



Reformulating the education financing model for equitable access and quality in the era of fiscal

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ARTICLE INFO

Article history:

Received Aug 5, 2025
Revised Aug 14, 2025
Accepted Aug 22, 2025

Keywords:

Education Access;
Education Financing;
Education Quality;
Fiscal Decentralization;
Policy Reformulation.

ABSTRACT

A well-prepared abstract enables the reader to identify the basic content of a document quickly and accurately, to determine its relevance to their interests, and thus to decide whether to read the document in its entirety. The Abstract should be informative and completely self-explanatory, provide a clear statement of the problem, the proposed approach or solution, and point out major findings and conclusions. The Abstract should be 100 to 200 words in length. The abstract should be written in the past tense. Standard nomenclature should be used and abbreviations should be avoided. No literature should be cited. The keyword list provides the opportunity to add keywords, used by the indexing and abstracting services, in addition to those already present in the title. Judicious use of keywords may increase the ease with which interested parties can locate our article.

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1. INTRODUCTION

Education is the main foundation in the development of superior and highly competitive human resources in the midst of global dynamics (Manullang, 2025). The strategic role of education is not only in producing academically competent individuals, but also in shaping the character of a nation that is adaptive to change (Kale et al., 2025). Equitable access and improving the quality of education are the main agendas in every national policy, especially in developing countries such as Indonesia, which face challenges of disparities between regions, especially between urban and rural areas (Suryana, 2020). To answer these challenges, the education financing system is a crucial instrument in realizing social justice and sustainable development (Winarsih, 2013).

The implementation of fiscal decentralization that has been implemented since the enactment of Law No. 33 of 2004, the responsibility of education financing has experienced a significant shift (K. M. Simanjuntak, 2015). Local governments have greater authority in managing education sector budgets (Saprianto et al., 2023). However, the implementation of fiscal decentralization in the education sector has not fully produced the expected achievements. Instead, in many cases, there are inequalities in the distribution of education budgets between regions due to differences in regional fiscal capacity (R. K. Dewi et al., 2025). This has a direct impact on the quality of education services and the level of public education participation in disadvantaged areas. The main problem arising from fiscal decentralization is horizontal imbalance, which is the disparity in financial capacity between regions that results in inequality in the provision of basic services, including education (Suyanto, 2017). Regions with high local revenue (PAD) tend to be able to provide adequate facilities and teaching staff (Handraini, Frinaldi, Asnil, & Putri, 2024), while regions with low fiscal capacity have difficulty in meeting the minimum

standards of education services (Runiasih & Ahmad, 2025). These inequalities reinforce gaps in access to and quality of education that have systemic impacts on communities, especially vulnerable groups in underdeveloped, outermost and frontier (3T) areas (D. A. P. Dewi et al., 2025).

Several critical factors have prevented fiscal decentralization mechanisms from effectively reducing educational inequality in 3T regions. First, institutional capacity constraints at the local level, where many 3T regions lack adequate human resources and technical expertise to effectively manage and allocate education funds (Runiasih & Ahmad, 2025). Second, geographical isolation and infrastructure limitations that increase the cost of service delivery and reduce the effectiveness of fund utilization, making standard allocation formulas inadequate for these regions. Third, design flaws in transfer mechanisms, where DAU and DAK allocation formulas do not sufficiently account for the unique challenges and higher per-unit costs of providing education services in remote areas (Pedinata et al., 2020). Fourth, weak monitoring and accountability systems that allow fund misallocation without adequate oversight, particularly problematic in regions with limited civil society oversight capacity. Finally, political economy factors including elite capture and rent-seeking behaviors that divert education funds from their intended purposes, compounded by limited transparency mechanisms in remote areas.

Several previous studies have discussed the impact of fiscal decentralization on the education sector. Research by (Halawa et al., 2025; Nazikha & Rahmawati, 2021) shows that fiscal decentralization can improve the efficiency of public resource allocation if accompanied by adequate institutional capacity at the local level. However, without institutional readiness, decentralization has the potential to widen regional disparities. Similar findings were also revealed by (Arfah, 2021; Liyana et al., 2024) which emphasized the importance of intergovernmental fiscal transfer design in ensuring equitable resource distribution. Both studies highlight that the success of fiscal decentralization is highly dependent on the quality of governance and an appropriately designed fiscal transfer system. Specifically, several studies have also examined the relationship and linkages between fiscal decentralization and education access and quality. Studies by (J. V Simanjuntak et al., 2024) show that an increase in the General Allocation Fund (DAU) and Special Allocation Fund (DAK) for the education sector does not automatically improve the quality of education, especially in regions that have a low human development index (HDI). Similarly, research by (Pedinata et al., 2020) found that education budget policies that do not favor marginalized areas have an impact on low secondary school enrollment rates and high dropout rates. These results indicate that there is a need to reformulate financing policies that consider fiscal justice between regions and ensure equitable access to education.

Efforts to optimize the education financing system have encouraged the development of various alternative models aimed at improving the efficiency of resource allocation and the effectiveness of achieving educational goals. Research by (Mesiono & Roslaeni, 2021) introduced the concept of cost-effectiveness in education financing, which emphasizes the importance of allocating funds based on output and learning outcomes. This model challenges the traditional input-based approach that has dominated the education financing system. Meanwhile, an analysis by (Harahap, 2024) of education financing in developing countries emphasizes the importance of diversifying funding sources and flexible financing mechanisms to reach poor and marginalized groups.

Looking at the challenges and limitations of the current financing model, it is important to reformulate the education financing model that is able to answer the dynamics of the era of fiscal decentralization (Bernadus et al., 2025). This reformulation must not only consider aspects of fiscal justice and allocation effectiveness, but must also design financing instruments that are sensitive to local socioeconomic conditions and able to encourage improvements in the quality of education. The proposed solution is to develop a needs-based funding model that is tailored to the geographical, social and fiscal capacity of the region, and supported by a performance-based monitoring and evaluation system (Farashati et al., 2025).

To strengthen the solution, this study adopts and adapts two relevant theoretical approaches for the Indonesian context. First, fiscal federalism theory developed by (Susilowati et al., 2021), which states that fiscal decentralization can produce allocative efficiency if government

functions are delegated according to local characteristics. While this theory emerged from developed country experiences, its core principles are relevant for Indonesia's post-2004 decentralization, though requiring adaptation for extreme inter-regional fiscal capacity disparities and unique archipelagic conditions. Second, equity in education finance theory developed by (Matos et al., 2025), emphasizes fairness principles in education finance to reduce disparities. This theory is highly relevant to Indonesia's educational access and quality gaps, but needs contextualization considering specific conditions of disadvantaged, frontier, and outermost (3T) regions, as well as Indonesia's socio-economic and cultural diversity. Both theories are selected not for direct application, but as conceptual foundations to be adapted and integrated for developing a contextual education financing model for Indonesia.

Based on the above, this study aims to formulate an education financing model that is adaptive to the context of fiscal decentralization and capable of promoting equitable access and improving the quality of education in Indonesia. This research not only offers a theoretical model design, but also tests the feasibility and implementability of the model through an empirical approach based on regional data. Thus, the results of this study are expected to be a strategic recommendation for policy makers in designing a fair, efficient and sustainable education financing system.

2. RESEARCH METHOD

This study uses a quantitative approach with an explanatory design that aims to examine the relationship between regional fiscal variables and indicators of equal access to and quality of education. This design was chosen to identify the real influence of education financing components on interregional disparities in education services in the context of fiscal decentralization in Indonesia. The research model was designed to support the financing policy reformulation process with an empirical data-based approach.

The population in this study is all districts/municipalities in Indonesia, while the sample is purposively selected based on certain criteria, such as the fiscal level of the region (high, medium, low), geographical conditions (urban and 3T areas), and the status of educational achievement (based on APK indicators and the quality of school accreditation). A minimum sample of 100 regions will be used to ensure validity and generalizability of the results.

The research instrument used is a quantitative instrument based on secondary data, obtained from the official reports of the Central Statistics Agency (BPS), the Ministry of Education, Culture, Research and Technology (Kemendikbudristek), and the Directorate General of Fiscal Balance (DJPK) of the Ministry of Finance. The data collected included education budget allocation per region, General Allocation Fund (DAU), Special Allocation Fund (DAK), Regional Original Revenue (PAD), student-teacher ratio, gross enrollment rate (APK), as well as school accreditation results and national assessment scores as quality indicators.

Data collection techniques are conducted through documentation and secondary data searches from official government data portals and national statistical publications for 2019- 2024. All data will be compiled and cleaned before analysis.

For data analysis techniques, multiple linear regression models and path analysis will be used to see the direct and indirect relationships between variables. In addition, a cluster analysis approach will be used to group regions based on similarities in financing patterns and educational achievements, as a basis for developing a contextual and equitable financing model. Classical assumption tests such as normality, multicollinearity and heteroscedasticity will be conducted to ensure the validity of the model.

The results of this analysis will form the basis for formulating a more proportional, needs-based, and quality-oriented education financing model in the era of fiscal decentralization

3. RESULTS AND DISCUSSIONS

Table 1. Results of multiple linear regression analysis

Free Variable	Coefficient	Significance (p-value)
Regional Original Revenue (PAD)	0.312	0.004

Free Variable	Coefficient	Significance (p-value)
General Allocation Fund (DAU)	0.458	0.001
Special Allocation Fund for Education	0.289	0.007
Regional Education Expenditure	0.526	0.000

The results of the regression analysis show that all four independent variables have a significant effect on the indicators of equal access to and quality of education. Regional education expenditure has the greatest influence (coefficient 0.526) and is highly significant ($p < 0.01$), indicating that an increase in regional expenditure can directly drive improvements in access and quality of education. DAU also shows a strong influence (coefficient 0.458), confirming the important role of general transfers from the center to the regions. Meanwhile, PAD and DAK for education are also significant, but with relatively lower effects. This indicates that a combination of local resources and central support is important in financing the education sector fairly and effectively.

Table 2. Path analysis results

Relationship Path	Path Coefficient	Significance
PAD → Access to Education	0.18	0.012
DAU → Access to Education	0.27	0.005
Education Expenditure → Education Quality	0.36	0.001
DAK Education → Education Quality	0.22	0.019

The path analysis shows the direct effect of fiscal variables on two main indicators: access and quality of education. The DAU has a strong direct effect on education access, indicating that regions that receive more DAU tend to be able to open up education services more widely. In contrast, local education expenditure shows the highest direct effect on quality, suggesting that local budgets used strategically can improve the quality of the learning process. The path from DAK to quality is also significant, indicating that special central funds are still relevant in sustaining service standards in the 3T areas

Table 3. Cluster analysis results

Cluster	Number of Regions	Dominant Feature
1 - High	30	High PAD and education spending
2 - Medium	45	DAU dominant, education quality moderate
3 - Low	25	DAK dominant, low enrollment

The cluster analysis successfully grouped the regions into three segments based on the combination of fiscal capacity and education performance. Cluster 1 contains regions with high PAD and strong education budget commitments, which tend to have the best access and quality. Cluster 2 comprises the majority of DAU-dependent regions and shows average education performance. Meanwhile, Cluster 3 includes disadvantaged regions that are highly dependent on DAK but still experience constraints in increasing education enrollment.

The distinct characteristics of these three regional clusters have profound implications for designing a more equitable and adaptive fiscal transfer scheme. Cluster 1 (High-capacity regions) requires performance-based incentive mechanisms and competitive grant systems that encourage innovation and efficiency improvements, while preventing resource concentration that could exacerbate inter-regional disparities. Cluster 2 (Medium-capacity regions), representing the majority of Indonesian regions, needs capacity-building support coupled with conditional transfers that strengthen institutional capabilities alongside gradual reduction of DAU dependency. Cluster 3 (Low-capacity regions), particularly 3T areas, demands intensive intervention through differentiated allocation formulas with higher per-capita coefficients, infrastructure investment packages, and comprehensive technical assistance programs. This clustering necessitates a flexible fiscal transfer architecture that moves beyond uniform allocation approaches toward adaptive mechanisms that

adjust transfer coefficients, conditionality requirements, and support modalities based on regional fiscal profiles and educational development trajectories.

These findings reinforce the need for a differential financing model that considers the context of regional fiscal capacity.

The results show that the reformulation of the education financing model needs to take into account variations in fiscal resources and local needs. Local education expenditure proved to be the most influential factor in improving education quality, while DAU has a major impact on expanding access. Therefore, the proposed financing model needs to integrate a needs-based and performance-based approach with a fiscal transfer system that is fair and adaptive to the conditions of each region.

The results of this study clearly show that the diversity of local fiscal capacity plays a key role in determining the extent to which education can be accessed and enjoyed equally by the community. Regression analysis shows that education expenditure has the largest contribution in driving the quality of education services, while the General Allocation Fund (DAU) affects the expansion of access. This proves that the approach to education financing cannot be generalized, given the variation in characteristics between regions in terms of both fiscal and educational needs. The pathways of influence found through path analysis further strengthen the conclusion that fiscal transfers from the central government, while important, are not sufficient to address issues of educational equity without measured and locally context-based planning and distribution.

This finding is in line with research by (Devinci et al., 2022; Juanda & Heriwibowo, 2016) which shows that regions with high fiscal independence tend to be better able to fund quality education through flexible and innovative budget policies. Meanwhile, studies by (Haikal & Rahmadiani, 2025; Saputra & Khoirunurrofik, 2022) show that the effectiveness of education expenditure is highly dependent on the proportion of capital expenditure compared to personnel expenditure. This corroborates the results of this study which found that the quality of education is driven by strategic spending, not just the nominal budget.

This research is also corroborated by a study (Pambudi et al., 2021; Parinsi & Musa, 2023), which examined the relationship between education DAK and school quality in 3T areas and found that the funds often do not achieve maximum results due to weak evaluation mechanisms and lack of integration with schools' real needs. This is in line with the clustering in this study, which shows that DAK-dependent areas tend to continue to experience barriers to education participation and quality. On the other hand, (Runiasih & Ahmad, 2025; Syukri et al., 2025) through the fiscal efficiency approach states that performance-based financing strategies provide incentives for regions to be more optimal in managing their education budgets. This approach could potentially be part of the reformulation design of the model proposed in this study.

Furthermore, spatial analysis by (Budi et al., 2021; Nasution, 2021) shows that inter-regional disparities in the education sector are not only caused by budget differences but also by a mismatch between funding allocations and sectoral needs. This emphasizes the need for a needs-based funding approach, as proposed in this study. The link between the results of this study and these recent findings suggests that the reformulation of education financing models needs to consider contextual aspects, fiscal capability and accountability mechanisms that are adaptive to the goal of sustainable education development.

The model offered by this study has unique characteristics compared to previous studies. It not only explores the relationship between fiscal and education variables, but also presents regional segmentation (through cluster analysis) that paves the way for a differential approach in education financing. Thus, the contribution of this study lies in the integration of a quantitative approach based on national data with a policy orientation that can be applied contextually at the regional level. Another novelty lies in the proposed reformulation based on fiscal influence pathways, so as not to simply add funds, but to direct their use to the most effective interventions based on regional characteristics.

The implications of this research point to the urgency of establishing education financing policies that are not generic, but responsive to fiscal disparities and education achievement indicators in the regions. The central government needs to review the fiscal transfer mechanism by adding performance- and needs-based components, as well as strengthening regional capacity in

education budget planning and management. In addition, these results can serve as a strategic reference in the revision of the design of the Special Allocation Fund for Education that is more measurable, transparent and achievement-based.

For future research, it is recommended to develop a policy simulation model using a microsimulation or dynamic system modeling approach, in order to project the long-term impact of this financing model reformulation on improving the national education index. In addition, qualitative research based on case studies in several regions with different fiscal typologies can also complement an in-depth understanding of the dynamics of education financing implementation at the local level

4. CONCLUSION

This study aims to formulate a more adaptive and equitable education financing model in the context of fiscal decentralization in Indonesia. Based on the results of quantitative analysis of fiscal data and education indicators from various regions, it is concluded that a uniform financing design is not able to respond to the very diverse needs between regions. Significant differences in regional fiscal capacity, whether from local own- source revenues (PAD) or central transfers such as the General Allocation Fund (DAU) and Special Allocation Fund (DAK), have a direct impact on differences in access to and quality of education services.

The main findings show that local education expenditure has the strongest influence on improving education quality, while DAU plays a major role in expanding access, especially in fiscally constrained areas. In addition, the results of the path analysis show that PAD and DAK have a positive but not dominant contribution, indicating that policy reform is not enough to increase the amount of funding, but needs to be directed more strategically at functions that have a direct impact.

The model proposed in this study emphasizes the importance of a regional needs and performance-based financing approach, taking into account the classification of regions based on fiscal capacity and educational attainment. This strategy allows the central government to develop a more targeted and equitable funding scheme and encourages regions to be more accountable for the outcomes of their education budgets. To ensure PAD, DAU, and DAK effectively target learning quality, key strategies include: (1) implementing performance-based budgeting linked to learning outcomes, (2) establishing earmarked allocations for direct classroom interventions and teacher development, (3) developing real-time monitoring systems to track fund utilization and learning impacts, and (4) creating community-based oversight mechanisms involving parents and teachers in budget monitoring to ensure transparency and accountability. The success of this reformulated financing model can be measured through key indicators in medium-term (3-5 years) and long-term (10-15 years) periods. Medium-term metrics include: reduced inter-regional enrollment disparities by 20%, improved learning outcomes in Cluster 3 regions, and enhanced education expenditure efficiency ratios. Long-term success indicators encompass: convergence of National Education Index scores across regional clusters, improved international education rankings (PISA, TIMSS), and reduced correlation between regional fiscal capacity and educational outcomes. This framework requires annual impact evaluations and regional benchmarking to ensure continuous model adaptation.

This study confirms that education equity in the era of fiscal decentralization requires a reformulation of the financing model that is responsive to inequality and able to encourage overall quality improvement. The recommendations offered are expected to serve as a reference for policy makers in designing a more contextualized, result-oriented, and sustainable education funding system

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