

## Learning Beyond Limits: A Literature Review on Educational Facilities and Student Achievement in 3T Regions

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### ABSTRACT

The disparity in education quality between urban areas and underdeveloped regions such as Maluku and Papua remains a critical issue in Indonesia. Limited educational facilities, such as classrooms, laboratories, and internet access are often perceived as major barriers to academic achievement. However, the success of students from these regions in national competitions like the Academy of Champions (AoC) by *Ruangguru* suggests that physical limitations do not necessarily hinder academic excellence. This study aims to examine how educational facility management can be effectively implemented under constrained conditions in 3T regions. Using a literature review method with a descriptive analytical approach, this research explores various secondary sources that highlight educational management practices in Maluku and Papua. The findings reveal that functional-based management, community participation, the use of educational technology, and adaptive school leadership are key success factors. The study concludes that limitations can be overcome through contextual and innovative managerial approaches, as well as through collaboration between schools, communities, and digital tools to create productive and inclusive learning environments.

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## Introduction

Education plays a crucial role in human capital development and national progress. However, in Indonesia, educational inequality between urban areas and frontier, deprived, and outer regions (3T) remains a persistent structural challenge, particularly in eastern regions such as Maluku and Papua (Suarlin et al., 2026; Sidauruk et al., 2025; Tuffahati & Tutukansa, 2022). These disparities are strongly associated with uneven distribution of

educational facilities and infrastructure, including inadequate classrooms, laboratories, libraries, as well as limited access to electricity and stable internet connectivity (Suhardi et al., 2024; Harsono et al., 2024). Such conditions often hinder the delivery of quality learning and limit students' academic opportunities.

Despite these structural constraints, empirical evidence shows that several schools in Maluku and Papua are able to sustain effective learning processes and even produce high-achieving students at the national level (Leasa & Batlolona, 2023; Gozali et al., 2019). One notable example is the success of students from these regions in the Academy of Champions (AoC), a national academic competition organized by *Ruangguru*. This phenomenon challenges the dominant assumption that adequate physical facilities are the primary determinant of academic success. Instead, it suggests that adaptive and contextual management of existing facilities and resources can significantly mitigate infrastructural limitations (Ebekozi et al., 2025; Gailea, 2024).

The AoC is a technology-based academic competition that emphasizes deep conceptual understanding, problem-solving skills, and independent learning through digital platforms. Unlike conventional examinations, AoC integrates online systems, interactive content, and app-based learning support, requiring participants to demonstrate digital literacy, critical reasoning, and learning autonomy (Zahrina & Jinan, 2025; Ashari & Saptiyono, 2025). The strong performance of students from schools in Wamena and Sorong illustrates that academic excellence is not solely determined by the availability of modern physical infrastructure, but rather by how educational facilities are functionally utilized and strategically managed (Qodir & Choerudin, 2024; Yu et al., 2024; Donkoh et al., 2023). In practice, students in these contexts often adopt adaptive learning strategies, such as studying in community halls, guard posts, or locations with better internet access, reflecting high levels of resilience and innovation (Qodir & Choerudin, 2024; Yu et al., 2024).

This phenomenon underscores the importance of educational facility and infrastructure management that prioritizes functionality, flexibility, and contextual relevance. Effective school leadership, teacher preparedness, community involvement, and the strategic use of educational technology emerge as critical factors in compensating for physical limitations (Timotheou et al., 2023; Saputri & Oktaria, 2023). Previous studies have predominantly focused on the negative impact of inadequate facilities on student achievement (Supriyadi, 2020; Filardo et al., 2019; Ramli et al., 2018; Akomolafe & Adesua, 2016). However, there is a clear research gap in the literature regarding how schools in resource-constrained and geographically isolated contexts actively manage and optimize limited facilities to sustain educational quality and academic excellence.

Most existing research treats infrastructure scarcity as a deficit condition, emphasizing what schools lack rather than examining how adaptive management practices transform limitations into functional learning ecosystems (Putri et al., 2025; Utami & Setiawati 2024; Marup et al., 2023). Moreover, studies that explicitly explore facility and infrastructure management in 3T regions tend to focus on policy implementation or physical development, with limited attention to school-level managerial strategies, community participation, and technology integration as forms of strategic adaptation.

Addressing this gap, the present study aims to systematically analyze educational facility and infrastructure management practices in Maluku and Papua that enable schools to survive and thrive under severe resource constraints. Using a literature-based approach, this study examines how school leaders, teachers, and communities collaboratively optimize limited facilities through contextual management models. The analysis emphasizes the roles of principal leadership, teacher capacity, community empowerment, and educational technology utilization in fostering inclusive and resilient learning environments.

The key contribution of this study lies in its conceptual reframing of educational facilities, not merely as physical assets, but as functional, social, and technological resources that can be adaptively managed in disadvantaged contexts. Synthesizing evidence from 3T regions and contextualizing it with the AoC phenomenon, this research contributes to the literature on educational management by offering a context-sensitive model of facility optimization for marginalized and remote areas. However, the aims of this study to examine how educational facility management can be effectively implemented under constrained conditions in 3T regions. The findings are expected to inform policymakers, school leaders, and researchers on sustainable strategies for improving educational quality in regions facing structural and geographical limitations.

## Method

This study adopts a qualitative research design using a structured literature review approach to examine the limitations and driving factors influencing students' learning motivation and enthusiasm in the regions of Maluku and Papua. The literature review method was selected to systematically synthesize existing empirical studies, theoretical perspectives, and policy-related documents to provide a comprehensive understanding of educational challenges (Faizin & Kusumaningrum, 2023) within geographically remote and disadvantaged contexts. The study specifically incorporates the case of AoC *Ruangguru* as an illustrative example of a digital education initiative implemented in these regions.

The research procedure followed a structured workflow as illustrated in the research flowchart (Figure 1). The process began with the identification of the research topic and objectives, which aimed to ensure conceptual clarity and maintain analytical focus on variables directly related to student learning motivation and contextual educational limitations. Following this stage, a comprehensive literature search was conducted using multiple sources, including academic databases, peer-reviewed journal articles, books, official government reports, and credible digital media publications. The selection of literature was guided by predefined inclusion criteria, namely relevance to student motivation, educational access in remote or 3T regions (frontier, deprived, and outer regions), digital learning initiatives, and contextual discussions specific to Maluku and Papua. Sources that did not contribute directly to the research objectives were excluded from further analysis. In total, 28 references were included, consisting of theoretical studies, empirical research findings, educational policy documents, and reports addressing the condition of educational facilities and infrastructure in the targeted regions.

After the literature collection stage, the data were subjected to a selection and classification process. The collected information was organized into two primary analytical categories: (1) structural and contextual limitations experienced by students and (2) factors that promote or sustain learning motivation. This classification process enabled systematic comparison across sources and facilitated thematic analysis. Data verification was subsequently conducted to ensure the validity and consistency of the information through cross-source comparison and triangulation, allowing the identification of converging evidence and minimizing potential bias.

The analysis stage employed descriptive qualitative analysis, focusing on identifying patterns, relationships, and underlying themes emerging from the literature. The findings were then presented through systematic descriptive narratives supported by tables and graphical representations where relevant, enabling clearer visualization of relationships between challenges and motivational factors. The final stage involved drawing conclusions and formulating recommendations based on synthesized evidence, providing deeper insights

into how students' learning enthusiasm persists despite contextual constraints in the socio-geographical environment of Maluku and Papua.

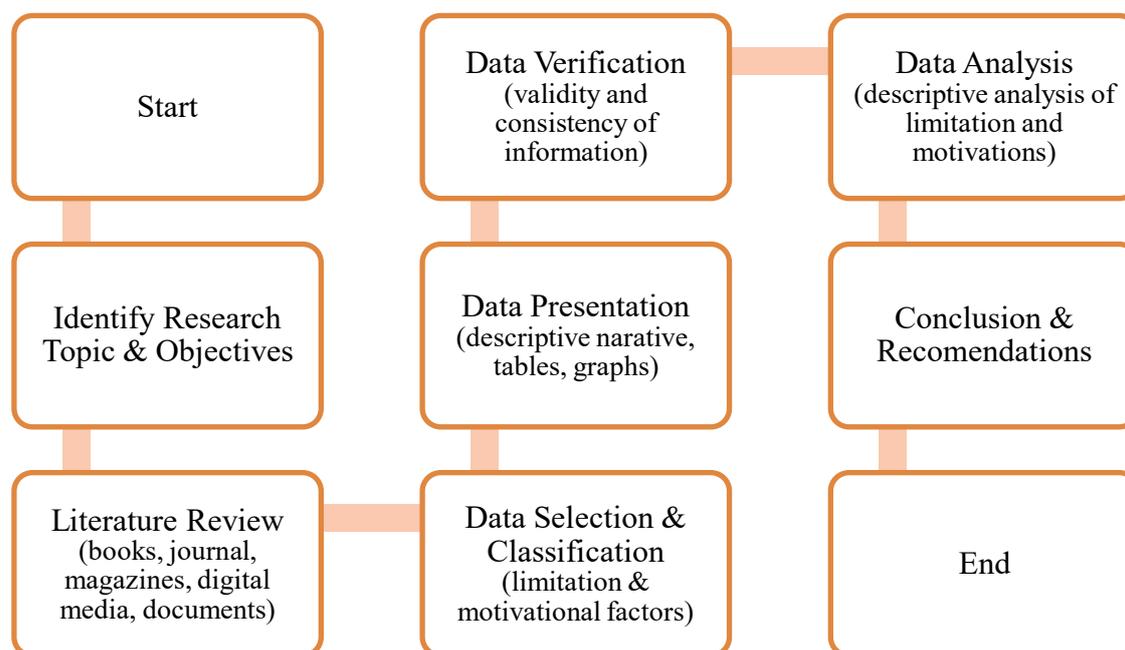


Figure 1. Flowchart of Research

## Results and Discussion

### Fundamental of Infrastructure Management in Remote Areas

Schools in Papua and Maluku are a real reflection of the practice of facility and infrastructure management that focuses on essential functions rather than physical equipment. In many cases, the learning spaces used are far from luxurious, with wooden plank walls, zinc roofs, no air conditioning and minimal digital facilities, but are still able to support an intensive and quality learning process (Lasamahu et al., 2021). One prominent example is Senior High School Wamena and Senior High School Averos Sorong, which despite being in areas with geographical and infrastructure limitations, were able to deliver their students as top participants in Academy of Champions (AoC) by *Ruangguru*, a technology-based academic competition that demands in-depth understanding, speed, and independent learning skills.

This shows that the effectiveness of educational facilities is not always linear to their physical completeness. Instead, the effectiveness is more influenced by the extent to which the facilities are utilized optimally and contextually. In the theory of resource-based management, the value of a resource is not only determined by its quantity and form, but also by the ability of the organization (school) to manage it into functional value (Aminudin et al., 2023; Karimah et al., 2024). The strategy of using local building materials such as bamboo and wood and involving the community in the construction of learning spaces not only reduces construction costs, but also accelerates the provision of classrooms amidst state budget constraints. More importantly, community involvement in construction creates a high sense of ownership of the school (Paci-Green et al., 2020; Zuckerman, 2019). Learning spaces are no longer seen as government property, but as community heritage.

On the other hand, the active involvement of students in facility maintenance activities (such as cleaning, minor repairs, and environmental cleanliness management) not only has an impact on the physical sustainability of the facilities, but also on the formation of responsible character (Saputri & Oktaria, 2023). Students are accustomed to treating school

as a space that must be maintained together. This creates a healthy, harmonious learning climate and encourages active participation in academic activities (Lating et al., 2022). In the context of AoC achievements, student participation from schools that manage facilities functionally shows that limitations are not an obstacle when there is a clean and orderly learning environment, an effective but simple class system, and the collective spirit of teachers and students in creating a lively learning space.

This is also in accordance with Bronfenbrenner's ecological theory of education, which states that proximal environments such as positive and supportive homes and schools are able to strengthen children's cognitive development, even in economic and physical limitations (Dharma, 2022; Salsabila, 2018). Schools in Papua and Maluku that have successfully accompanied their students to the national competition stage have proven how function-based management and local participation are actually advantages compared to management models that rely entirely on formal budgets and bureaucratic structures. Thus, the practice of infrastructure management in these schools shows that simple infrastructure does not limit academic output if managed well, strengthening collective values and mutual cooperation becomes a crucial non-material asset and student success in competitions such as AoC is a direct manifestation of a functional and supportive learning environment, not merely the result of technological intervention or modern facilities.

### **Sustainable Community Engagement**

Management of facilities and infrastructure in 3T areas requires an approach that goes beyond the conventional administrative model. Education in Papua and Maluku is not solely managed by the school bureaucracy, but also through cooperation between the school and the local community which includes traditional figures, parents, village youth and religious groups (Wambarop et al., 2025; Hermino, 2016). Rather than relying on limited government budgets or slow logistics, schools in this area adopt the principle of pedagogical gotong royong, where educational facilities are managed as the community manages other communal resources such as traditional halls or places of worship. Activities such as replacing zinc roofs, repairing bamboo blackboards, or cleaning the school environment have two meanings. First, the technical function as a physical maintenance activity. Second, the symbolic function that reflects respect for educational institutions as an integral part of social life. This form of community contribution fosters the internalization of social values such as cooperation, collective responsibility, and a sense of belonging to educational institutions (Jones et al. 2021; Juvonen et al., 2019). This school is no longer a foreign space, but a community living space. This has direct implications on student participation and their perception of the importance of education.

The formation of social capital occurs when the relationship between the community and the school is one that is both emotional and moral. Despite the fact that they are learning in classrooms with wooden walls and roofs that leak, many traditional leaders, teachers, and religious leaders, as well as members of the community, urge students in 3T regions to stick with their studies and not give up. This type of psychosocial assistance is not something that can be substituted by the infrastructure that is being developed today. The use of straightforward technology can be maximised if it is backed by a strong community (Mapotse, 2018; Lester et al., 2016). This is demonstrated by best practices in a number of schools located in Maluku and Papua. It is also possible for parents who were initially uneducated in technology to learn how to operate learning programs or to give time for collective learning at home. An actual manifestation of the resilient learning ecosystem, in which the absence of physical facilities is filled by social synergy and adaptive creativity, this is an example of how the ecosystem works.

The success of community-based management in Papua and Maluku provides important lessons for Indonesia at general. National education policies must open up space for cultural and participatory approaches in managing infrastructure. Practices such as school committees involving traditional leaders, village deliberations for the allocation of local materials to schools and the integration of schools into the religious and social agendas of the community, need to be formalized in regional regulations and programs such as moving schools so that they can be replicated in other 3T areas.

### **The Employment of Technology as a Substitute for Physical Presence**

Educational technology has transformed into a key managerial strategy in overcoming physical limitations in remote educational areas, in the context of Maluku and Papua, where the absence of laboratories, libraries and multimedia rooms is a systematic problem, the integration of digital-based technology has become a form of strategic substance for conventional educational facilities (Karimah et al., 2024). Schools that successfully deliver their students in national competitions such as AoC *Ruangguru* are not schools with the best facilities, but schools that are able to manage the potential of technology adaptively, they do not see technology as a tool, but as a core component of the learning process and learning management itself. In the midst of limited facilities such as science laboratories and physical libraries, digital content becomes an effective and efficient substitute (Susanto & Hermina, 2024). Experimental videos, interactive simulations, online learning modules, and adaptive problem sets have become “new learning tools” that are flexible, portable, and relatively cheaper than building physical facilities. Students also use offline storage media such as SD cards or flash drives to store learning content when they have internet access, and study it again at home independently. This marks a shift from a supply-based learning approach to a learning model based on student independence and initiative (Afif, 2019).

Student involvement in the technology-based learning process not only provides content, but also builds new competencies, namely digital literacy, information navigation, problem solving skills and digital resilience. In the context of *Ruangguru*, the ability to access information, answer questions based on online systems, and communicate online with mentors are essential skills (Saputri & Oktaria, 2023). Several schools in the 3T areas also demonstrated digital survival strategies, where students utilized village halls, security posts or hilltops as internet access points. Some of them formed small study groups to access technology together. This shows that the limitations of digital infrastructure have become a breeding ground for social innovation and community-based education. Of course, the use of this technology does not stand alone. There is a role for the leadership of visionary principals and teachers who are adaptive to innovation (Arnov et al., 2024; Musa et al., 2022). Principals are working on digital devices through collaboration with donors, corporate CSR, and community outreach. Meanwhile, teachers are designing modular digital modules, adapting national content to local contexts, and ensuring students understand how to access and utilize them. In addition, time and digital resource management are new skills in the role of teachers. They set efficient online learning schedules, train students to use applications such as Google Form, Zoom, or *Ruangguru*, and monitor learning progress asynchronously. Their role is not just as a material provider, but also as a facilitator, technologist, and digital adaptation guide.

The experience of schools in Maluku and Papua in using technology as a substitute for physical facilities provides an important lesson for the world of Indonesian education that the resilience of education is not measured by the luxury of facilities, but by the ability of the education system to adapt, manage existing resources, and develop a resilient and contextual learning ecosystem. In other words, in the hands of the right management,

technology is not only a savior of education in limited areas but also a driver of achievement transformation.

The findings of this study provide several important theoretical, practical, and policy-related impact and implications for educational development in geographically remote and disadvantaged regions such as Maluku and Papua. From a theoretical perspective, this research contributes to the growing body of literature on student motivation by demonstrating that structural limitations, such as infrastructure constraints and unequal access to educational resources, do not necessarily diminish students' learning enthusiasm. In terms of policy implications, this research emphasizes the need for integrated educational policies that combine infrastructure development, equitable resource distribution, and digital innovation strategies. Policymakers should consider expanding digital learning infrastructure, improving internet connectivity, and supporting collaborative partnerships between government institutions and private educational technology providers to enhance educational access in 3T regions. Policies that prioritize inclusivity and contextual adaptability may help reduce educational disparities between central and peripheral regions.

## Conclusion

Based on this literature review, it is evident that limited educational facilities and infrastructure in underdeveloped regions such as Maluku and Papua are not absolute barriers to student academic achievement. Educational institutions in these areas cultivate high-achieving students by employing innovative resource management, fostering active community engagement, and utilising educational technology as a substitute for traditional physical infrastructure. This achievement is facilitated by the innovative leadership of school administrators, flexible educators, and contextually relevant, participatory, and locally grounded management practices. The findings affirm that educational change in the 3T regions relies on management innovation rather than only on infrastructure, and can inspire inclusive and responsive educational policies to address geographical difficulties across Indonesia. This study also opens avenues for future research by encouraging empirical investigations that examine the effectiveness of digital education programs through field-based studies, mixed-method approaches, or longitudinal designs. Further research may also explore comparative analyses between different remote regions to better understand contextual variations in student motivation and technology adoption. Such studies would strengthen the evidence base for developing sustainable and scalable educational interventions in geographically diverse environments.

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