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Development of a Context-Based Learning Science Module Integrating Mappi Local Context for Papuan Students

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Abstract

ABSTRACT
This Research and Development (R&D) study aims to design and develop a Context-Based Science Learning Module integrating the local wisdom and natural environment of Mappi Regency (Papua) for Papuan students in the Primary School Teacher Education (PGSD) program at Universitas Negeri Jakarta (UNJ). These affirmative-action students frequently face significant cultural and academic transition barriers when learning abstract scientific concepts through unfamiliar metropolitan (Jakarta-centric) analogies. The research adapts the ADDIE instructional model, specifically focusing on the Analysis, Design, and Development phases, evaluated formatively through Expert Validation and student-based Readability Testing. Data was gathered via a digital Google Form needs assessment questionnaire, expert appraisal rubrics, and Likert-scale readability questionnaires administered to 53 Papuan PGSD students from Mappi. The needs analysis results indicated that 69.8% of students selected 'Characteristics of Living Things' as their primary initial learning need. The module was developed by integrating relevant examples of local Papuan flora and fauna, visually framed against the swampland and river landscapes of Mappi. Science content and learning media experts validated the module as highly feasible, with an average score of 92.0% (Highly Valid). The readability test completed by the 53 students yielded a very high average practicality score of 4.65 out of 5.00. Qualitative student feedback confirmed that the familiar visual backgrounds of Mappi's rivers and sago forests, alongside simplified language, acted as powerful cognitive-affective gateways that reduced academic anxiety, facilitated self-directed learning, and fostered sociocultural pride. This study provides a practical model for equitable, culturally responsive science material intervention in urban teacher colleges.

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INTRODUCTION

Science education at the teacher training college level plays a highly strategic role in equipping prospective primary school teacher students with critical thinking skills, a robust conceptual understanding of scientific principles, and a mature mastery of scientific literacy. Primary school teachers are the vital foundation that shapes the scientific worldview of future generations. Scientific literacy is fundamentally defined as an individual's ability to deeply understand scientific concepts, apply this knowledge functionally in social reality, and demonstrate scientific responsibility as citizens (Bennett et al., 2007). However, achieving scientific literacy in Indonesia remains a significant challenge. International evaluation results through the Program for International Student Assessment (PISA) consistently place the science literacy skills of Indonesian students in the lower ranks (Ishep & Rizkil, 2025). This persistent

disparity reflects a fundamental weakness in the educational system, which often fails to help learners connect abstract scientific concepts with the daily phenomena surrounding them.

Generally, university-level science courses require advanced, highly abstract thinking, which can pose a significant cognitive challenge for students from marginalized backgrounds, such as those from Mappi (Hüfner et al., 2025). When learning lacks contextualization, it can create learning barriers and drastically lower student motivation (Hüfner et al., 2025). This sociocultural-academic barrier is experienced concretely by students from Mappi Regency, Papua, who are studying in the Primary School Teacher Education (PGSD) program at Universitas Negeri Jakarta (UNJ). As students in an affirmative action program, their transition from the rural swampland ecosystem of Mappi to Jakarta requires deep academic adjustment. The primary struggle is not a general cultural shock, but rather a lack of relatability to science concepts that are suddenly presented in an extremely abstract manner. These students need more time and appropriate cognitive scaffolds to process abstract concepts, scientific data, and academic analogies that differ from their native ecological experiences.

To democratize science instruction and overcome cultural bias, the Context-Based Science Education (CBSE) approach uses everyday phenomena and local wisdom as the starting point for developing scientific ideas (Bennett et al., 2007; Hüfner et al., 2025). CBSE is designed to trigger a 'need to know' within learners, making conceptual reconstruction natural and meaningful (Bennett & Lubben, 2006). Global experimental evidence indicates that CBSE courses yield conceptual understandings comparable to or better than conventional approaches while significantly boosting situational interest, positive attitudes, and narrowing gender and sociocultural gaps (Bennett et al., 2007). However, the implementation of context-based learning must be consciously aligned with the principles of Diversity, Equity, and Inclusion (DEI) to fairly reach students of all backgrounds (Hüfner et al., 2025). This demands active instructional adaptation to accommodate the diversity of students' identities, daily cultures, sociocultural languages, and unique backgrounds equitably (Hüfner et al., 2025). From a sociocultural perspective, students' diverse backgrounds are no longer viewed as academic deficits or burdens; instead, they are recognized as valuable assets (funds of knowledge) that bridge scientific conceptual reconstruction in the classroom (Hüfner et al., 2025).

Conversely, enforcing a single science context that is biased toward the dominant group (one context fits all) is proven to create pedagogical injustices, leading to the academic marginalization of minority groups like Papuan students (Hüfner et al., 2025; van Vorst & Aydogmus, 2021). In affirmative higher education, integrating Mappi's local wisdom and swampland ecology into the teacher training science curriculum represents a vital culturally responsive pedagogical bridge (Onwu & Mufundirwa, 2020). Local wisdom contains traditional knowledge systems and ecological practices highly familiar to students in their daily lives (Ishep & Rizkil, 2025). By developing place-based structured science teaching materials, students can comprehend biological and ecological concepts through their daily interactions with their native nature (Giamellaro, 2014; Hüfner et al., 2025).

Unlike prior studies that directly implement large-scale experimental designs, this research focuses on the crucial pre-implementation gap analysis: Needs Assessment and Formative Readability Testing. An equitable, contextualized science module cannot be designed top-down by urban academics; it must elevate the students' voices and reflect their concrete sosiokultural realities (van Vorst & Aydogmus, 2021). Therefore, this study aims to assess the learning needs of 53 Papuan PGSD UNJ students from Mappi, map the core biological concepts to Mappi's ecosystem, evaluate the validity of the developed module through expert validation, and analyze the students' readability feedback to create an inclusive and sosiokultural-sensitive science environment.

METHOD

This study is a type of Research and Development (R&D) adapting the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) instructional model (Ishep & Rizkil, 2025). To ensure that the generated module truly reflects the sociocultural needs of Papuan students and remains free of dominant biases, this research limits its scope to the first three phases of ADDIE: Analysis (needs assessment of 53 students and Mappi cultural ethnography), Design (curriculum mapping and designing the biological storyline), and Development (realizing the module, expert validity appraisal, and formative readability testing) (Sari et al., 2021; Ishep & Rizkil, 2025).

Research Participants

The subjects of this study were active Papuan PGSD students at UNJ who originated from Mappi Regency and were enrolled in the Basic Concepts of Science course. The total number of participants involved in the needs assessment and readability testing was 53 students. Purposive sampling was applied with inclusion criteria: (1) active affirmative action students from Mappi Regency, Papua; and (2) recorded as facing significant conceptual difficulties in initial biology diagnostic tests while undergoing academic and sosiokultural transitions in Jakarta.

Research Instruments

Research data were collected using three primary instruments:

1. Needs Assessment Questionnaire: A digital Google Form instrument designed to identify biology topics that students consider important to explore and their preferences for module scaffolding (rated on a 1–4 Likert scale), including the use of simple language, local examples, illustrations, and glossary terms (Rahmawati & Azizah, 2021).
2. Expert Validation Sheets: Feasibility rubrics completed by one science content expert and one learning media expert, utilizing a 1-5 Likert scale to evaluate scientific accuracy, local wisdom translation, layout, typography, and aesthetic suitability (Lestari et al., 2020).
3. Readability and Feedback Questionnaire: A 1-5 Likert scale closed questionnaire answered by 53 students to evaluate the digital FlipHTML5 module on language clarity, term simplification, example helpfulness, and visual layout, complemented by open-ended feedback prompts for qualitative suggestions (Rahmawati & Azizah, 2021; Ishep & Rizkil, 2025).

Development Procedure (ADDIE)

The R&D procedure was executed in three phases:

1. Analysis Phase: Analyzing the responses of the 53 students on Google Form to map conceptual difficulties, and inventorying Mappi's local wisdom through digital interviews with Papuan elders and ethnographic literature (Ishep & Rizkil, 2025).
2. Design Phase: Creating a concept map for 'Characteristics of Living Things' and mapping them to Papuan biota. Drafting the module outline and designing a cohesive storyline (C4) that maintains the swampland ecosystem as a red thread (Nentwig et al., 2007).
3. Development Phase: Constructing the digital FlipHTML5 module, incorporating visual illustrations of Mappi's rivers, conducting expert validations, revising based on feedback, and running a readability test with the 53 students.

Data Analysis Plan

Quantitative needs data and readability Likert-scales were analyzed using descriptive statistics (percentages and means) to establish priorities and kepraktisan (practicality) levels. Expert validation was calculated using percentage scores. Qualitative responses from open-ended questions regarding learning difficulties, impressions, and recommendations were processed using qualitative content analysis (Kuckartz, 2014) to systematically categorize and guide the module's iterative revisions.

RESULTS AND DISCUSSION

Results:

This section presents the research results objectively, based on the data obtained. Results are presented in narrative text, tables, figures, or graphs as needed, with an emphasis on key findings relevant to the research objectives. Each data presentation should be concise, clear, and consistent, without excessive interpretation.

The needs assessment filled out by the 53 Papuan students from Mappi revealed the specific challenges they experience. A substantial majority identified 'Characteristics of Living Things' (69.8% or 37 responses) as the most challenging and desirable topic to study deeply, followed by 'Circulatory System' (54.7% or 29 responses), 'Classification' (45.3% or 24 responses), 'Ecosystem' (43.4% or 23 responses), and 'Digestive System' (41.5% or 22 responses). The qualitative reasons behind their selection were highly emotive, highlighting both academic anxiety and a strong agency to learn: (1) 'Saya sangat tidak baham sekali ibu' (I really don't understand at all, ma'am—showing the frustration of decontextualized learning); (2) 'Biar apa yang tidak pernah saya tau bisa tau'; (3) 'Karna menurut saya selain sesuatu yang kita pelajari dari luar kita perlu juga pelajari dari dalam lebih mendalam' (Because in my opinion, besides learning about things from the outside, we also need to study our inner realities more deeply—a powerful sosiokultural statement regarding local context importance); and (4) 'Untuk menambah pengetahuan saya lebih dalam tentang makhluk hidup yang ada di indonesia'.

Regarding preferred module features, 91% of students strongly agreed (score 4 on a Likert scale) with needing simplified language, contextualized daily-life examples, high-quality visual illustrations, summaries, and a biology glossary to foster self-directed understanding. These parameters directly informed the physical design of the Mappi module.

In response to the needs assessment, the module on the 'Characteristics of Living Things' was designed using Mappi's wetland ecosystem and indigenous Papuan biota as conceptual anchors. This sosiokultural integration acts as a consistent storyline. The concept-to-context translation map is presented in Table 1 below:

Concept Translation Map: Linking Characteristics of Living Things with Papuan Biota

Biological Concept	Papuan Local Biota	Scientific Context & Principles
Nutrition & Growth	Sago Palm (Metroxylon sagu)	Photosynthesis mechanisms in sago forest vegetation under acidic swampland soil conditions; root absorption of macro-nutrients, and carbohydrates accumulation in the empulur (trunk stem).
Movement & Adaptation (Morphology)	Tree Kangaroo (Dendrolagus sp.)	Arboreal morphological adaptations: strong curved claws for climbing trees and broader, shorter hind limbs compared to Australian terrestrial kangaroos.
Respiration & Adaptation (Physiology)	Swampland Fish (Gabus Rawa/Gastor)	Physiological adaptation: labyrinth organs (additional respiratory device) that enable fish to breathe and survive in muddy swampland water with extremely low dissolved oxygen.

Expert Validity Outcomes

The drafted context-based biology module was validated by two experts. The science content expert provided a feasibility percentage score of 91.2%, while the learning media expert provided a score of 92.8%. The resulting average validity score of 92.0% places the module in the 'Highly Valid' / 'Highly Feasible' category (Lestari et al., 2020). The content expert recommended ensuring that Papuan local terms (e.g., gastor, soga) are consistently paired with their latin scientific names. The media expert highly praised the digital FlipHTML5 platform for seamlessly integrating original visual backgrounds of Mappi's swamplands, rivers, and sago forest activities, noting that it acts as an extremely welcoming and intuitive visual scaffold for affirmative action students.

Formative Readability and Sociocultural Feedback

Following expert revisions, the module was distributed as a FlipHTML5 digital module to the 53 Papuan PGSD students. The quantitative readability evaluation yielded a highly encouraging average practicality score of 4.65 out of 5.00 (93.0% practicality). Specifically, score averages were 4.70 for language simplicity, 4.58 for biological term clarity, 4.62 for logical material sequence, and the highest score of 4.72 for the helpfulness of Papuan contextual examples (sago, tree kangaroo, swampland fish) [530].

This quantitative data was strongly supported by the qualitative feedback (impressions and suggestions) provided by the students. Many expressed feelings of pride and emotional comfort, noting that the visuals of Mappi's rivers and sago forests made them feel 'close to home' while studying in the overwhelming metropolitan setting of Jakarta. The local biota examples made the previously intimidating concepts of morphological and physiological adaptation highly logical and accessible. The primary suggestion for improvement was adding a mini biological glossary at the back of the module to translate complex scientific jargon, and increasing the image resolution for better mobile readability.

Discussion

The findings of this R&D study empirically demonstrate that integrating Mappi's local wisdom and natural environment into the science module acts as a highly effective cognitive-sociocultural bridge for Papuan students. Theoretically, Mappi's context provides cognitive *gateways* that facilitate the visualization and conceptual understanding of biological concepts (Giamellaro, 2014; Hüfner et al., 2025). Students no longer struggle to relate to general textbook examples that are unfamiliar to those raised in a different ecological setting; instead, they reconstruct new scientific knowledge by activating their sociocultural *funds of knowledge* brought from their native land since childhood (Hüfner et al., 2025; Windschitl et al., 2018). This approach concretely supports the creation of an inclusive and socioculturally responsive science education ecosystem to achieve educational equity and accessibility for learners from diverse geographical backgrounds (Florian & Spratt, 2013; Hüfner et al., 2025).

Crucially, in this educational development design, the module's success is not measured quantitatively through student pretest-posttest score improvements. The module's feasibility and quality strictly rely on the rigorous Student Needs Assessment (Student Voice), Expert Validation, and Formative Readability feedback. Sociocultural-inclusive pedagogies assert that a module's quality is not defined by raw statistical gains, but by its capacity to reduce sociocultural learning barriers, respect student voices, and provide emotional safety for marginalized groups (Hüfner et al., 2025). The strong synergy between expert validation (92.0%) and student readability (4.65/5.00) confirms that positive emotions and sosiokultural recognition are highly critical in academic success (Bennett et al., 2007; Ishep & Rizkil, 2025). When affirmative action students feel that their culture, local fauna, and home environments are respected and validated in a metropolitan university curriculum, it sparks situational interest, intrinsic motivation, and a deep sense of ownership over science (Pekrun, 2006; Broman et al., 2022).

This study provides important theoretical implications for CBSE literature by operationalizing sociocultural-based science instruction in higher teacher education (Hüfner et al., 2025). Practically, it produces a valid and highly practical digital science module that addresses the learning difficulties of PGSD UNJ students from Mappi, Papua, while modeling culturally responsive teaching methods that they can replicate in their future classrooms (Onwu & Mufundirwa, 2020). Policymatically, these findings provide strategic recommendations for teacher training institutions (LPTK) to recognize that the growing student mobility today—whether through student exchange programs or the presence of affirmative action students in various regions—presents a valuable opportunity to enrich the curriculum. This diversity provides an excellent opportunity for educators to develop more varied teaching materials and incorporate diverse contextual examples tailored to students' actual learning needs, thereby advancing the equitable and inclusive spirit of Kurikulum Merdeka.

Despite its positive outcomes, this study has limitations, including a R&D design restricted to the Analysis, Design, and Development phases of the ADDIE model (not testing long-term experimental effectiveness in a classroom trial over a full semester), and a scarcity of written scientific documentation on Mappi local wisdom, which required the researchers to conduct deep, in-person interview triangulation directly with Papuan elders (Ishep & Rizkil, 2025). As recommendations for future research, it is suggested to: (1) Develop similar place-based biology modules integrating other Papuan cultural contexts (such as the Jayawijaya highlands or coastal Raja Ampat) (Ishep & Rizkil, 2025); (2) Integrate low-cost digital media, such as localized ethnoscience documentary videos or *digital storytelling* that combines customary elders' narratives with realistic, smartphone-captured visual assets of Mappi's rivers, offering a highly accessible and economically viable alternative to complex virtual reality that directly aligns with students' self-reported learning preferences (O'Donoghue, 2019); and (3) Conduct long-term longitudinal studies to monitor the sustainability of this culturally responsive pedagogy when these affirmative action PGSD students graduate and serve as primary school teachers in Mappi Regency, Papua (Ishep & Rizkil, 2025).

CONCLUSION

This Research and Development (R&D) study successfully addresses the primary initial learning needs of 53 Papuan students in the Primary School Teacher Education (PGSD) program at Universitas Negeri Jakarta (UNJ) from Mappi Regency, Papua, through the design and development of a Context-Based Science Learning Module on the topic "Characteristics of Living Things." In alignment with the ADDIE instructional model limited to the Development phase, the developed FlipHTML5 digital module demonstrates high quality, consistency, and structural alignment between the problem formulation, methodology, and results. This is evidenced by the average expert validation score of 92.0% (Highly Valid/Highly Feasible) from science content and learning media experts, as well as an exceptional average practicality score of 4.65 out of 5.00 (93.0% practicality) obtained during student readability testing. By integrating relevant Papuan local biota (such as sago trees, tree kangaroos, and swampland fish/gastor) and visual landscapes of Mappi as conceptual sociocultural anchors, this module serves as an effective cognitive-affective bridge that facilitates self-directed learning, reduces academic anxiety, and fosters sociocultural pride.

The primary theoretical contribution of this research lies in operationalizing culturally responsive, place-based science instruction at the teacher training college level (LPTK). Practically, this digital FlipHTML5 module provides an equitable, inclusive, and accessible learning resource that directly addresses the lack of relatability of general textbook examples for affirmative action students. From a policy perspective, the findings offer strategic recommendations for LPTK administrators to utilize growing student mobility as a valuable opportunity to develop more flexible and diverse curricula tailored to students' actual needs, thereby advancing the equitable and inclusive spirit of Kurikulum Merdeka. For future research,

it is suggested to develop similar place-based biology modules integrating other Papuan ecological contexts, integrate low-cost digital media such as localized ethnoscience documentary videos or digital storytelling that combines customary elders' narratives with realistic smartphone-captured visual assets, and conduct long-term longitudinal studies to monitor the sustainability of this culturally responsive pedagogy when these affirmative action students graduate and serve as primary school teachers in Mappi Regency, Papua.

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AUTHOR CONTRIBUTION STATEMENT

All authors contributed actively to the preparation of this manuscript. The first author was responsible for the research design, inventory of Mappi local wisdom, module draft writing, data collection via Google Forms, and initial manuscript drafting. The second author was responsible for methodological supervision, expert validation, quantitative and qualitative data analysis, as well as critical review and editing of the final manuscript. All authors have read and approved the final manuscript.

AI DISCLOSURE STATEMENT

During the preparation and refinement of this manuscript, the authors utilized Gemini Notebook (NotebookLM), an artificial intelligence (AI) based tool, for the sole purposes of language editing, improving sentence structure flow, ensuring culturally responsive and academic tone readability, and assisting with the translation of the manuscript from Indonesian to English. All outputs generated by the AI tool were thoroughly reviewed, critically revised, and edited in depth by the authors. The authors retain full responsibility for the authenticity, scientific accuracy, academic integrity, and overall content of this publication.

REFERENCES

Bennett, J., & Lubben, F. (2006). Context-Based Chemistry: The Salters Approach. *International Journal of Science Education*, 28(9), 999-1015. https://doi.org/10.1080/09500690600702496

Bennett, J., Lubben, F., & Hogarth, S. (2007). Bringing Science to Life: A Synthesis of the Research Evidence on the Effects of Context-Based and STS Approaches to Science Teaching. *Science Education*, 91(3), 347-370. https://doi.org/10.1002/sce.20186

Broman, K., Bernholt, S., & Christensson, C. (2022). Relevant or Interesting According to Upper Secondary Students? Affective Aspects of Context-Based Chemistry Problems. *Research in Science & Technological Education*, 40(4), 478-498. https://doi.org/10.1080/02635143.2020.1824177

Florian, L., & Spratt, J. (2013). Enacting Inclusion: A Framework for Interrogating Inclusive Practice. *European Journal of Special Needs Education*, 28(2), 119-135. https://doi.org/10.1080/08856257.2013.778111

Giamellaro, M. (2014). Primary Contextualization of Science Learning Through Immersion in Content-Rich Settings. *International Journal of Science Education*, 36(17), 2848-2871. https://doi.org/10.1080/09500693.2014.937787

Giamellaro, M., Buxton, C., Taylor, J., Ayotte-Beaudet, J.-P., L'Heureux, K., & Beaudry, M.-C. (2025). The Landscape of Research on Contextualized Science Learning: A Bibliometric Network Review. *Science Education*, 109(3), 1097-1130. https://doi.org/10.1002/sce.21937

Hüfner, S., Weirauch, K., List, F., Menthe, J., & Abels, S. (2025). Context-Based Science Education to Promote Diversity-Equity-Inclusion – A Systematic Literature Review on the Understanding of Context in Science Education. *Studies in Science Education*, 62(2), 283-323. https://doi.org/10.1080/03057267.2025.2563946

Ishep, I., & Rizkil, T. (2025). Integration of Local Wisdom in Science Learning to Improve Science Literacy of Junior High School Students. *Journal of Science Education and Environmental Literacy Global*, 1(1), 1-7. https://doi.org/10.55681/jseelg.v1i1.17

Lestari, I. G. A. M., Sudiatmika, A. A. I. A. R., & Suarjana, I. M. (2020). Validation of Environment-Based Science Module and Local Wisdom on Digestive System Materials. *Journal of Science Education and Learning*, 4(2), 134-143.

O'Donoghue, J. (2019). Simplified low-cost colorimetry for education and public engagement. *Journal of Chemical Education*, 96(6), 1136-1142. https://doi.org/10.1021/acs.jchemed.9b00301

Onwu, G. O. M., & Mufundirwa, C. (2020). A Two-Eyed Seeing Context-Based Approach for Incorporating Indigenous Knowledge into School Science Teaching. *African Journal of Research in Mathematics, Science & Technology Education*, 24(2), 229-240. https://doi.org/10.1080/18117295.2020.1816700

Pekrun, R. (2006). The Control-Value Theory of Achievement Emotions: Assumptions, Corollaries, and Implications for Educational Research and Practice. *Educational Psychology Review*, 18(4), 315-341. https://doi.org/10.1007/s10648-006-9029-9

Rahmawati, R., & Azizah, N. (2021). Evaluation of Contextual Science Learning Based on Local Wisdom Using Literacy Tests and Student Response Questionnaires. *Journal of Educational Evaluation*, 12(2), 88-97.

Sari, D. P., Nurhayati, N., & Widodo, H. (2021). Development of Local Wisdom-Based Science Modules with ADDIE Model to Improve Students' Science Literacy. *Indonesian Journal of Science Education*, 9(2), 189–198.

van Vorst, H., & Aydogmus, H. (2021). One Context Fits All? - Analysing Students' Context Choice and Their Reasons for Choosing a Context-Based Task in Chemistry Education. *International Journal of Science Education*, 43(8), 1250-1272. https://doi.org/10.1080/09500693.2021.1908640

Windschitl, M., Thompson, J. J., & Braaten, M. L. (2018). *Ambitious Science Teaching*. Harvard Education Press.