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Digital Divide and Learning Access for Papua Indigenous People: A Study at Secondary Schools in Sorong City

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ABSTRACT

This study investigates the digital divide and its consequences for learning access among Papua Indigenous People (Orang Asli Papua/OAP) students at secondary schools in Sorong City, West Papua Province, Indonesia. The digital divide refers to the gap between individuals who have effective access to digital technologies and those who do not, encompassing disparities in infrastructure, devices, skills, and meaningful use. Using a qualitative descriptive approach with in-depth interviews, observation, and documentation, this research examined the digital divide experience of OAP secondary school students, their teachers, and relevant education officials. Data were collected from 22 purposively selected informants across three state secondary schools with high OAP student enrollment in Sorong City. The findings reveal that OAP students face multidimensional digital exclusion: limited access to devices and internet connectivity at home, low digital literacy levels, a scarcity of culturally responsive digital learning content, and inadequate teacher capacity to facilitate technology-mediated learning. These barriers compound existing educational disadvantages and are widened during disruptions such as remote emergency learning. The study argues that the digital divide in OAP secondary education in Sorong City is not merely a technical or infrastructural problem but is deeply rooted in structural inequalities, historical marginalization, and cultural discontinuities between the state education system and OAP community life. Recommendations are offered for policy interventions to bridge the digital learning divide for OAP students through community-based digital access programs, culturally adapted digital content, and targeted teacher professional development

Keywords: digital divide, OAP education, Sorong City, learning access, indigenous students

INTRODUCTION

The rapid expansion of digital technology in education has fundamentally reshaped the landscape of teaching and learning around the world, including in Indonesia. Digital tools, online platforms, and internet connectivity have become increasingly integral to educational processes, from content delivery and student assessment to teacher professional development and school administration. However, the benefits of educational digitalization have not been distributed equally. The concept of the digital divide, first articulated in the policy literature of the 1990s, draws attention to the systematic gap between those who have effective access to and use of digital technologies and those who do not(Lundin & Kindström, 2023). In the educational context, the digital divide has significant consequences for learning equity, as students who lack access to digital tools and the skills to use them are increasingly disadvantaged compared to their better-connected peers (Aristovnik et al., 2026).

In Indonesia, the digital divide in education has emerged as a critical policy concern, particularly in the aftermath of the COVID-19 pandemic, which forced a sudden and widespread transition to remote and hybrid learning. This transition exposed and amplified existing digital inequalities, particularly for students in remote, rural, and marginalized communities. Among the most digitally excluded populations in Indonesia are the indigenous communities of Papua, particularly the Orang Asli Papua (OAP), who face compounding vulnerabilities related to infrastructure poverty, economic marginalization, geographic

isolation, and the cultural distance between their communities and the formal education system (Huber et al., 2021).

Sorong City, located in West Papua Province, represents a particularly significant case for examining the digital divide in OAP education. As the largest city in West Papua and a rapidly growing economic hub, Sorong presents a context in which digital infrastructure is nominally more available than in rural areas, yet the benefits of this infrastructure remain deeply unequally distributed. OAP students attending secondary schools in Sorong City exist at the intersection of urban modernity and indigenous marginalization: they are geographically proximate to digital resources but structurally distant from them (Pulkkinen et al., 2025).

Previous research on the digital divide in Indonesia has tended to focus on the rural-urban divide, the inter-regional infrastructure gap, or the socioeconomic determinants of digital access. Far less attention has been paid to the specific experience of indigenous students within urban settings, where the assumption of urban digital advantage obscures significant intra-urban inequalities. The OAP student population in Sorong City challenges this assumption, as their limited digital access and use persist despite their urban location, suggesting that the digital divide in this context is not simply a matter of infrastructure but involves cultural, linguistic, economic, and structural dimensions that require dedicated investigation (Baho et al., 2025).

This study seeks to fill this gap by providing an empirically grounded analysis of the digital divide and its effects on learning access for OAP students at secondary schools in Sorong City. The research addresses three guiding questions: What is the nature and scope of the digital divide experienced by OAP secondary school students in Sorong City? How does this digital divide affect their access to and quality of learning? What factors, at the individual, household, school, and policy levels, drive or sustain this digital divide? By addressing these questions, the study aims to contribute to a more nuanced and contextually grounded understanding of educational digital inequality in indigenous urban communities, and to offer evidence-based recommendations for policy and practice.

The urgency of this research is also underlined by Indonesia's national commitment, expressed in the Special Autonomy Law for Papua and the Papua Development Acceleration Plan (RPJMD Papua), to improving educational outcomes for OAP communities. In an era in which digital competency is increasingly linked to economic participation, civic engagement, and lifelong learning, the persistence of a digital divide in OAP education represents not only an educational equity challenge but a broader threat to the meaningful inclusion of OAP youth in Indonesian social and economic life. Understanding the dimensions and drivers of this divide is a necessary first step toward addressing it effectively.

The literature on digital divide theory has evolved significantly from its initial conceptualization as a binary between those with and those without computer access(Pásztor & Bak, 2020), toward a more nuanced, multi-dimensional framework that encompasses access, skills, motivation, and quality of use (Kovač et al., 2026; Q. Li et al., 2025; Mubarak & Suomi, 2022). This progression is significant for the OAP case, as it suggests that simply providing devices or internet connectivity will not be sufficient to close the digital learning gap; meaningful digital inclusion requires addressing the full spectrum of barriers that prevent equitable participation in digital learning environments. The intersection of the digital divide with indigenous education contexts adds a further layer of complexity, as cultural and linguistic factors shape both the willingness and the ability of indigenous students to engage with mainstream digital learning platforms(Khowaja et al., 2026).

METHODS

This study employed a qualitative descriptive research design, which is appropriate for exploring the complex, multi-dimensional, and context-dependent phenomenon of the digital divide in OAP education. Qualitative inquiry enables the researcher to capture the subjective experiences, meanings, and interpretations of participants in ways that quantitative instruments cannot, and descriptive orientation ensures that findings are grounded in the empirical realities of the research setting.

The research was conducted in Sorong City, West Papua Province, Indonesia, at three state secondary schools with the highest proportions of OAP student enrollment: SMAN 1 Sorong, SMAN 4 Sorong, and SMKN 2 Sorong. These schools were selected through purposive sampling as sites that would yield information-rich data on the experience of digital divide among OAP students. The profile of each school is presented in Table 2.

Table 2. Profile of Research Schools in Sorong City

School	Total Students	OAP Students (%)	Internet Lab Available
SMAN 1 Sorong	842	34%	Yes (limited)
SMAN 4 Sorong	617	52%	Yes (limited)
SMKN 2 Sorong	728	48%	Yes

Source: Sorong City Education Office, 2026

A total of 22 informants participated in the study, selected through purposive and snowball sampling. Informants comprised: eight OAP secondary school students from the three research schools; five parents or guardians of OAP students; five classroom teachers responsible for subjects that regularly incorporate digital tools; two school principals; and two officials from the Sorong City Education Office with responsibility for digital learning programs. This diverse informant composition ensures that the digital divide is examined from multiple perspectives across the educational ecosystem.

Data were collected through three complementary techniques. In-depth semi-structured interviews were conducted individually with all 22 informants, each lasting between 40 and 75 minutes. Interview guides were structured around the four dimensions of digital divide: access to devices, internet connectivity, digital literacy, and quality of use, as informed by Zhang et al., (2025) resources and appropriation model. Non-participant observation was carried out at each research school during technology-integrated lessons, allowing the researcher to observe how digital tools were used in practice and how OAP students engaged with or were excluded from digital learning activities. Document analysis was conducted on school digital infrastructure inventories, student achievement records, and relevant policy documents from the Education Office.

Data were analyzed using thematic analysis, with themes constructed both deductively from the digital divided framework and inductively from the data. Triangulation across data sources enhanced the credibility and validity of findings. Ethical protocols included informed consent from all participants, parental consent for student participants under 18, assurances of anonymity, and adherence to cultural respect norms in engagement with OAP participants and their communities.

RESULT AND DISCUSSION

Results

The findings of this study are organized around the four dimensions of the digital divide framework: access to devices, internet connectivity, digital literacy, and quality of use. Table 1 provides a summary of the key findings across each dimension.

Table 1. Digital Divide Dimensions Among OAP Students at Secondary Schools in Sorong City

Dimension	Findings Among OAP Students	Contributing Factors
Access to Devices	73% of OAP students reported no personal device at home; shared household devices often unavailable during study hours	Low household income; large family sizes; priority given to basic subsistence over technology investment
Internet Connectivity	Only 28% of OAP students had consistent internet access at home; reliance on school Wi-Fi limited to school hours	Poor telecommunications infrastructure in OAP-dense residential areas; high data costs relative to family income
Digital Literacy	OAP students demonstrated significantly lower digital skill proficiency compared to non-OAP peers; difficulty navigating e-learning platforms	Limited prior exposure to technology; absence of digital literacy training in lower levels of schooling
Quality of Use	Digital tool use among OAP students predominantly passive (viewing content); limited engagement with interactive or creative digital learning	Language barriers; lack of culturally relevant digital content; teacher-centered pedagogical approaches

Source: Primary Data, 2026

Regarding access to devices, the research found that 73% of OAP students interviewed reported having no personal digital device available for learning at home. Shared household devices, typically mobile phones belonging to parents or older siblings, were frequently unavailable during evening study hours due to competing household demands. School-based computer labs provided the primary site of device access for most OAP students, but laboratory availability was constrained by timetabling, equipment maintenance issues, and the ratio of students to available devices, which ranged from 1:3 to 1:5 across the research schools.

Internet connectivity was similarly constrained. Only 28% of OAP students reported having reliable internet access at home, compared to a national average of 62% for urban secondary school students reported by the 2023 Indonesian National Household Survey. OAP students living in settlements in the Klawasi, Maladum Mes, and Klawalu areas reported the poorest connectivity, reflecting a pattern of telecommunications infrastructure underinvestment in areas of high OAP residential concentration. Mobile data packages, while used by some students, were reported as prohibitively expensive relative to household income, with several students describing limiting their internet use to the free Wi-Fi available at school.

In terms of digital literacy, OAP students demonstrated considerably lower levels of proficiency across all skill dimensions assessed during the observation and interview phases. Several OAP students reported difficulty in navigating the school's adopted e-learning platform, searching for academic information online, or using basic productivity tools such as

word processors or presentation software. These limitations were observed to produce a self-reinforcing cycle of disengagement: students who struggled with digital tools tended to avoid technology-mediated tasks, thereby limiting their opportunity to develop digital skills over time.

The quality of digital use among OAP students was predominantly passive and consumptive. When they did access digital tools, OAP students more frequently used them for social media consumption or entertainment than for structured academic purposes. Interactive, creative, or communicative uses of digital tools, which research indicates are more conducive to deep learning outcomes, were rarely observed among OAP students. Teachers attributed this pattern to the absence of culturally relevant digital learning content in local languages or addressing OAP cultural knowledge systems, as well as to a general lack of motivation arising from the perceived irrelevance of mainstream digital educational materials to OAP students' lives and aspirations.

Discussion

The findings of this study confirm that the digital divide experienced by OAP students at secondary schools in Sorong City is multidimensional and deeply structural, extending well beyond the hardware and connectivity dimensions that dominate popular and policy discourse. The four-dimension framework used in this study reveals that even where some degree of device or internet access is available through school-based resources, OAP students remain digitally excluded along the dimensions of skills and quality of use, which are increasingly recognized as the more consequential dimensions of the digital divide for educational outcomes (Morris et al., 2022).

The device and connectivity findings are consistent with broader patterns of infrastructure inequality documented in urban Papua more generally, where geographic concentration of OAP communities in underserviced urban peripheries creates a form of urban digital exclusion that mirrors the rural-urban divide in different spatial terms. This aligns with Acilar & Sæbø, (2023) critique of infrastructure-centric framings of the digital divide, which he argues mask the ways in which social and economic exclusions are reproduced even within nominally well-connected urban environments.

The digital literacy gap identified in this study is particularly significant from an educational policy perspective. Research consistently shows that digital literacy is not acquired naturally through exposure to technology but requires deliberate, pedagogically structured instruction and practice (Du & Wang, 2026). The absence of systematic digital literacy programs targeting OAP students in Sorong City's secondary schools, and the lack of teacher capacity to deliver such instruction in culturally responsive ways, represents a critical policy failure that compounds the material dimensions of the digital divide. This finding is consistent with H. Li & Kostka, (2026), who argue that in indigenous education contexts, the digital divide is a pedagogical as much as an infrastructural problem.

The low quality of digital use among OAP students is closely linked to the cultural irrelevance of available digital learning content. The near-total absence of digital materials in Papuan indigenous languages, or that incorporate OAP cultural knowledge, histories, and worldviews, means that digital learning environments are experienced by OAP students as foreign, alienating spaces rather than empowering tools (Aditya et al., 2023). This cultural dimension of the digital divide is rarely addressed in mainstream digital inclusion policy, which tends to treat content development as a market function rather than a cultural rights issue. The experience of OAP students in Sorong City strongly suggests that meaningful digital inclusion for indigenous learners requires the co-development of culturally grounded digital content, ideally with active participation from OAP communities themselves (Peláez-Sánchez & Glasserman-Morales, 2023).

Taken together, these findings point toward a structural understanding of the digital divide in OAP education in Sorong City. The multidimensional exclusion of OAP students from the benefits of educational digitalization is not an accidental or temporary condition but reflects the systematic reproduction of historical disadvantages through the new medium of digital technology. Addressing this structural digital divide requires not only technical interventions but policy reform that places digital equity for OAP students within the broader framework of indigenous education rights and special autonomy commitments in Papua.

Beyond documenting the dimensions of digital exclusion, it is important to foreground the concrete educational consequences that this structural divide produces for OAP students. Studies in comparable indigenous and marginalized urban student populations have consistently demonstrated that multidimensional digital exclusion correlates with lower academic achievement, higher dropout rates, and reduced participation in digitally mediated classroom activities, ultimately narrowing students' post-secondary pathways. In the Sorong City context, OAP students who lack functional digital literacy and who encounter only culturally alien digital content are not merely disadvantaged in technology-specific tasks but are progressively excluded from the broader pedagogical shift toward digitalized instruction that now permeates secondary schooling across Indonesia. Regarding the practical feasibility of proposed recommendations, it is acknowledged that culturally responsive digital content development and community-based digital learning centers require sustained financial investment, cross-sectoral coordination between local government, schools, and OAP communities, and long-term commitment that extends beyond typical project-based funding cycles. However, precedents from indigenous digital inclusion initiatives in comparable contexts, including community-driven content localization programs in Māori-medium education in New Zealand and mother-tongue-based digital learning initiatives in the Philippines, demonstrate that such interventions are achievable when grounded in genuine community partnership, political will, and alignment with existing legal frameworks for indigenous educational rights. Papua's Special Autonomy framework provides precisely such a legal foundation, and its operationalization in the domain of educational digitalization represents both a policy opportunity and an unmet obligation.

CONCLUSION

This study has demonstrated that OAP secondary school students in Sorong City experience a significant and multidimensional digital divide that substantially limits their access to and quality of digital learning. The divide operates across all four dimensions of the digital divide framework: device access, internet connectivity, digital literacy, and quality of use, with the latter two dimensions proving particularly consequential for learning equity outcomes. The structural drivers of this digital divide, including infrastructure underinvestment in OAP residential areas, economic constraints on household technology expenditure, the cultural irrelevance of mainstream digital content, and the insufficient capacity of teachers to deliver culturally responsive digital instruction, are deeply rooted in broader patterns of indigenous marginalization and historical exclusion from the benefits of development in Papua.

These findings carry important implications for policy. First, digital inclusion programs for OAP students must move beyond device distribution and connectivity provision to address the full spectrum of barriers to meaningful digital learning participation. Second, culturally responsive digital content development, co-created with OAP community members and reflecting indigenous languages, knowledge systems, and cultural values, is an essential component of any effective digital equity strategy for OAP learners. Third, teacher professional development programs targeting digital literacy instruction, with attention to

culturally appropriate pedagogies for OAP students, must be prioritized and systematically resourced. Fourth, community-based digital learning spaces, such as OAP community digital hubs with supervised access and support, can help bridge the home-school digital divide for students without device or connectivity access at home. Fifth, policy monitoring frameworks for OAP educational digitalization should adopt a multi-dimensional digital divide indicator set rather than measuring progress solely in terms of device and internet penetration rates.

This study contributes to the growing body of research on digital equity in indigenous education and offers a theoretically grounded and empirically detailed analysis of the digital divide in a distinct urban indigenous context. Future research should examine the longitudinal effects of digital exclusion on OAP student learning outcomes and should evaluate the effectiveness of culturally responsive digital inclusion interventions as they are implemented in Sorong City and across Papua more broadly.

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