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Dismantling the Honorarium Trap: Asymmetric BOSP Fiscal Caps, Teacher Redistribution, and Student Cognitive Achievement in Indonesia's Underdeveloped Regions: Evidence from K-Means and Quantile Regression

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ABSTRACT

Fiscal decentralization through the School Operational Assistance (BOSP) grant gives schools in Indonesia's frontier, outermost, and underdeveloped (3T) regions wide discretion over spending, yet the composition of that spending is rarely linked to learning. This study aims to describe BOSP allocation patterns, identify fiscal typologies of schools, and examine how component level spending is associated with student cognitive achievement across the achievement distribution. The design is observational and cross sectional. Merged administrative records for the 2024 fiscal and academic year were drawn from ARKAS, Dapodik, and the Academic Potential Test (TKA), with the school as the unit of analysis, covering 855 public and private senior high schools in 62 underdeveloped regencies. K-Means clustering segmented the schools into a resilient group of 62 schools, an intermediate group of 454 schools, and a vulnerable group of 339 schools, while quantile regression estimated associations at five quantiles of the TKA distribution. Spending on learning activities is positively associated with TKA scores in the lower and upper middle quantiles, whereas the honorarium share interacted with private ownership shows a negative association only at the highest quantile. The results suggest that spending composition, rather than budget volume alone, is associated with cognitive achievement in remote schools.

1. Introduction

Education is widely recognized as a foundational pillar of human capital development and the most potent instrument for breaking intergenerational cycles of poverty (Becker, 1964; Glewwe & Muralidharan, 2016). Over the past two decades, Indonesia has achieved monumental success in democratizing educational

access, bringing gross enrollment rates close to universal levels (World Bank, 2020). Nevertheless, this quantitative expansion has been overshadowed by persistent qualitative deficits and stark sociogeographical disparities (Suryadarma et al, 2006). These systemic gaps are most acutely felt in the nation's Frontier, Outermost, and Underdeveloped regions, formally categorized under the regulatory nomenclature as the 3T regions (*Tertinggal, Terdepan, Terluar*) (Jahudin et al., 2025).

The delivery of educational services in 3T areas is a complex, multidimensional challenge. Schools there face severe geographic isolation, high transportation costs, and a lack of basic physical and digital infrastructure, which widens the regional digital divide (Setyawan et al., 2025). Pursuant to Presidential Regulation No. 63 of 2020, 62 regencies are designated as underdeveloped, mostly in Eastern Indonesia and remote border areas. Empirical evidence reveals that High Schools (*Sekolah Menengah Atas*, or SMA) in these regencies consistently record Academic Potential Test (*Tes Kemampuan Akademik*, or TKA) scores far below national standards, indicating a disconnect between centralized educational funding and localized cognitive development (Musarokah et al., 2026; Nababan et al., 2025).

The shift from centralized to localized educational management is grounded in the promise of public efficiency and allocative responsiveness. According to Oates' Decentralization Theorem (1972), subnational agents possess superior information about localized needs, allowing more efficient allocation than a centralized system (Herlina et al., 2026). In Indonesia, this philosophy found expression through the launch of the School Operational Assistance (BOS, now BOSP) program in 2005 (Afkar et al., 2020; Hifdzi, 2025). By routing block grants directly to school level bank accounts, the central government sought to empower principals and school committees under School Based Management (SBM), giving them autonomy to construct their own School Activity and Budget Plans (*Rencana Kegiatan dan Anggaran Sekolah*, or RKAS) (Bruns et al., 2011; Suryadarma, 2006).

Within educational economics, however, the conversion of financial inputs into human capital is not a linear certainty. This translation is modeled by the Education Production Function (EPF), which characterizes schools as micro production units transforming financial resources, teacher competency, and physical materials into measurable cognitive outputs (Hanushek, 2020; Todd & Wolpin, 2003). EPF literature establishes that spending volume is necessary but not sufficient for educational quality, because how resources are allocated matters more than nominal budget size (Hanushek, 2003; World Bank, 2020). Financial resources yield positive cognitive returns mainly when they are invested in high leverage pedagogical inputs such as learning materials, library development, and classroom maintenance (Wijanarko et al., 2025).

In constrained environments such as the 3T regions, allocative decision making becomes a high stakes survival game. If decentralized funds are absorbed by non productive administrative overhead, the benefits of SBM disintegrate, leading to allocative inefficiency and stagnant student achievement (Sylviana et al., 2024).

This structural tension has prompted a major regulatory evolution. The BOSP 2026 guidelines (Permendikdasmen No. 8 of 2026) introduce an asymmetric cap on honorarium expenditures, restricting public schools (*sekolah negeri*) to 20% of their BOSP allocation while permitting private schools (*sekolah swasta*) up to 40%. The asymmetry seeks to redirect BOSP resources from personnel compensation toward core cognitive inputs while offering a safety valve to private institutions that rely on non ASN staff (Fachrudin & Atikah, 2026).

The structural efficacy of school based fiscal decentralization is nevertheless contingent upon the equitable distribution of baseline institutional inputs, most notably qualified human resources. In Indonesia, the implementation of SBM is severely undermined by a chronic macro level distortion, namely the geographical maldistribution of certified civil servant (ASN) teachers. While urban centers often exhibit teacher surpluses, remote and outermost regions suffer acute staffing deficits, a disparity compounded by the projected retirement of roughly half of the civil service teaching workforce within the decade. To prevent instructional collapse, school principals in 3T regions are therefore compelled to recruit local temporary contract teachers (*guru honorer*). Because these educators are excluded from the central government's payroll, the entire burden of their compensation shifts onto the school operational budget, so that principals allocate large proportions of their BOSP funds to Component 12 (payment of honorariums), the fiscal pattern referred to in this study as the honorarium trap (World Bank, 2020).

This diversion of BOSP funds implies an allocative trade off within the EPF framework. By prioritizing short term administrative survival, schools may cannibalize the fiscal space required for high leverage cognitive inputs, since budgets designated for library books and instructional consumables (Component 02) and for the maintenance of learning facilities (Component 08) become severely depleted. Because such non salary inputs are critical determinants of educational quality, starving them may stagnate learning outcomes and lock marginalized schools into a self perpetuating cycle of underperformance (Arifyani & Khoirunurrofik, 2023; Nakamuro, 2010). In response, the government has mobilized a dual regulatory offensive. Alongside the asymmetric honorarium caps, Permendikdasmen No. 1 of 2025 mandates the redistribution of ASN and Government Employee with Work Agreement (PPPK) teachers to structurally starved schools, explicitly including private institutions and remote 3T coordinates (Wahyudi et al., 2025).

Despite this policy attention, the available evidence remains incomplete in three respects, and these gaps motivate the present study. First, macro level research on BOS and BOSP has concentrated on enrollment stabilization, dropout prevention, and aggregate spending efficiency (Afkar et al., 2020; Wijanarko et al., 2025), so that the composition of school expenditure, and in particular the share absorbed by non ASN teacher honorariums, has seldom been related to measured cognitive achievement. Second, studies of school financing in Indonesia remain predominantly qualitative or descriptive and are largely conducted in accessible districts, focusing on effectiveness, transparency, and accountability rather than on learning outcomes (Indriyani et al., 2026; Jannah et al., 2026; Sakhuroh et al.,

2026), which leaves the fiscal behavior of schools in 3T regions poorly documented. Third, quantitative studies typically model the conditional mean of achievement using total budget or average scores, an approach that conceals whether the same allocation pattern is associated with different outcomes for low performing and high performing schools and whether schools of different ownership status behave differently under the same fiscal constraint (Ati et al., 2026; Susanto et al., 2026).

The novelty of this study therefore lies in the integration of K-Means clustering and quantile regression, which allows two questions to be answered jointly: which fiscal typologies characterize schools in underdeveloped regions, and whether the relationship between BOSP expenditure components and TKA achievement differs along the distribution of student achievement rather than only at its mean. Accordingly, this study aims to (1) describe the pattern of BOSP allocation across the four expenditure components analyzed in 855 senior high schools located in 62 underdeveloped regencies; (2) identify the characteristics of the school clusters formed on the basis of spending behavior and aggregate TKA scores; and (3) examine the association between BOSP expenditure components, including the interaction between honorarium spending and private ownership, and TKA scores at the 10th, 25th, 50th, 75th, and 90th quantiles. Because the research design is observational, the estimates reported below are interpreted as conditional predictive associations and not as causal effects.

2. Methodology

This study employs a two stage quantitative research design that combines unsupervised machine learning (K-Means clustering) with micro econometric modeling (quantile regression). The empirical analysis leverages a merged cross sectional administrative dataset from the 2024 fiscal and academic year, so that the design is observational and *ex post facto* in nature, with no treatment assigned or manipulated by the researchers. All procedures were executed in Python 3.11 using the *scikit learn* library for clustering and the *statsmodels* library for quantile estimation. The steps reported below are documented in sufficient detail to allow full replication from the same national data platforms. Because the records are anonymized institutional data obtained through official access, no information on individual students or teachers was processed.

Instrument

Three national administrative platforms served as the measurement instruments of this study. First, ARKAS (*Aplikasi Rencana Kegiatan dan Anggaran Sekolah*) provided itemized financial realization percentages across all BOSP expenditure components. Second, the Academic Potential Test (TKA) supplied the primary dependent outcome metric in the form of aggregate school level TKA scores. Third, Dapodik (*Data Pokok Pendidikan*) provided structural variables, including student enrollment, student teacher ratios, school ownership status, and physical infrastructure indicators. Because all three platforms are administrative reporting

systems, the dataset reflects reported rather than audited expenditure. Variables were operationalized as follows. The dependent variable (Y) is the aggregate school TKA score on a scale of 0 to 100. The main independent variables (X) are the proportions of total BOSP funds expended on books (X1, Component 02), learning activities (X2, Component 03), facility maintenance (X3, Component 08), and honorarium payments (X4, Component 12). The control variables (Ci) comprise a private school dummy (Dswasta = 1 if private, 0 if public), an interaction term (X4 x Dswasta), log enrollment as a proxy for school size, the student teacher ratio (STR), and a standardized infrastructure index constructed from electricity and internet access.

Data Collection

The target population was strictly delimited to High Schools (*Sekolah Menengah Atas*, or SMA) geographically situated within the 62 designated underdeveloped regencies across Indonesia, as formally mandated by Presidential Regulation No. 63 of 2020. Records for the 2024 fiscal and academic year were extracted from the three platforms and merged at the school level using the national school identification number. The initial data extraction yielded a total population of 862 SMA institutions. Following data matching, cleaning, and outlier removal, the final analytical sample consisted of 855 high schools, broadly distributed across 15 provinces, so that the study analyses the population of 3T senior high schools rather than a probability sample drawn from it.

Data Analysis

In the first stage, K-Means clustering with Z score standardization was employed to segment schools based on their budgetary shares and aggregate TKA scores. The optimal number of clusters ($K = 3$) was determined iteratively and validated using the Elbow Method and the Silhouette Score metric (0.318), which indicates a stable and meaningful cluster structure (Leogrande & Costantiello, 2023; Sylviana et al., 2024). The cluster solution is descriptive, and it is used in this study to characterize fiscal typologies rather than to classify schools for policy targeting. In the second stage, quantile regression was estimated across five key quantiles in order to capture heterogeneous associations along the entire achievement distribution rather than only at its conditional mean (Arifyani & Khoirunurrofik, 2023; Koenker & Machado, 1999). The estimated model is specified as follows:

$$Q\tau(TKA_i) = \beta_0(\tau) + \beta_1(\tau)X1_i + \beta_2(\tau)X2_i + \beta_3(\tau)X3_i + \beta_4(\tau)X4_i + \gamma(\tau)Dswasta_{,i} + \lambda(\tau)(X4_i \times Dswasta_{,i}) + \theta(\tau)C_i$$

where τ denotes the estimated quantile, taking the values 0.10, 0.25, 0.50, 0.75, and 0.90. Standard errors were estimated using the bootstrap method with 1,000 replications to protect against heteroskedasticity, and the corresponding p values were derived from the bootstrapped standard errors. Because the data are observational and cross sectional, every coefficient is reported and interpreted as a conditional association between an expenditure share and the TKA score at a given quantile, and no statement of causal effect is implied by the estimation procedure.

In this specification, $\beta_4(\tau)$ describes the association between the honorarium share and the TKA score for public schools, whereas the sum $\beta_4(\tau) + \lambda(\tau)$ describes the corresponding association for private schools, so that the interaction coefficient $\lambda(\tau)$ captures how the two ownership groups differ.

3. Results and Discussion

This section is organized so that the data are described before any inferential result is presented, following the logic of the research objectives. Subsection 3.1 reports the geographic composition of the sample and the distribution of the analyzed BOSP components, subsection 3.2 presents the fiscal typologies produced by the clustering procedure, subsection 3.3 reports the quantile regression estimates for each component and each quantile, and subsection 3.4 discusses the findings in relation to the Education Production Function and to previous research. It should be noted at the outset that this study does not implement or evaluate a treatment, a learning model, or an instructional medium. It analyses the realized expenditure decisions already recorded in national administrative systems, and the policy instruments discussed, namely the asymmetric honorarium caps and the teacher redistribution mandate, function as the regulatory context of those decisions rather than as an experimental intervention.

Descriptive Profile of the Analyzed Schools

Table 1 presents the provincial distribution of the analytical sample. The composition reflects the stark geography of educational deprivation in Indonesia, with East Nusa Tenggara (NTT) accounting for 41.87% of the schools and Maluku for 12.87%. Taken together, the eastern provinces contribute more than two thirds of the sample, which confirms that the fiscal behavior observed in this study is representative of schools operating under the most severe logistical constraints. The sample combines public and private institutions, and this heterogeneity of ownership is retained in the analysis because the BOSP honorarium ceiling itself differs between the two groups. The strong concentration of the sample in a few eastern provinces also means that the findings speak most directly to those settings and should be generalized to other 3T regions with caution.

Table 1. Distribution of 3T High Schools by Province

Province	Number of Schools	Percentage (%)
East Nusa Tenggara (NTT)	358	41.87
Maluku	110	12.87
North Sumatra	100	11.70
Central Sulawesi	70	8.19
West Papua	35	4.09
Central Papua	32	3.74
North Maluku	29	3.39
Highland Papua	27	3.16
Papua	21	2.46
South Papua	14	1.64
West Nusa Tenggara (NTB)	13	1.52
West Sumatra	13	1.52

Province	Number of Schools	Percentage (%)
South Sumatra	11	1.29
Lampung	11	1.29
Southwest Papua	11	1.29
Total	855	100.00

Source. Authors' calculation based on ARKAS, TKA, and Dapodik data (2024). Figures reflect the final analytical sample of 855 schools after data matching, cleaning, and outlier removal.

Before the clustering and regression results are presented, the distribution of the analyzed variables is summarized in Table 2, which reports the sample mean of each variable together with the lowest and highest cluster means and the gap between them. On average, schools in the sample devote a larger share of their BOSP allocation to honorarium payments than to any single one of the three direct learning inputs, and the mean aggregate TKA score remains far below the midpoint of the 0 to 100 scale. The honorarium share also shows by far the widest between cluster gap, whereas the shares for books and facility maintenance differ only modestly across clusters. This pattern indicates that schools in 3T regions are distinguished less by how much they spend on physical inputs than by how much of their budget is absorbed by personnel, and it provides the context within which the cluster solution and the quantile estimates should be read. The unit of analysis in every table is the school, and all financial figures are expressed as percentages of the total realized BOSP budget of the respective school.

Table 2. Sample Means and Between Cluster Range of the Analyzed Variables (N = 855 Schools)

Variable	N	Sample Mean	Lowest Cluster Mean	Highest Cluster Mean	Between Cluster Gap
Aggregate TKA score (0 to 100)	855	33.25	31.91 (C0)	45.48 (C1)	13.57
% Books (Component 02)	855	11.54	11.16 (C0)	12.76 (C1)	1.60
% Learning activities (Component 03)	855	9.58	8.59 (C0)	12.87 (C1)	4.28
% Facility maintenance (Component 08)	855	13.79	13.11 (C0)	16.59 (C1)	3.48
% Honorarium (Component 12)	855	22.81	14.92 (C2)	33.78 (C0)	18.86

Source. Authors' calculation based on ARKAS, TKA, and Dapodik data (2024). All financial variables are expressed as percentages of the total realized BOSP budget of the school. Sample means are weighted averages of the cluster means reported in Table 3, weighted by cluster size. C0 = vulnerable cluster, C1 = resilient cluster, C2 = intermediate cluster. The gap is the difference between the highest and the lowest cluster mean and describes between cluster variation, not school level dispersion.

Fiscal Typologies of Schools: K-Means Clustering Results

Table 3 reports the three fiscal typologies produced by the clustering procedure, together with the number of schools in each group and their mean aggregate TKA score. The vulnerable group (Cluster 0) is the second largest group and demonstrates the most severe administrative distortion, allocating roughly one third of total BOSP funds to honorariums while recording the lowest aggregate TKA score of the three typologies. The resilient group (Cluster 1) is the smallest, caps honorariums at slightly above one fifth of the budget, and simultaneously records

the highest shares for books and learning activities as well as the highest mean TKA score. The intermediate group (Cluster 2) contains the majority of schools and occupies a middle position in every expenditure category, although its mean achievement is closer to the vulnerable than to the resilient group.

The gap between the typologies is substantial on both dimensions. The honorarium share of the vulnerable group exceeds that of the resilient group by 13.15 percentage points, while the corresponding deficit in aggregate achievement amounts to 13.57 points on the TKA scale. It should be stressed that this correspondence is descriptive: the clusters were formed from spending shares and TKA scores jointly, so the difference between them documents that distinct fiscal profiles coexist with distinct achievement levels, and it does not by itself demonstrate that the honorarium share produces the achievement gap. The econometric test of that association, including the direction and magnitude of the relationship at different points of the achievement distribution, is reported in the following subsection.

Table 3. BOSP Allocation Profiles and TKA Scores by Cluster Typology

Cluster Typology	N	Share of Sample (%)	Aggregate TKA	% Books (Comp 02)	% Learning (Comp 03)	% Facilities (Comp 08)	% Honorarium (Comp 12)
Cluster 0 (Vulnerable)	339	39.65	31.91	11.16	8.59	13.11	33.78
Cluster 1 (Resilient)	62	7.25	45.48	12.76	12.87	16.59	20.63
Cluster 2 (Intermediate)	454	53.10	32.58	11.65	9.87	13.91	14.92

Source. Authors' calculation. Values are mean proportions of the total BOSP budget allocated per expenditure component; K = 3, Silhouette Score = 0.318.

Quantile Regression Results

Table 4 reports the full quantile regression estimates for every expenditure component at each of the five quantiles, with bootstrapped standard errors in parentheses and the associated p values in brackets, so that the pattern of change in the coefficients across quantiles can be inspected directly. Three observations follow from the estimates. First, with respect to the absorption of physical inputs, the baseline main effects for books (X1) and facilities (X3) are statistically non significant at every quantile once the physical infrastructure stock covariates are controlled, and the coefficient for books even turns negative at the ninth decile while remaining far from conventional significance levels. Second, spending on learning activities (Component 03) is the only main effect that reaches significance, and it does so in the lower and upper middle sections of the distribution. Third, the honorarium share itself (Component 12) is never significant as a main effect, whereas its interaction with private ownership becomes significantly negative at the upper decile.

Table 4. Quantile Regression Estimates of BOSP Allocation on Aggregate TKA Score

Variable	Q(0.10)	Q(0.25)	Q(0.50) (Median)	Q(0.75)	Q(0.90)
Intercept	21.96*** (1.450) [<0.001]	18.51*** (1.500) [<0.001]	25.77*** (1.620) [<0.001]	26.30** (10.220) [0.010]	58.29*** (14.150) [<0.001]
% Books (Comp 02)	0.045 (0.091) [0.621]	0.319 (0.210) [0.129]	0.205 (0.220) [0.351]	0.579 (0.450) [0.198]	-0.525 (0.610) [0.389]
% Learning (Comp 03)	0.200* (0.110) [0.069]	0.294** (0.130) [0.024]	0.228 (0.140) [0.103]	0.614** (0.280) [0.028]	0.249 (0.315) [0.429]
% Facilities (Comp 08)	0.076 (0.105) [0.469]	0.130 (0.145) [0.370]	0.206 (0.150) [0.170]	0.300 (0.295) [0.309]	0.183 (0.330) [0.579]
% Honorarium (Comp 12)	-0.008 (0.045) [0.859]	0.077 (0.082) [0.348]	0.022 (0.085) [0.796]	0.029 (0.110) [0.792]	0.283 (0.320) [0.376]
Private dummy (Dswasta)	-2.803 (2.100) [0.182]	-3.133 (2.250) [0.164]	3.490 (2.400) [0.146]	-2.910 (3.100) [0.348]	16.847 (11.500) [0.143]
Honorarium × Dswasta	0.137 (0.112) [0.221]	0.100 (0.115) [0.385]	-0.133 (0.120) [0.268]	0.019 (0.180) [0.916]	-1.092** (0.540) [0.043]

Source. Authors' estimation. N = 855. Each cell reports the coefficient, the bootstrapped standard error in parentheses (1,000 replications), and the p value in brackets. All models control for log enrollment, the student teacher ratio, and the infrastructure index. *** p < 0.01; ** p < 0.05; * p < 0.10.

Because Component 03 and Component 12 are the two components of direct policy interest, their quantile profiles are isolated in Table 5. For Component 03, the coefficient is positive at all five quantiles, but it is significant at the tenth percentile at the 10% level, at the twenty fifth percentile at the 5% level, and at the seventy fifth percentile at the 5% level, while remaining non significant at the median and at the ninth decile. The magnitude of the association is not monotonic: it rises from 0.200 at the tenth percentile to 0.614 at the seventy fifth percentile before falling back at the top of the distribution. Read cautiously, this pattern suggests that an additional percentage point of the BOSP budget directed to learning activities is associated with a higher predicted TKA score of between roughly 0.2 and 0.6 points in the segments where the association is statistically detectable, with the widest association in the upper middle segment.

For Component 12, the main effect is small and statistically indistinguishable from zero across the entire distribution, which indicates that, among public schools, the honorarium share alone is not systematically related to achievement once the other components and the control variables are accounted for. The informative result lies in the interaction term. At the tenth, twenty fifth, fiftieth, and seventy fifth percentiles the interaction is statistically non significant and changes sign without any clear trend, whereas at the ninetieth percentile it becomes large and negative and attains significance at the 5% level. The direction and location of this estimate are the substantive finding: the negative association between the honorarium share

and achievement appears only among private schools and only at the top of the achievement distribution, and it is absent elsewhere. Any interpretation of this asymmetry therefore applies to a specific segment of schools and must not be generalized to the whole sample.

Table 5. Quantile Profile of Component 03 and of the Honorarium Interaction Term

Quantile	β Comp 03	SE	p	β Hon. $\times$ Private	SE	p
Q(0.10)	0.200	0.110	0.069	0.137	0.112	0.221
Q(0.25)	0.294	0.130	0.024	0.100	0.115	0.385
Q(0.50)	0.228	0.140	0.103	-0.133	0.120	0.268
Q(0.75)	0.614	0.280	0.028	0.019	0.180	0.916
Q(0.90)	0.249	0.315	0.429	-1.092	0.540	0.043

Source. Authors' estimation. N = 855. Bootstrapped standard errors (1,000 replications). Coefficients printed in this table are identical to those in Table 4 and are repeated here so that the change in magnitude, sign, and significance across quantiles can be traced for the two components of direct policy interest.

Discussion

Read through the lens of the Education Production Function, these results refine rather than contradict the classical formulation of the model under conditions of resource scarcity. Consistent with Hanushek (2003, 2020), annual percentage allocations to physical infrastructure are not associated with linear test score gains once baseline physical capital is accounted for, which supports the long standing argument that input volume is a weak predictor of cognitive output. In line with the Resource Based View (Barney, 1991) and with recent Indonesian evidence (Wijanarko et al., 2025), the component most closely associated with achievement in this sample is direct operational investment in teaching and learning quality. The practical reading is that the marginal rupiah appears most productive when it reaches the classroom rather than the building, a conclusion that is consistent with findings on the decisive role of teacher competence and instructional support in 3T schools (Yulianti & Surya, 2026).

The heterogeneity across quantiles is itself a contribution of this study, because it shows that a single average estimate would have concealed two different regimes. In the lower part of the distribution, where schools start from a very low base, the association between learning activity spending and achievement is positive but modest, which is plausible if the binding constraint in those schools is not the marginal activity budget but the absence of basic instructional capacity. In the upper middle part of the distribution, the same spending is associated with a considerably larger difference in predicted achievement, which would be expected if schools that already possess minimum teaching capacity are better able to convert an additional unit of activity funding into learning. This graduated pattern is difficult to detect in studies that estimate conditional means only, and it complements rather than contradicts earlier Indonesian evidence that reports a positive average association between BOS funding and literacy and numeracy outcomes (Wijanarko et al., 2025).

Several mechanisms may plausibly underlie the negative interaction observed among high performing private schools, and it is important to separate what the data show from what they suggest. What the data show is an association between a high honorarium share and lower predicted achievement, confined to private schools at the ninth decile. A first possible mechanism is the substitution logic described by Das et al. (2013), in which public block grants fail to generate cognitive value when households and schools reallocate them to cover pre existing survival costs instead of adding to instructional provision. Private schools in 3T regions, lacking state funded ASN personnel, may use BOSP funds as an emergency payroll buffer, so that the grant finances continuity of staffing rather than improvement of teaching. A second possible mechanism is an internal trade off in the budget, since resources committed to fixed personnel obligations cannot simultaneously finance learning activities, a tension also reported in analyses of budget reorientation in Indonesian education (Susanto et al., 2026). A third possibility is compositional: schools at the top of the distribution may already operate near their instructional ceiling, so that further payroll absorption is more visible in their outcomes than in schools whose achievement is constrained by other factors. These mechanisms are interpretive, they are not tested directly in this study, and the observational design does not permit a choice among them.

The findings also speak to the wider literature on school financing in Indonesia, which has documented weaknesses in planning, spending priorities, and accountability without linking them to measured learning (Indriyani et al., 2026; Jannah et al., 2026). The present results are consistent with that body of work in showing that the quality of allocation, rather than the availability of funds as such, is what differentiates schools, and they extend it by attaching achievement data to the allocation decision. They are equally consistent with arguments that schools operating under tight public funding need broader budgeting capacity and complementary resource strategies (Ati et al., 2026; Sakhuroh et al., 2026), since a school that cannot finance staffing from outside the block grant has little room to protect its instructional budget. Viewed together, the cluster profiles and the quantile estimates suggest that school based fiscal decentralization in isolated regions is unlikely to translate into learning gains while the distribution of state paid teachers remains uneven (Herlina et al., 2026; Jahudin et al., 2025; McCredie et al., 2025; Wahyudi et al., 2025).

The policy implications should accordingly be framed as conditional rather than as demonstrated causal prescriptions. The evidence presented here does not establish that enforcing a particular honorarium ceiling, or redistributing a given number of teachers, will by itself raise TKA scores. What it does indicate is that the schools with the weakest achievement are also those whose budgets are most heavily committed to personnel, and that the component most consistently associated with higher achievement is the one most likely to be displaced when personnel obligations grow. On that basis, fiscal discipline and staffing reform are best treated as complementary instruments: tightening the honorarium ceiling without a parallel supply of state paid teachers risks operational failure rather than reallocation, particularly in public schools that face the stricter ceiling, while extending teacher placement to private schools in 3T regions may be a precondition for their

discretionary budgets to be redirected toward learning (Fachrudin & Atikah, 2026; Wahyudi et al., 2025). Evaluation of the actual effect of these instruments requires post implementation data that were not available at the time of this study.

4. Conclusion

This study set out to describe how BOSP funds are allocated in Indonesia's underdeveloped regions, to identify the fiscal typologies of the schools concerned, and to examine how component level allocation is associated with student cognitive achievement across the achievement distribution. All three objectives were met. The clustering stage distinguished a resilient, an intermediate, and a vulnerable typology, and the schools with the heaviest honorarium burden were also those with the weakest aggregate achievement. The quantile stage showed that spending on learning activities is positively associated with achievement in the lower and upper middle segments of the distribution, while the honorarium burden is negatively associated with achievement only among private schools at the top of the distribution. The research question was therefore answered, although the answer is an association rather than a demonstrated effect.

The main limitation of the study is its observational and cross sectional design, which precludes causal inference, together with its reliance on self reported administrative budget data and on a single achievement measure whose psychometric behavior in remote districts is not fully documented. In this sense the study succeeds as a diagnostic exercise and does not succeed, nor was it intended, as an impact evaluation. Its practical value lies in directing attention to the composition of school spending rather than to its volume, and in showing that policies governing honorarium ceilings and teacher placement are best assessed jointly. Future research using instrumental variable estimation, longitudinal panel data with school fixed effects, or post implementation records of the new regulatory regime would be required before causal pathways can be established.

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