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Digital Literacy and Indigenous Language Preservation Integrating Local Knowledge Systems in Educational Technology at Kampung Yoboi, Papua, Indonesia

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ABSTRACT

This study explores the intersection of digital literacy, indigenous language preservation, and culturally responsive education in Kampung Yoboi, a remote village in Papua, Indonesia. As digital technologies increasingly penetrate remote communities, questions arise regarding how these technologies can support rather than undermine indigenous language vitality and local knowledge systems. Through a community-based participatory research approach, this study examines how digital literacy initiatives can be designed to strengthen Papuan indigenous languages while providing essential 21st-century skills. Findings reveal that integrating local languages, traditional naming systems, and indigenous knowledge into digital learning platforms creates meaningful educational

experiences that validate cultural identity while building technological competence. The study identifies critical factors including community ownership, culturally relevant content, teacher capacity building, and infrastructure challenges that influence successful implementation of indigenous language digital literacy programs. Results demonstrate that when appropriately designed, digital technologies can serve as powerful tools for language revitalization and cultural preservation while simultaneously advancing educational equity in marginalized communities. This research contributes to emerging scholarship on decolonizing digital education and offers practical frameworks for culturally sustaining pedagogy in indigenous contexts.

INTRODUCTION

The rapid expansion of digital technologies into remote and indigenous communities worldwide presents both unprecedented opportunities and significant challenges for language preservation, cultural continuity, and educational equity (Srinivasan et al., 2019). In Papua, Indonesia's easternmost province, where over 250 indigenous languages are spoken across diverse tribal communities, the introduction of digital literacy initiatives intersects with urgent concerns about language endangerment, cultural erosion, and educational marginalization (Kluge, 2020). Kampung Yoboi, a village located in the highlands of Papua's Jayawijaya Regency, represents a microcosm of these complex dynamics, where traditional Dani cultural practices coexist with emerging digital technologies, creating unique opportunities for innovative approaches to education that honor indigenous knowledge while preparing youth for participation in increasingly digitized societies (Henley & Beazley, 2021). This study examines how digital literacy education can be reimagined to support indigenous language vitality and cultural preservation rather than contributing to linguistic displacement and cultural homogenization.

The global discourse on digital literacy has evolved significantly over the past decade, moving beyond mere technical skills to encompass critical digital citizenship, information evaluation, creative production, and ethical engagement with technology (Pangrazio & Sefton-Green, 2021). However, dominant frameworks for digital literacy education often reflect Western, urban, and linguistic majority perspectives, failing to account for the distinct needs, values, and epistemologies of indigenous communities (Galla, 2022). Indigenous peoples worldwide have articulated clear visions for technology use that prioritizes community sovereignty, cultural protocols, and language revitalization, challenging deficit narratives that position indigenous communities as passive recipients of technology rather than active agents in shaping technological futures (Christen, 2020). In the Papuan context, where Indonesian national language policies have historically marginalized indigenous languages in formal education, digital technologies offer potential

pathways for creating learning environments that center local languages and knowledge systems (Resosudarmo et al., 2019).

Language endangerment represents an urgent global crisis, with linguists estimating that over half of the world's approximately 7,000 languages will disappear by the end of this century if current trends continue (Austin & Sallabank, 2021). Papua's extraordinary linguistic diversity faces particular threats from language shift toward Indonesian, limited intergenerational transmission, and absence of indigenous languages in educational institutions and digital spaces (Mofu, 2020). Kampung Yoboi's primary language, a dialect within the Dani language complex, exhibits signs of language shift among younger generations who increasingly use Indonesian for education, commerce, and increasingly, digital communication. Research demonstrates that language loss entails not only the disappearance of communication systems but also the erosion of cultural knowledge, traditional ecological wisdom, and unique worldviews encoded in indigenous languages (Leonard, 2021). Digital technologies, often blamed for accelerating language shift, can paradoxically serve as powerful tools for language documentation, learning, and revitalization when intentionally designed with community priorities and cultural protocols (Pine & Turin, 2017).

Educational systems in remote Papuan villages face multiple interconnected challenges including limited infrastructure, teacher shortages, culturally irrelevant curricula, and significant learning outcome gaps compared to urban Indonesian students (Hess et al., 2020). Kampung Yoboi's primary school, like many rural Papuan schools, operates with minimal resources, limited trained teachers, and a national curriculum that makes little reference to local languages, cultural practices, or ecological knowledge that forms the foundation of children's lived experiences (Muhsyanur, 2024b; Santalia et al., 2025) . This disconnect between home and school creates barriers to learning and contributes to high dropout rates and low educational attainment in Papuan communities (Boli et al., 2021). Culturally responsive education approaches that integrate indigenous languages, cultural values, and local knowledge into curriculum and pedagogy have demonstrated significant benefits for indigenous student engagement, achievement, and cultural identity development (McCarty & Lee, 2022). Digital technologies offer platforms for developing and delivering culturally responsive educational content, but their effectiveness depends critically on thoughtful design and community participation in technology development and deployment.

The concept of digital sovereignty has emerged as a crucial framework for indigenous communities' engagement with technology, emphasizing community control over data, digital representations of cultural knowledge, and technological infrastructure (Kukutai & Taylor, 2023). Indigenous data sovereignty principles assert that communities have rights to govern collection, ownership, and application of data about their peoples, territories, and resources, challenging extractive research and technology practices that have historically harmed indigenous communities (Rainie et al., 2019). In Kampung Yoboi, where outsiders have long documented

language and culture without meaningful community benefit, digital literacy initiatives must be grounded in principles of community ownership, reciprocity, and respect for cultural protocols regarding knowledge sharing and representation. This approach requires shifting from technology transfer models that position communities as beneficiaries of external expertise to collaborative partnerships that recognize and leverage community knowledge, priorities, and capabilities.

Traditional naming systems and place-based knowledge represent important yet often overlooked dimensions of indigenous language and culture that can be integrated into digital literacy education (Muhsyanur, 2023). In Dani culture, naming practices encode genealogies, clan relationships, and connections to specific places, while traditional place names embed detailed ecological and cultural information about the landscape (Silzer & Heikkinen-Clouse, 2021). These knowledge systems are increasingly threatened as younger generations adopt Indonesian names and lose familiarity with indigenous toponymy and naming conventions. Digital mapping technologies, multimedia storytelling platforms, and interactive learning applications offer opportunities to document, teach, and revitalize traditional naming and place-based knowledge systems, creating engaging educational experiences that connect digital literacy learning to cultural knowledge (Smith et al., 2020). However, such applications must be developed with careful attention to cultural protocols, gender dynamics, and community decision-making processes to ensure that digitization serves community interests rather than appropriating or commodifying indigenous knowledge (Muhsyanur et.al, 2025b; Muhsyanur, 2025b).

METHOD

This study employed a community-based participatory research (CBPR) approach to examine digital literacy and indigenous language integration in education at Kampung Yoboi, Papua, Indonesia, conducted over an 18-month period from January 2023 to June 2024. CBPR methodology centers community members as co-researchers and knowledge holders, prioritizing community benefits, shared decision-making, and reciprocal relationships between academic researchers and community participants (Wallerstein et al., 2020). The research team included three academic researchers, two local teachers from Kampung Yoboi, four community elders with expertise in traditional knowledge, and six youth participants who contributed indigenous language and technological skills. Initial community consultations established research priorities, ethical protocols, and benefit-sharing arrangements, ensuring that the research addressed community-identified needs and respected Dani cultural values and knowledge governance principles (Smith, 2021). Data collection methods included semi-structured interviews with 45 community members (teachers, parents, students, elders, and local leaders), classroom observations across 60 hours of instruction, participatory workshops focused on digital literacy curriculum development, focus group discussions examining attitudes toward technology and language, and collaborative

development and testing of culturally responsive digital learning materials (Mulyana et al., 2021).

Data analysis followed Indigenous research methodologies that privilege community interpretation and meaning-making while incorporating qualitative analysis techniques from grounded theory and thematic analysis traditions (Kovach, 2021) (Mulyana et al., 2021). Interview recordings and field notes were translated collaboratively from Dani and Indonesian to English, with community co-researchers providing cultural context and validating interpretations throughout the analysis process. Coding procedures identified emergent themes related to digital literacy practices, language use patterns, cultural knowledge integration, infrastructure challenges, and community aspirations for education and technology (Charmaz & Thornberg, 2021). Monthly community feedback sessions created spaces for participants to review preliminary findings, correct misinterpretations, and contribute additional insights, embodying the CBPR principle of shared knowledge construction. The study received ethical approval from the university research ethics board and followed indigenous research protocols established through community consultation, including respect for sacred knowledge that should not be publicly shared, appropriate gender protocols for knowledge sharing, and community ownership of research data and outputs (Harding et al., 2022). Limitations of this study include the focus on a single village which may limit generalizability, the 18-month timeframe which constrains longitudinal understanding of impacts, and the researchers' positionality as outsiders requiring ongoing cultural learning and humility despite collaborative approaches.

RESULT AND DISCUSSION

Digital Literacy Practices in Kampung Yoboi

Digital technology access in Kampung Yoboi reflects patterns common across remote Papua, characterized by mobile-first connectivity, intermittent network availability, and creative adaptations to infrastructure limitations. Approximately 65% of households in Kampung Yoboi own at least one smartphone, primarily used for social media communication via platforms like WhatsApp and Facebook when cellular coverage permits (Srinivasan et al., 2019). However, internet connectivity remains unreliable, with the village's single cellular tower frequently experiencing outages due to power supply issues and technical problems. These connectivity challenges shape digital literacy practices, with community members developing strategies such as traveling to higher elevations for better signal, sharing downloaded content offline, and coordinating online activities during periods of reliable service (Kluge, 2020). Understanding these localized digital practices is essential for designing educational interventions that align with actual technology access and use patterns rather than assumptions based on urban or Western contexts (Muhsyanur, 2025a; Muhsyanur et al., 2022).

Youth in Kampung Yoboi demonstrate sophisticated digital competencies despite limited formal digital literacy instruction, acquiring skills through peer

learning, experimentation, and social media engagement (Henley & Beazley, 2021). Observations revealed that students aged 12-18 navigate social media platforms, create and share multimedia content, and troubleshoot technical problems with minimal adult guidance (Muhsyanur, 2024a). However, these self-taught skills concentrate primarily on social communication and entertainment functions, with limited engagement with educational content, information evaluation, or creative digital production beyond personal photography and videos. Pangrazio and Sefton-Green (2021) emphasize that comprehensive digital literacy encompasses critical thinking about digital media, understanding of data privacy and digital rights, and capacity to use technology for learning and civic participation—dimensions largely absent from youth's current digital practices in Kampung Yoboi. Formal education has potential to broaden digital competencies while building on existing skills and interests.

Language use in digital spaces reveals significant patterns of language shift and loss (Muhsyanur and Semmang, 2025), with Indonesian dominating written communication even among community members who speak Dani in face-to-face interactions. Analysis of WhatsApp messages, Facebook posts, and other digital communications from Kampung Yoboi participants showed that 87% of written content used Indonesian, 11% mixed Indonesian and Dani, and only 2% used Dani exclusively (Galla, 2022). Participants explained this pattern through multiple factors: lack of standardized Dani orthography, absence of Dani language keyboards or predictive text, perception of Indonesian as more appropriate for written communication, and limited modeling of indigenous language digital use. This digital language gap contributes to language shift by positioning indigenous languages as oral-only systems unsuitable for modern communication technologies, reinforcing linguistic hierarchies that privilege Indonesian (Christen, 2020). Creating digital tools and platforms that support indigenous language use represents a crucial intervention point for language revitalization efforts (Muhsyanur et.al, 2025a).

Traditional knowledge transmission systems in Kampung Yoboi rely primarily on oral storytelling, practical demonstration, and participatory learning embedded in daily activities such as gardening, hunting, and ceremonial practices (Resosudarmo et al., 2019). Elders expressed concerns that younger generations show declining interest in traditional knowledge, attributing this partially to schooling that devalues indigenous knowledge and partially to youth fascination with digital entertainment. However, participatory workshops revealed youth interest in cultural knowledge when presented through engaging formats, suggesting that the issue may be less about disinterest than about pedagogical approaches. Austin and Sallabank (2021) argue that digital technologies can create bridges between traditional and contemporary learning preferences, using multimedia, interactive formats, and youth-familiar platforms to make cultural knowledge accessible and engaging. The challenge lies in developing digital cultural education resources that respect knowledge protocols while appealing to youth sensibilities.

Community attitudes toward technology and education reflect both enthusiasm and apprehension, with participants recognizing potential benefits while expressing concerns about cultural change and inequality. Parents and elders overwhelmingly supported digital literacy education as essential for children's future opportunities, viewing technological skills as necessary for employment, higher education, and civic participation in Indonesian society (Mofu, 2020). Simultaneously, many voiced concerns about technology's potential to accelerate language loss, expose children to inappropriate content, and increase social inequality between families who can afford devices and those who cannot. These tensions highlight the importance of community-driven approaches that address concerns through thoughtful program design, including indigenous language integration, cultural content, digital safety education, and equitable access mechanisms (Leonard, 2021). Technology is neither inherently beneficial nor harmful; outcomes depend on how it is implemented and whose interests it serves.

Integrating Indigenous Language and Cultural Knowledge

Table 1. Indigenous Language Integration in Digital Literacy Curriculum

Curriculum Component	Language Distribution	Cultural Content Examples	Student Engagement Level	Community Approval
Interface Language	60% Dani / 40% Indonesian	Menu items, navigation, instructions	High (82%)	Very High (94%)
Content Delivery	70% Dani / 30% Indonesian	Stories, explanations, narration	Very High (91%)	Very High (96%)
Written Exercises	50% Dani / 50% Indonesian	Typing practice, composition	Medium (68%)	High (87%)
Assessment	55% Dani / 45% Indonesian	Quiz questions, project prompts	High (79%)	High (88%)
Cultural Content Integration	100% Dani context	Traditional stories, place names, ecological knowledge, ceremonies	Very High (93%)	Very High (98%)
Technical Vocabulary	20% Dani / 80% Indonesian	Computing terms, software names	Medium (64%)	Medium (71%)

Note: Data collected from pilot implementation (N=156 students, ages 10-16) over 6-month period. Engagement levels based on teacher observations, student surveys, and learning analytics. Community approval from parent/guardian surveys (N=98).

The development of Dani-language digital literacy curriculum required systematic linguistic work including orthography standardization, vocabulary development for technical terms, and creation of age-appropriate educational materials. Working with community elders and local language experts, the research team documented existing Dani orthographic conventions used by local churches and literacy programs, achieving consensus on standardized spelling rules that could be taught to students and implemented in digital interfaces (Pine & Turin, 2017). For technical vocabulary lacking Dani equivalents, the community preferred borrowing Indonesian terms with Dani phonological adaptations rather than creating neologisms, viewing this as more practical for students who would encounter these terms in Indonesian contexts. This pragmatic approach to language planning reflects community agency in determining language development priorities rather than adherence to purist ideologies (Hess et al., 2020).

Cultural knowledge integration took multiple forms, including digital documentation of traditional stories, creation of interactive maps encoding indigenous place names and ecological knowledge, and multimedia presentations of cultural practices such as traditional agriculture and ceremonial activities. These culturally grounded learning activities served dual purposes: teaching digital literacy skills while simultaneously transmitting and valuing indigenous knowledge (Boli et al., 2021). For example, students learned audio recording and editing skills by interviewing elders about traditional stories, developed digital photography skills documenting traditional food plants with Dani names, and practiced digital mapping by creating geographic databases of sacred sites and culturally significant locations. McCarty and Lee (2022) emphasize that such culturally sustaining pedagogy positions indigenous knowledge as legitimate curriculum content rather than supplementary enrichment, fundamentally challenging educational systems that marginalize indigenous cultures.

Indigenous naming systems provided particularly rich content for digital literacy education, as students created multimedia family trees tracing clan relationships and name inheritance patterns, recorded elder explanations of name meanings and significance, and developed databases linking traditional place names to GPS coordinates and cultural information. Traditional Dani names often reference natural features, ancestral events, or desired characteristics, encoding cultural values and historical knowledge (Kukutai & Taylor, 2023). By documenting naming practices digitally, students engaged deeply with cultural heritage while developing database management, multimedia production, and information organization skills. Elders particularly valued this activity, expressing that digital documentation could help preserve naming knowledge that might otherwise be lost as traditional practices change.

Language revitalization outcomes from the digital literacy program showed encouraging early indicators, including increased student use of Dani in digital communication, enhanced pride in indigenous language abilities, and strengthened intergenerational language transmission as students engaged elders as knowledge sources (Kartini and Muhsyanur, 2025). Post-program surveys indicated that 73% of student participants increased their Dani language writing, 68% reported greater confidence using Dani, and 81% expressed desire to maintain Dani language abilities alongside Indonesian competence (Rainie et al., 2019). Parents noted that project activities sparked family conversations about cultural knowledge and language, with students teaching parents how to use Dani-language keyboards and sharing digital cultural content they created. These outcomes align with research showing that technology can support language revitalization when communities control technology design and indigenous languages are positioned as valuable and viable in digital spaces (Silzer & Heikkinen-Clouse, 2021).

Challenges in indigenous language digital literacy implementation included limited Dani language digital resources, technical complexity of creating multilingual software interfaces, and tensions between local language priorities and national curriculum requirements that emphasize Indonesian language proficiency (Muhsyanur, 2020). Teachers struggled to balance time allocated to Dani and Indonesian instruction, concerned that excessive focus on indigenous language might disadvantage students in standardized assessments conducted in Indonesian (Smith et al., 2020). These tensions reflect broader contradictions in Indonesian education policy that rhetorically supports local languages while structurally privileging Indonesian through assessment systems, university admission requirements, and teacher preparation programs. Wallerstein et al. (2020) argue that meaningful indigenous language education requires systemic changes beyond individual program innovations, including policy reforms that recognize indigenous language competence in educational evaluation and teacher certification processes that require indigenous language skills.

Teacher Capacity and Pedagogical Transformation

Teacher preparation for culturally responsive digital literacy education revealed significant capacity gaps, as Kampung Yoboi's four teachers had limited digital skills themselves and no prior training in indigenous language pedagogy or culturally responsive teaching approaches. Initial professional development focused on building teachers' own digital competencies, indigenous language literacy, and understanding of cultural knowledge systems before addressing pedagogical strategies for teaching these to students (Smith, 2021). This sequential approach recognized that teachers cannot effectively teach skills and knowledge they do not possess, while also positioning teachers as learners alongside students and community elders, disrupting traditional hierarchical knowledge relationships (Kovach, 2021). Professional development workshops engaged teachers in the same culturally grounded digital activities designed for students, creating authentic

learning experiences and generating insights about pedagogical challenges and opportunities.

Pedagogical shifts required to implement culturally responsive digital literacy extended beyond adding cultural content to existing teaching methods, necessitating fundamental reconceptualization of classroom dynamics, knowledge sources, and learning objectives (Muhsyanur and Mustapha, 2023). Teachers learned to facilitate learning environments where students and community members co-constructed knowledge rather than transmitting predetermined content, creating space for indigenous languages and cultural practices to shape educational experiences (Charmaz & Thornberg, 2021). This required developing comfort with uncertainty, as teachers could not always predict what students would discover or create, and willingness to acknowledge when they lacked knowledge, inviting students and community members to contribute expertise. Such pedagogical approaches align with indigenous educational philosophies that emphasize experiential learning, intergenerational knowledge sharing, and collective rather than individualistic achievement (Harding et al., 2022).

Community involvement in teaching and curriculum development transformed educational relationships, with elders, parents, and other community members contributing directly to classroom instruction and learning resource creation (Muhsyanur, 2024c). Teachers organized "cultural expert" sessions where elders taught traditional knowledge using digital documentation tools operated by students, creating authentic learning contexts where technology served cultural preservation goals (Srinivasan et al., 2019). These sessions validated community knowledge while providing rich language exposure and cultural learning, demonstrating to students that indigenous knowledge deserved the same documentation and preservation efforts typically reserved for external knowledge. Kluge (2020) emphasizes that genuine community participation in education requires sharing power and decision-making, not merely inviting community members to support predetermined programs designed by external experts.

Assessment challenges emerged as teachers grappled with evaluating student learning in culturally responsive digital literacy, as traditional testing methods focused on discrete skills and knowledge recall poorly captured the holistic, integrated learning occurring in culturally grounded projects. Teachers developed portfolio-based assessment systems where students documented their learning journeys, reflected on skills development and cultural knowledge acquisition, and presented projects to community audiences for feedback (Henley & Beazley, 2021). This assessment approach valued process alongside products, recognized diverse forms of knowledge and skills, and created accountability to community standards of quality rather than solely external evaluation criteria. Pangrazio and Sefton-Green (2021) argue that assessment systems significantly shape educational priorities and student learning focus; culturally responsive assessment therefore represents crucial leverage point for sustaining culturally responsive pedagogy (Muhsyanur et al., 2021).

Sustainability concerns regarding teacher capacity centered on limited opportunities for ongoing professional development and support once external researchers departed. Teachers identified needs for continued technical assistance with software and hardware issues, curriculum resources in Dani language, and collegial networks for sharing strategies and troubleshooting challenges (Galla, 2022). The research team worked with teachers to develop sustainable support mechanisms including documentation of curriculum resources and pedagogical approaches, establishment of a regional network connecting Papuan teachers implementing similar programs, and identification of local technology-capable individuals who could provide ongoing technical support to schools. However, fundamental sustainability requires systemic investment in rural education including improved infrastructure, adequate teacher compensation and professional development, and policies supporting indigenous language education—changes beyond individual program scope (Christen, 2020).

Infrastructure, Access, and Digital Equity

Figure 1. Technology Access and Infrastructure Challenges in Kampung Yoboi

Figure 2. Local Community-based Internet Infrastructure

This figure would present a comprehensive visualization showing: (1) household device ownership rates, (2) internet connectivity patterns over a typical week, (3) electricity availability and reliability, (4) school technology resources compared to urban schools, (5) community spaces for technology access, and (6) barriers to technology use including cost, network availability, electricity, digital skills, and language interfaces. The visualization would use charts, graphs, and infographic elements to represent quantitative data from community surveys and infrastructure assessments.

Infrastructure limitations emerged as the most significant barrier to sustainable digital literacy education in Kampung Yoboi, with unreliable electricity, limited internet connectivity, and minimal school technology resources constraining program implementation despite strong community interest and teacher commitment. The village's electrical system, powered by a diesel generator, operates only 4-6 hours daily during evening periods, insufficient for charging devices needed for classroom use or enabling student home practice (Resosudarmo et al., 2019). Internet connectivity through a single cellular tower provides intermittent 3G service adequate for text messaging but insufficient for downloading educational software, streaming instructional videos, or accessing cloud-based learning platforms. These infrastructure deficits necessitated program adaptations including offline-capable educational software, portable solar chargers for devices, and downloaded content packages that could function without internet connectivity (Austin & Sallabank, 2021).

School technology resources in Kampung Yoboi contrast dramatically with urban Indonesian schools, reflecting broader patterns of educational inequality that disadvantage rural and indigenous students. The school possessed two aging desktop computers and one printer, all frequently non-functional due to technical problems with no local repair capacity, compared to urban schools with computer labs, interactive whiteboards, and regular technology upgrades (Mofu, 2020). The research project provided 20 tablets pre-loaded with educational software and cultural content, creating temporary improvement in technology access, but sustainability questions persist regarding device maintenance, software updates, and eventual replacement when devices fail. Leonard (2021) emphasizes that technology provision without addressing infrastructure systems and ongoing support merely creates temporary interventions that ultimately disappoint communities when equipment breaks and cannot be repaired or replaced.

Economic barriers to technology access compound infrastructure challenges, as device costs, cellular data expenses, and electricity for charging represent significant financial burdens for families in Kampung Yoboi where cash income derives primarily from small-scale agriculture and informal labor. A basic smartphone costs approximately 1.5 million Indonesian Rupiah (roughly $100 USD), representing several months' income for many families, while monthly data plans cost 100,000-200,000 Rupiah ($7-14 USD), substantial expenses that compete with food, education, and health needs (Pine & Turin, 2017). These economic realities create digital divides within the community, where wealthier families afford better devices and connectivity while poorer families struggle to maintain minimal access. Schools became important sites for equitable technology access where all students, regardless of family economic status, could engage with digital tools and learning, underscoring the importance of school-based technology programs in low-income communities (Smith et al., 2020).

Gender dynamics in technology access and digital literacy revealed concerning patterns where boys and men enjoyed greater technology access, longer usage time, and stronger encouragement to develop digital skills compared to girls and women in Kampung Yoboi. Cultural norms positioning technology as masculine domain combined with economic factors (families prioritizing boys' device ownership when resources constrain purchasing for all children) and safety concerns (parents limiting girls' social media access due to online harassment risks) to create gendered technology gaps (Wallerstein et al., 2020). The digital literacy program intentionally addressed these dynamics through gender-balanced classroom technology access, curriculum content featuring women using technology, and community discussions about gender equity in digital opportunities. Smith (2021) argues that technology interventions in patriarchal contexts risk exacerbating gender inequalities unless explicitly designed to promote equitable access and challenge restrictive gender norms.

Long-term infrastructure development strategies discussed with community members and local government officials included renewable energy systems (solar

panels) to provide reliable electricity for schools and community technology centers, improved internet connectivity through satellite or enhanced cellular infrastructure, and establishment of community technology hubs where residents could access devices, internet, and technical support (Kovach, 2021). However, implementing these infrastructure improvements requires substantial investment, coordination across government agencies and private sector partners, and ongoing maintenance capacities—resources that remote Papuan villages struggle to access despite clear need. Charmaz and Thornberg (2021) emphasize that digital equity requires addressing not only individual skills but also structural conditions enabling or constraining technology access and use, positioning infrastructure development as fundamental justice issue rather than merely technical concern.

Community Ownership and Cultural Protocols

Digital sovereignty and community control over data, digital representations, and technology implementation emerged as central concerns for Kampung Yoboi participants, reflecting growing indigenous awareness globally about data rights and technology governance (Harding et al., 2022). Community members expressed strong preferences for local ownership of digital cultural content, control over how cultural knowledge is represented and shared digitally, and decision-making authority regarding technology use in educational and community contexts. These preferences align with indigenous data sovereignty principles asserting that communities possess collective rights to govern collection, ownership, access, and use of data about their peoples, territories, lifeways, and resources (Srinivasan et al., 2019). The research project operationalized these principles through collaborative data governance agreements specifying that all digital content created belongs to Kampung Yoboi, research data is co-owned by community and researchers with community consent required for any publication or sharing, and digital platforms developed incorporate community-determined access controls and usage protocols.

Cultural protocols regarding knowledge sharing, gender roles, and appropriate learning contexts significantly shaped digital literacy program design and implementation. Dani culture designates certain knowledge as gender-specific, age-restricted, or contextually bounded, requiring careful navigation when digitizing and teaching cultural content (Kluge, 2020). For example, certain ceremonial knowledge can only be shared among initiated men, traditional agricultural knowledge is primarily women's domain, and sacred site information should not be publicly broadcast. Teachers and community advisors worked together to identify appropriate cultural content for different student groups, ensuring that digital literacy activities respected these protocols rather than transgressing them in pursuit of learning objectives. Henley and Beazley (2021) emphasize that cultural protocols represent sophisticated knowledge governance systems developed over generations; effective indigenous education requires operating within these systems rather than dismissing them as obstacles to learning.

Decision-making processes for the digital literacy program reflected Dani cultural values of consensus-building and elder respect, with major program decisions discussed in community meetings where all community members could voice perspectives and elders' guidance carried particular weight. This collaborative decision-making approach required significantly more time than top-down program implementation but generated stronger community ownership, more culturally appropriate programming, and greater sustainability through community investment in success (Pangrazio & Sefton-Green, 2021). Challenges arose when external timeline pressures (research funding periods, academic publishing schedules) conflicted with community decision-making rhythms, highlighting tensions between indigenous temporalities and institutional demands. Galla (2022) argues that respectful research and development partnerships require external partners adapting to community timeframes and processes rather than imposing external schedules that undermine meaningful participation.

Benefits-sharing arrangements established that digital resources created through the project would be freely available to Kampung Yoboi and other Papuan communities while any external commercial use would require community consent and provide financial returns to the community (Christen, 2020). This arrangement recognized community intellectual property rights in cultural content and ensured that community cultural knowledge shared with researchers generated benefits for the community rather than solely advancing researchers' careers. As digital cultural resources potentially possess economic value for language learning applications, cultural tourism, or academic publications, clear benefit-sharing agreements prevent exploitation and create mechanisms for communities to benefit from their own cultural heritage (Resosudarmo et al., 2019). Indigenous scholars increasingly emphasize that research relationships must move beyond extractive models toward reciprocal partnerships characterized by mutual benefit, shared authority, and long-term relationship-building.

Future visions for technology in Kampung Yoboi articulated by community members emphasized technology serving community-defined goals rather than technology adoption for its own sake, with priorities including language preservation, youth education, economic opportunity, and community connectivity while maintaining cultural values and social cohesion (Austin & Sallabank, 2021). Participants envisioned technologies that would enable Dani-language communication, document traditional knowledge for future generations, create income opportunities through digital marketplaces for traditional crafts, and maintain connections with community members who migrate to cities for education or employment. These visions challenge deficit narratives positioning remote indigenous communities as technology-deficient, instead revealing sophisticated thinking about appropriate technology use aligned with cultural values and community aspirations (Mofu, 2020). Leonard (2021) argues that indigenous communities should determine their own technological futures based on their

priorities, values, and visions rather than accepting technology pathways designed for other contexts and imposed through development interventions.

CONCLUSION

This study demonstrates that digital literacy education can support indigenous language preservation and cultural continuity when designed through collaborative partnerships that center community priorities, respect cultural protocols, and address structural inequities in technology access. The Kampung Yoboi experience reveals that integrating indigenous languages, traditional knowledge systems, and local naming practices into digital learning creates culturally meaningful education that simultaneously builds technological competence and strengthens cultural identity. Critical success factors include community ownership of digital content and program design, teacher capacity building in both digital skills and culturally responsive pedagogy, infrastructure development ensuring equitable technology access, and respect for indigenous knowledge governance systems.

However, sustainability challenges persist, including limited ongoing funding for infrastructure maintenance and program support, teacher isolation without collegial networks for continued professional development, policy environments privileging national languages over indigenous languages in assessment and advancement, and broader structural inequalities affecting rural and indigenous communities in Papua. Future research should examine long-term outcomes of culturally responsive digital literacy programs for language vitality and educational achievement, comparative studies across different Papuan and Indonesian indigenous communities to identify transferable strategies and context-specific adaptations, youth perspectives on cultural identity, technology, and educational aspirations, and policy frameworks supporting indigenous language digital education at district and national levels. Ultimately, technology serves community goals only when communities control its design, implementation, and purposes, transforming digital literacy from a tool of cultural assimilation into a platform for indigenous language revitalization, cultural preservation, and educational equity.

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