson planning ug mag-share og best practices. Regular mi mag-meeting to discuss student performance ug cultural considerations. Usahay mag co-design mi og activities nga integrated across subjects. Through teamwork, mas consistent among teaching ug mas napaligon ang support for IP learners.” (IDI-TF, p. 13, lines 12–15)

“We collaborate in lesson planning and share best practices. We regularly meet to discuss student performance and cultural considerations. Sometimes, we co-design activities that are integrated across subjects. Through teamwork, our teaching becomes more consistent, and support for IP learners is strengthened.” (IDI-TF, p. 13, lines 12–15)

Through these voices, I realized that division of labor in learning is culturally and historically situated, where responsibilities are shared and informed by community knowledge, allowing teachers to co-construct inclusive and meaningful Science education together.

Perceptions on the Goals for teaching in the IP Schools

In exploring Perceptions of the Goals for teaching in IP Schools, I realized that science teachers view their goals not only as delivering content but also as transforming learning into something meaningful, empowering, and culturally grounded for Indigenous learners. I felt how intentional they were in shaping outcomes that go beyond academic understanding toward confidence, identity, and real-life application.

I noticed how Participant B expressed this clearly,

“I set meaningful goals nga i-connect ang science concepts sa ilang culture, environment, ug daily experiences. Gusto nako nga ma-build ilang confidence sa paggamit sa Science to protect their environment, help their community, ug ma-proud sa ilang cultural identity ug academic growth.” (IDI-TB, p. 4, lines 3–6)

It shows that the goal of teaching is deeply tied to both knowledge and identity. I also felt the strong sense of purpose in Participant F’s response,

“Akong tumong kay masabtan nila ang science samtang napalambo ang ilang cultural pride. Gusto nako nga makita nila nga naa pud scientific thinking sa ilang tradisyon. Target nako ang critical thinking, environmental awareness, ug confidence sa pag-express. Dili lang para makapasa, kundi mahimong informed individuals nga magamit ang science sa ilang komunidad.” (IDI-TF, p. 4, lines 10–13)

“My goal is for them to understand science while also developing their cultural pride. I want them to see that there is also scientific thinking within their traditions. I aim to foster critical thinking, environmental awareness, and confidence in expressing themselves. It is not just about passing, but about becoming informed individuals who can use science in their community.” (IDI-TF, p. 4, lines 10–13)

I further noticed how Participant G emphasized connection and belonging,

“Akong tumong kay masabtan nila ang science ug makita nga kini naa na sa ilang adlaw-adlaw nga kinabuhi. Ginapa-oberbar nako sila sa ilang palibot aron ma-connect ang theory sa tinuod nga experience. Importante pud nga mapalambo ang ilang kumpiyansa aron mabati nila nga naa silay lugar sa classroom ug importante ang ilang kahibalo.” (IDI-TG, p. 4, lines 14–18)

“My goal is for them to understand science and see that it is already present in their everyday lives. I encourage them to observe their surroundings so they can connect theory with real-life experiences. It is also important to develop their confidence so they feel that they belong in the classroom and that their knowledge is valued.” (IDI-TG, p. 4, lines 14–18)

Through these voices, I realized that teachers perceive the goal of learning as a bridge toward meaningful outcomes—where Science becomes relevant, culturally affirming, and transformative for Indigenous learners.

Perceptions on turning the goals for teaching in the IP Schools into outcomes

In exploring the Perceptions on turning the Goals for teaching in IP Schools into Outcomes, I realized that teachers see success not only in students’ academic performance but in their engagement, confidence, and ability to connect Science with their cultural identity. I felt how fulfilling it was for teachers to witness these transformations in their learners.

I noticed how Participant B shared,

“Gina-evaluate nako ang kalampusan sa akong lessons kung masabtan ug ma-apply sa mga estudyante ang science samtang ma-connect nila kini sa ilang kultura ug adlaw-adlaw nga experience.” (IDI-TB, p. 15, lines 2–5)

“I evaluate the success of my lessons based on whether students can understand and apply science while connecting it to their culture and everyday experiences.” (IDI-TB, p. 15, lines 2–5)

It emphasizes meaningful application as an outcome. I also felt the impact of Participant F’s reflection,

“Ginatimbang nako ang kalampusan sa leksyon pinaagi sa participation sa students ug sa ilang ability to relate concepts to their own culture,” (IDI-TF, p. 15, lines 10–12)

“I measure the success of the lesson through students’ participation and their ability to relate concepts to their own culture.” (T-Page 15, Line 10-12)

Success is seen through cultural connection and active participation. I further noticed how Participant G highlighted student transformation,

“Students become more confident and engaged when they realize that their culture is valued in the classroom.” (IDI-TG, p. 16, lines 3–5)

Through these voices, I realized that turning teaching goals into outcomes is culturally and historically grounded, where learning becomes successful when students not only understand Science but also feel valued, confident, and connected to their identity and community.

Summary Findings

1. Based on the perceptions of my study participants, I found that the cultural and historical contexts of tools are the locally used materials and practices; subjects are redefined cultural role of teacher as facilitator; rules in promoting respect and dialogue; community as co-educators; and division of labor in teaching as a collaborative process. These cultural and historical contexts shape the deeper understanding, cultural identity, active participation, and holistic development among Indigenous learners.
2. Based on the perceptions of my study participants, I found that teachers view the transformation of goals into outcomes as a culturally grounded process—where connecting Science to students lived experiences, culture, and environment shapes outcomes that foster deeper understanding, meaningful application, cultural identity, confidence, active participation, and a strong sense of belonging among Indigenous learners.

IV. DISCUSSION

In this chapter, I presented the discussion of my study by synthesizing the summary of findings, supported by related literature and contrasting studies, which I reflected on deeply as I engaged with them wholeheartedly.

Cultural and Historical Contexts Shaping Teachers' Goals

In this study, I found that the cultural and historical contexts of tools, subject, rules, community, and division of labor significantly shaped teachers' goals toward fostering deeper understanding, cultural identity, active participation, and holistic development among Indigenous learners. I observed that my findings support Paris and Alim (2023), who emphasized that culturally sustaining pedagogy enables learners to maintain and value their cultural identities while engaging in academic learning. Their work affirmed my observation that integrating local materials, redefining teacher roles as facilitators, and involving the community as co-educators contribute to meaningful and inclusive learning experiences. Likewise, my findings align with Geneva Gay (2023), who states that culturally responsive teaching practices—such as promoting respect, dialogue, and collaboration—enhance student engagement and understanding by aligning instruction with learners' cultural contexts, which I also found evident in my study.

On the contrary, with my findings, I opposed the study of Kirschner et al. (2023), who argued that learning is more effective when instruction is highly structured and teacher-centered rather than culturally embedded and collaborative. My findings revealed that culturally and historically grounded practices—through the use of local tools, redefined teacher roles, respectful rules, community involvement, and collaborative division of labor—enhance deeper understanding, cultural identity, active participation, and holistic development among Indigenous learners. These results demonstrate that learning becomes more meaningful when it is contextualized and rooted in learners' cultural realities. While Kirschner et al.'s study was grounded in a quantitative and experimental design focusing on student performance, my descriptive qualitative approach involving seven (7) science teachers highlights the importance of

context, perception, and lived classroom practices, thereby affirming that culturally responsive and community-driven approaches are more appropriate in Indigenous learning environments.

Transforming Goals into Meaningful and Culturally Grounded Outcomes

In this study, I found that teachers perceived the transformation of goals into outcomes as a culturally grounded process, where connecting Science to students' lived experiences, culture, and environment led to meaningful and holistic learning. This finding is supported by the work of Aronson (2023), who asserted that culturally relevant pedagogy enhances students' academic engagement and identity development by anchoring learning in their cultural contexts and everyday realities. In the same way, my findings uphold Paris (2023), who emphasized that culturally sustaining practices not only improve comprehension but also affirm learners' identities, enabling them to actively participate and recognize their value in the learning process. As I reflected on these assertions, I saw how they aligned with my findings, where teachers intentionally connected learning goals to students' cultural backgrounds, resulting in outcomes that fostered deeper understanding, confidence, and a strong sense of belonging

In contrast, I oppose the study of Kirschner (2023), who argued that instructional approaches grounded in contextual and experiential learning may not be as effective as structured, teacher-directed methods in achieving academic outcomes. While this perspective emphasizes efficiency in content delivery and measurable performance, my findings show that in the context of Indigenous learners, learning cannot be limited to cognitive outcomes alone but must also consider cultural identity, engagement, and relevance. I observed that teachers perceive success not merely through test performance but through students' ability to apply scientific concepts in real-life contexts, connect these to their cultural experiences, and develop confidence in expressing their knowledge. This suggests that outcomes become more meaningful when they are grounded in learners' lived realities and cultural backgrounds. Although Kirschner's position is rooted in a controlled and performance-oriented approach, my findings highlight that culturally grounded and learner-centered practices foster deeper understanding, active participation, and a stronger sense of belonging among Indigenous learners, thereby demonstrating that transformative learning

extends beyond traditional measures of academic achievement and affirms the value of culturally responsive education in diverse learning contexts.

Future Direction of my Study

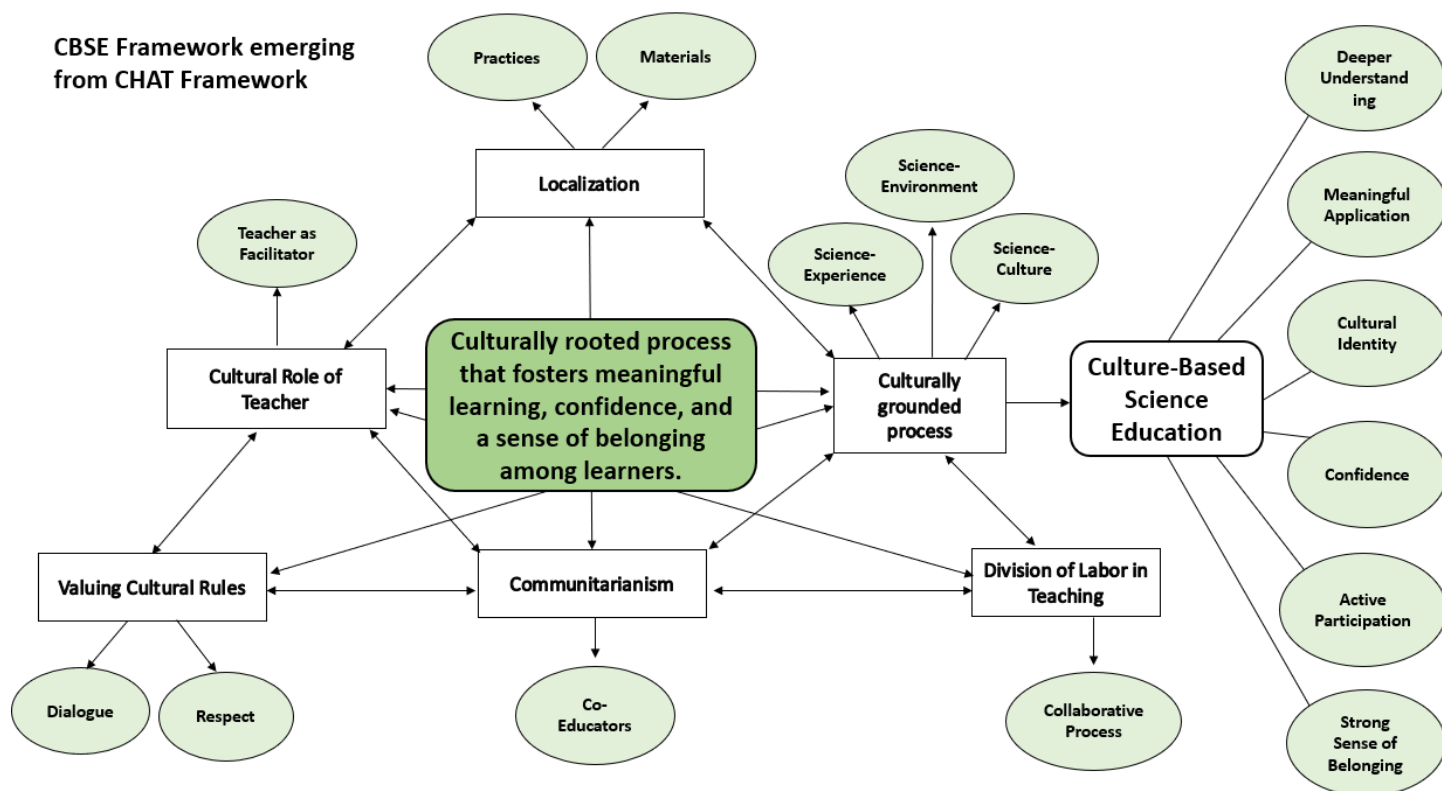
Based on the modified paradigm, I see so much potential in conducting multiple linear regression analysis utilizing the following themes as predictors of culture-based science education, namely, localization, teacher role, valuing rules, communitarianism, division of labor, and culturally grounded process. Likewise, an exploratory factor analysis may be pursued to develop quantitative survey tools for these variables, utilizing the corresponding sub-themes that emerged in my study as indicators.

Implications for Practice

Based on the findings, I see the need for science teachers to put a lot of energy into localizing science activities and learning materials, playing as facilitators rather than as sole owners of knowledge, promoting dialogue and cultural respect, working with the community as co-educators, and distributing responsibilities towards optimizing culture-based science education.

Modified Paradigm

CBSE Framework emerging from CHAT Framework



REFERENCES

- [1.] Aikenhead, G. S., & Michell, H. (2019). *Bridging cultures: Indigenous and scientific ways of knowing in science education*. Pearson Education.
- [2.] Aikenhead, G. S., & Michell, H. (2021). *Bridging cultures: Indigenous and scientific ways of knowing nature*. Pearson Canada.
- [3.] Bang, M., Marin, A., Faber, L., & Suzukovich, E. S. (2022). Repatriating Indigenous knowledge in science education. *Science Education*, 106(5), 1069–1095. <https://doi.org/10.1002/sce.21719>
- [4.] Barnhardt, R., & Kawagley, A. O. (2020). Indigenous knowledge systems and Alaska Native ways of knowing. *Anthropology & Education Quarterly*, 51(2), 145–161.
- [5.] Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- [6.] Brayboy, B. M. J., Castagno, A. E., & Solyom, J. A. (2021). Toward a theory of culturally responsive Indigenous education. *Journal of American Indian Education*, 60(1), 3–25.
- [7.] Brayboy, B. M. J., Fann, A. J., & Castagno, A. E. (2022). Indigenous education and student engagement: Culturally grounded approaches. *Educational Researcher*, 51(6), 387–396.
- [8.] Bunkar, Y., Yadav, A., & Pandey, R. (2024). Triangulation in qualitative research: Ensuring validity through multiple perspectives. *Qualitative Inquiry Journal*, 30(1), 15–27. <https://doi.org/10.1177/10778004231234567>
- [9.] Carter, L. (2020). Culturally responsive science teaching: Integrating Indigenous knowledge in the classroom. *Australian Journal of Science Education*, 66(3), 45–59. <https://doi.org/10.1007/s11422-020-09980-1>
- [10.] Carter, L., Tzou, C., & Bulow, K. (2022). Place-based science education: Connecting culture, land, and learning. *Cultural Studies of Science Education*, 17(3), 673–689.

-
- [11.] Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). SAGE Publications.
- [12.] Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2021). *Effective teacher professional development*. Learning Policy Institute.
- [13.] Department of Education. (2015). *Indigenous Peoples Education Framework*. <https://www.deped.gov.ph>
- [14.] Engeström, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Orienta-Konsultit.
- [15.] Gay, G. (2020). *Culturally responsive teaching: Theory, research, and practice* (3rd ed.). Teachers College Press.
- [16.] Kimmerer, R. W. (2021). *Braiding sweetgrass: Indigenous wisdom, scientific knowledge, and the teachings of plants*. Milkweed Editions.
- [17.] Ladson-Billings, G. (2021). Culturally relevant pedagogy 2.0: Aka the remix. *Harvard Educational Review*, 91(1), 1–22.
- [18.] McKinley, E., & Stewart, G. (2020a). Decolonizing science education: Moving beyond cultural inclusion. *Science Education*, 104(4), 678–695. <https://doi.org/10.1002/sce.21581>
- [19.] McKinley, E., & Stewart, G. (2020b). Out of place: Indigenous knowledge in the science curriculum. *International Journal of Science Education*, 42(8), 1231–1248.
- [20.] Morse, J. M. (2000). Determining sample size. *Qualitative Health Research*, 10(1), 3–5. <https://doi.org/10.1177/104973200129118183>
- [21.] Moustakas, C. (1994). *Phenomenological research methods*. SAGE Publications.
- [22.] Organisation for Economic Co-operation and Development. (2022). *Equity and inclusion in education: Finding strength through diversity*. OECD Publishing.
-

-
- [23.] Salvador, M. L., & Estacio, L. A. (2022). Contextualizing science education: The role of Indigenous knowledge systems in the Philippines. *Asia Pacific Journal of Education*, 42(2), 210–224. <https://doi.org/10.1080/02188791.2022.2043857>
- [24.] Santoro, N. (2020). Teachers' cultural identities and implications for culturally responsive practice. *Teaching Education*, 31(4), 410–425.
- [25.] Smith, L. T. (2021). *Decolonizing methodologies: Research and Indigenous peoples* (3rd ed.). Zed Books.
- [26.] Snively, G., & Williams, W. L. (2021). *Knowing home: Braiding Indigenous science with Western science* (Book 2). University of British Columbia Press.
- [27.] UNESCO. (2021). *Reimagining our futures together: A new social contract for education*. UNESCO Publishing.
- [28.] van Manen, M. (2016). *Phenomenology of practice: Meaning-giving methods in phenomenological research and writing*. Routledge. <https://doi.org/10.4324/9781315422657>
- [29.] Whyte, K. (2020). Indigenous climate change studies: Indigenizing futures, decolonizing the Anthropocene. *English Language Notes*, 58(1), 153–162.