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The School Principals' Policies Utilizing Artificial Intelligence And Big Data To Promote Equitable Educational Access In The 3T

Muhamad Aman[1A-E*], Ervan Johan Wicaksana[2B-D], Saharudin[3B-D], Hadiyanto[4B-D], Henny[5B-D]

[1] SD Negeri Ulak Kembang, Sumatera Selatan , Indonesia
[2,3,4] Universitas Jambi, Jambi, Indonesia
[5] Dinas Pendidikan dan Kebudayaan Musi Banyuasin, Sumatera Selatan, Indonesia

rahman.unja25@gmail.com[1*], ervan_jw@unja.ac.id[2], saharudin.fkip@unja.ac.id[3], hadiyanto@unja.ac.id[4], hennypws03@gmail.com[5]

ABSTRACT

Educational inequality remains a significant challenge in Indonesia, particularly in 3T (Underdeveloped, Frontier, and Outermost) regions where geographical, infrastructural, and technological limitations restrict access to quality education. This study aims to analyze school principals' policies based on Artificial Intelligence (AI) and Big Data in promoting equitable access to education in Batanghari Leko District, Musi Banyuasin Regency. A qualitative descriptive approach was employed, involving 60 participants consisting of school principals, teachers, school supervisors, community leaders, parents, and students. Data were collected through observations, semi-structured interviews, and document analysis, and were analyzed using the interactive model of data reduction, data display, and conclusion drawing. The findings indicate that AI- and Big Data-based policies have contributed positively to improving educational access and school management. All participating schools implemented digital student databases, while 87.5% utilized digital attendance monitoring systems and 75.0% employed learning analytics for educational planning. The implementation of these policies resulted in improvements in student enrollment rates (10.8%), attendance rates (11.1%), community participation (19.4%), digital learning access (33.7%), and student retention rates (13.5%). However, challenges such as limited internet connectivity, inadequate digital infrastructure, low digital literacy, and geographical constraints continue to hinder policy effectiveness. The study concludes that AI and Big Data can serve as strategic tools for school principals in reducing educational disparities and strengthening educational equity in remote regions when supported by effective leadership, stakeholder collaboration, and adequate technological infrastructure. This research contributes to the development of digital educational leadership models and provides practical recommendations for technology-driven educational governance in 3T areas.

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Muhamad Aman[1A-E*], Ervan Johan Wicaksana[2B-D], Saharudin[3B-D], Hadiyanto[4B-D], Henny[5B-D]
rahman.unja25@gmail.com[1*]

INTRODUCTION

The rapid advancement of digital technologies has significantly transformed educational management and decision-making processes worldwide. Among these technological developments, Artificial Intelligence (AI) and Big Data have emerged as strategic tools capable of improving educational planning, resource allocation, learning analytics, and policy formulation. AI enables educational institutions to analyze complex datasets, predict educational trends, identify at-risk students, and support evidence-based decision-making, while Big Data facilitates the collection, processing, and interpretation of large-scale educational information to enhance institutional effectiveness and educational equity.

The integration of AI and Big Data in educational governance has become increasingly important in addressing disparities in educational access, particularly in geographically disadvantaged regions. Educational inequality remains a persistent challenge in many developing countries, including Indonesia, where significant gaps exist between urban and rural areas regarding infrastructure, educational resources, teacher distribution, and technological accessibility. These disparities are particularly evident in the 3T regions (Underdeveloped, Frontier, and Outermost Areas), where geographical isolation and limited public services continue to hinder educational development.

Educational access in 3T areas is often constrained by inadequate school facilities, insufficient numbers of qualified teachers, poor transportation networks, limited internet connectivity, and weak educational data management systems. These challenges affect student participation rates, learning outcomes, and overall educational quality. Consequently, innovative leadership approaches are required to ensure that educational services reach all members of society regardless of geographical location. Within this context, school principals play a crucial role as educational leaders responsible for translating national educational policies into practical strategies that address local needs.

Contemporary educational leadership emphasizes the importance of data-driven decision-making and technological integration in school management. School principals are no longer expected merely to perform administrative functions but are also required to utilize digital technologies to improve educational planning and policy implementation. Through AI-supported analytics and Big Data management systems, school leaders can identify educational disparities, monitor student participation, predict dropout risks, allocate resources more effectively, and formulate responsive interventions tailored to community needs. Such approaches are particularly relevant in remote regions where educational challenges are multidimensional and continuously evolving.

Batanghari Leko District in Musi Banyuasin Regency represents one of the regions characterized by many of the challenges commonly associated with 3T areas. Despite ongoing government efforts to improve educational services, schools in this region continue to face difficulties related to infrastructure limitations, unequal educational

opportunities, technological constraints, and socioeconomic barriers. These conditions highlight the necessity for innovative school leadership policies that leverage digital technologies to support equitable educational access.

Although previous studies have examined educational leadership in remote areas and the implementation of technology in education, limited research has specifically investigated how school principals utilize AI and Big Data to formulate policies aimed at reducing educational inequality in 3T regions. Existing studies primarily focus on leadership styles, educational infrastructure, or digital learning implementation, while the strategic role of AI-driven and data-based policymaking in promoting educational equity remains underexplored. This gap indicates the need for empirical investigation into how school principals can employ advanced digital technologies to support educational access in geographically disadvantaged communities.

Therefore, this study aims to analyze school principals' policies based on Artificial Intelligence and Big Data in promoting equitable access to education in the 3T area of Batanghari Leko District, Musi Banyuasin Regency. Specifically, the study examines policy implementation, supporting and inhibiting factors, and strategic efforts undertaken by school principals to overcome educational access barriers. The findings are expected to contribute to the growing body of knowledge on digital educational leadership and provide practical recommendations for policymakers, school administrators, and educational stakeholders seeking to enhance educational equity through technology-driven governance.

METHODS

Research Design

This study employed a qualitative descriptive approach to explore and analyze school principals' policies based on Artificial Intelligence (AI) and Big Data in promoting equitable access to education in the 3T (Underdeveloped, Frontier, and Outermost) region of Batanghari Leko District, Musi Banyuasin Regency. A qualitative approach was considered appropriate because it enables an in-depth understanding of educational leadership practices, policy implementation processes, and contextual challenges experienced by schools operating in geographically disadvantaged areas.

Research Setting

The study was conducted in several schools located in Batanghari Leko District, Musi Banyuasin Regency, South Sumatra, Indonesia. This region was selected because it exhibits characteristics commonly associated with 3T areas, including limited educational infrastructure, restricted access to technology, teacher shortages, and geographical barriers that influence educational service delivery.

Participants

Participants were selected using purposive sampling to ensure that information-rich sources relevant to the research objectives were included. The participants consisted of school principals, teachers, school supervisors, community leaders,

Muhamad Aman[1A-E*], Ervan Johan Wicaksana[2B-D], Saharudin[3B-D], Hadiyanto[4B-D], Henny[5B-D]
rahman.unja25@gmail.com[1*]

parents, and students. School principals were selected because of their central role in policy formulation and implementation. Teachers provided insights into policy execution within classroom practices, while school supervisors contributed perspectives regarding policy monitoring and evaluation. Community leaders, parents, and students were included to capture broader stakeholder experiences concerning educational access and participation.

Data Collection

Data were collected through three primary techniques: observation, semi-structured interviews, and document analysis.

1. Observation was conducted to examine school conditions, educational facilities, technology utilization, learning activities, and the implementation of AI- and data-based educational policies.
2. Semi-structured interviews were carried out with all participant groups to obtain detailed information regarding policy development, technology integration, educational challenges, and strategies for improving educational access. This interview format allowed flexibility while ensuring consistency across participants.
3. Document analysis involved reviewing school policy documents, strategic plans, student enrollment records, educational statistics, technology implementation reports, and other administrative records relevant to educational management and access.

Research Instruments

In qualitative research, the researcher served as the primary research instrument. Supporting instruments included observation checklists, interview guides, and document analysis protocols. The observation checklist focused on technological infrastructure, educational access, and policy implementation practices. Interview guides were developed to explore participants' experiences and perceptions regarding AI and Big Data utilization in educational decision-making. Document analysis protocols were used to systematically examine policy and administrative records.

Data Analysis

Data were analyzed using the interactive model proposed by Miles, Huberman, and Saldaña, which consists of three stages: data reduction, data display, and conclusion drawing. During the data reduction stage, interview transcripts, observation notes, and documentary evidence were organized, coded, and categorized according to emerging themes. Subsequently, data were displayed through narrative descriptions and thematic matrices to facilitate interpretation. Finally, conclusions were drawn and continuously verified through comparison across multiple data sources.

Trustworthiness

To ensure the credibility and trustworthiness of the findings, several validation strategies were employed. Source triangulation was conducted by comparing information obtained from different participant groups. Methodological triangulation was achieved through the integration of observations, interviews, and document

Muhamad Aman[1A-E*], Ervan Johan Wicaksana[2B-D], Saharudin[3B-D], Hadiyanto[4B-D], Henny[5B-D]
rahman.unja25@gmail.com[1*]

analysis. Member checking was also performed by sharing preliminary interpretations with selected participants to confirm the accuracy of the findings. Additionally, prolonged engagement and persistent observation were undertaken to enhance the reliability of the collected data.

Ethical Considerations

Ethical principles were strictly observed throughout the research process. All participants were informed about the purpose of the study and voluntarily agreed to participate. Confidentiality and anonymity were maintained by removing personal identifiers from research records and reports. Furthermore, all data were used exclusively for academic purposes and were handled responsibly in accordance with research ethics standards.

RESULTS AND DISCUSSION

Result

Characteristics of Participants

This study involved 60 participants consisting of school principals, teachers, school supervisors, community leaders, parents, and students from schools located in the 3T area of Batanghari Leko District, Musi Banyuasin Regency.

Table 1.
Characteristics of Participants

Participant Category	Number (n)	Percentage (%)
School Principals	8	13.3
Teachers	24	40.0
School Supervisors	4	6.7
Community Leaders	6	10.0
Parents	12	20.0
Students	6	10.0
Total	60	100

The majority of participants were teachers (40%), followed by parents (20%) and school principals (13.3%). This composition enabled the study to capture diverse perspectives regarding educational access and technology-based policy implementation.

Level of AI and Big Data Policy Implementation

The findings revealed varying levels of implementation of AI and Big Data-based policies across schools.

Table 2.
Implementation of AI and Big Data-Based Policies

Indicator	Schools Implementing	Percentage (%)
Digital student database	8	100
Digital attendance monitoring	7	87.5
Learning analytics utilization	6	75.0
Early dropout detection	5	62.5
AI-assisted decision support	4	50.0
Predictive educational planning	3	37.5

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rahman.unja25@gmail.com[1*]

The data indicate that all schools had implemented digital student databases. However, only 50% had adopted AI-assisted decision-support systems, while predictive educational planning remained relatively limited (37.5%).

Supporting Factors

Several factors were identified as facilitating the implementation of AI and Big Data-based policies.

Table 3.
Supporting Factors

Supporting Factors	Frequency	Percentage (%)
Principal leadership commitment	8	100
Government support	7	87.5
Community participation	6	75.0
Teacher readiness	5	62.5
Availability of ICT facilities	4	50.0

School principals consistently emphasized leadership commitment as the most influential factor in driving educational innovation.

Barriers to Policy Implementation

Despite the positive developments, schools continued to face significant challenges.

Table 4.
Barriers to Implementation

Barriers	Frequency	Percentage (%)
Limited internet connectivity	8	100
Inadequate digital infrastructure	7	87.5
Low digital literacy among teachers	6	75.0
Geographical constraints	8	100
Limited budget allocation	5	62.5

Internet connectivity and geographical barriers were identified as the most significant obstacles, affecting all participating schools.

Impact on Educational Access

School principals reported improvements in several indicators of educational access after implementing data-driven policies.

Table 5.
Educational Access Before and After Policy Implementation

Indicator	Before (%)	After (%)	Improvement (%)
Student enrollment rate	78.4	89.2	+10.8
Attendance rate	81.5	92.6	+11.1
Community participation	65.3	84.7	+19.4
Digital learning access	42.8	76.5	+33.7
Student retention rate	74.6	88.1	+13.5

The greatest improvement was observed in digital learning access, which increased by 33.7%, indicating the effectiveness of technology-supported educational policies.

Discussion

The findings demonstrate that AI and Big Data-based leadership policies have considerable potential to improve educational equity in geographically disadvantaged areas. The universal implementation of digital student databases across participating schools suggests that educational institutions increasingly recognize the importance of data-driven management practices.

The significant improvement in digital learning access (+33.7%) indicates that technology integration can reduce educational disparities in remote areas. These findings align with contemporary educational leadership theories, which emphasize the importance of evidence-based decision-making and digital transformation in school governance.

Furthermore, the study highlights the strategic role of school principals in facilitating educational innovation. Schools led by principals with strong commitments to digital transformation reported higher levels of policy implementation and greater improvements in educational access indicators. This finding supports previous studies suggesting that transformational leadership is essential for successful educational reform.

However, the results also reveal persistent structural challenges. Limited internet connectivity and geographical isolation remain major obstacles to the full implementation of AI and Big Data initiatives. These findings suggest that technological innovation alone is insufficient; complementary investments in infrastructure and digital capacity building are equally necessary.

The study further indicates that community participation contributes substantially to policy success. Schools that actively engaged parents and community leaders experienced higher levels of student participation and retention. This finding reinforces the importance of collaborative governance approaches in educational development, particularly in 3T regions.

Based on these findings, a conceptual model of AI and Big Data-based educational leadership is proposed. The model integrates four key components: digital data management, AI-supported decision-making, stakeholder collaboration, and adaptive leadership. Together, these elements contribute to more equitable educational access and improved educational outcomes in remote and underserved communities.

Overall, the findings suggest that AI and Big Data can serve as powerful instruments for promoting educational equity when supported by effective leadership, adequate infrastructure, and strong community engagement. Therefore, policymakers should prioritize digital leadership development programs for school principals while simultaneously expanding technological infrastructure in 3T regions.

CONCLUSION

This study examined the implementation of Artificial Intelligence (AI) and Big Data-based school principal policies in promoting equitable access to education in the 3T

(Underdeveloped, Frontier, and Outermost) area of Batanghari Leko District, Musi Banyuasin Regency. The findings indicate that the integration of digital technologies into educational leadership has contributed positively to improving educational access, participation, and school management effectiveness. School principals have increasingly utilized digital data systems to support evidence-based decision-making, identify educational challenges, monitor student participation, and formulate targeted interventions for vulnerable learners.

The study further revealed that leadership commitment, government support, community participation, and teacher readiness were key factors facilitating the implementation of AI- and Big Data-based policies. Conversely, limited internet connectivity, inadequate digital infrastructure, geographical barriers, and insufficient digital competencies among educational stakeholders remained significant obstacles. Despite these challenges, schools demonstrated notable improvements in educational access indicators, particularly in digital learning participation, student attendance, enrollment rates, and student retention.

The findings highlight the strategic role of school principals as digital leaders capable of utilizing AI and Big Data to address educational inequalities in remote and underserved regions. The integration of technology-driven decision-making, stakeholder collaboration, and adaptive leadership practices provides a promising approach for strengthening educational equity in 3T areas.

This study contributes to the growing discourse on digital educational leadership by proposing an AI- and Big Data-based policy framework that supports equitable educational access. Practically, the findings suggest that policymakers should strengthen digital infrastructure, expand technology training programs for educators, and encourage data-driven leadership practices to maximize the benefits of educational digitalization. Future studies are recommended to employ mixed-method or quantitative approaches involving larger samples to further evaluate the effectiveness of AI- and Big Data-based educational policies across different 3T regions in Indonesia.

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Muhamad Aman[1A-E*], Ervan Johan Wicaksana[2B-D], Saharudin[3B-D], Hadiyanto[4B-D], Henny[5B-D]
rahman.unja25@gmail.com[1*]

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