

Process Output Gaps in Educational Performance Across Bali: A Regional Typology for Targeted Education Policy

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ABSTRACT

Regional education evaluation often emphasizes overall performance rankings, which may obscure whether favorable educational processes are consistently aligned with student outcomes. This study examines process-output alignment across Bali's nine local government territories using data from *Rapor Pendidikan Indonesia 2025*. A quantitative evaluative-comparative, cross-sectional design was employed. Nine educational process indicators and three output indicators were transformed from ordinal categories into standardized scores, aggregated into a Process Index (PI) and Output Index (OI), and used to calculate process-output gaps. Spearman's rank correlation and a median-based four-quadrant typology were then applied. The results show substantial territorial variation. The OI exceeded the PI in all regions, with the largest gaps observed in Klungkung, Bangli, and Jembrana, while Buleleng showed the closest numerical alignment. The PI and OI were moderately positively associated ($p = 0.552$, $p = 0.123$, $n = 9$), although the relationship was not statistically significant. The typology identified consolidated performance, educational resilience, conversion gaps, and structural vulnerability. These findings support differentiated regional education policy, while interpretation remains limited by cross-sectional aggregated data and ordinal score transformation.

Evaluasi pendidikan daerah sering menekankan peringkat kinerja secara keseluruhan, sehingga dapat mengaburkan apakah kondisi proses pendidikan yang baik benar-benar selaras dengan capaian siswa. Penelitian ini menganalisis keselarasan proses-output pada sembilan wilayah pemerintah daerah di Bali menggunakan data Rapor Pendidikan Indonesia 2025. Penelitian menggunakan desain kuantitatif evaluatif-komparatif dengan pendekatan cross-sectional. Sembilan indikator proses dan tiga indikator output ditransformasikan dari kategori ordinal menjadi skor terstandar, kemudian diagregasikan ke dalam Process Index (PI) dan Output Index (OI), serta digunakan untuk menghitung process-output gap. Analisis dilanjutkan dengan korelasi peringkat Spearman dan tipologi empat kuadran berbasis median. Hasil menunjukkan adanya variasi kewilayahan yang cukup jelas. Nilai OI lebih tinggi daripada PI di seluruh wilayah, dengan gap terbesar di Klungkung, Bangli, dan Jembrana, sedangkan Buleleng menunjukkan keselarasan numerik terdekat. PI dan OI memiliki hubungan positif sedang ($p = 0,552$; $p = 0,123$; $n = 9$), tetapi tidak signifikan secara statistik. Tipologi menghasilkan kategori consolidated performance, educational resilience, conversion gap, dan structural vulnerability. Temuan ini mendukung kebijakan pendidikan daerah yang lebih terdiferensiasi, dengan keterbatasan pada data agregat cross-sectional dan transformasi skor ordinal.]

Keywords: educational performance, educational policy, process output gap, regional typology

Introduction

Quality education is increasingly understood as more than the expansion of school access or the attainment of minimum academic standards. Within the Sustainable Development Goal 4 agenda, education systems are expected to provide inclusive, equitable, and meaningful learning opportunities while ensuring that differences in students' educational experiences and outcomes are not systematically reproduced by their social or territorial circumstances. Educational equity itself is multidimensional, encompassing the distribution of resources,

learning experiences, educational outcomes, and opportunities for growth rather than merely the achievement of identical results across populations (Levinson et al., 2022). Recent evidence from international assessments further demonstrates that socioeconomic inequalities in education remain persistent and vary considerably across education systems, indicating that improvements in aggregate performance do not necessarily imply improvements in equity (Enchikova et al., 2024). Consequently, evaluating educational quality requires attention not only to what students ultimately achieve, but also to the educational conditions through which those achievements are produced.

From a systems perspective, student outcomes emerge from the interaction of educational resources, institutional capacity, school leadership, teaching practices, and the quality of students' learning environments. Cross-cultural evidence indicates that dimensions of school quality—including teacher availability, classroom conditions, and access to learning resources—are associated with literacy and numeracy achievement, although the strength of these relationships differs considerably across contexts (Rawlings et al., 2024). Resource provision alone is also insufficient to guarantee equitable outcomes. Using international PISA data, the latest study showed that students from different socioeconomic backgrounds may derive unequal benefits from school resources (Yang & Lee, 2022), while others demonstrated that instructional leadership and socioeconomic conditions interact in shaping achievement gaps (Gümüş et al., 2022). In the Indonesian context, strengthening teacher professional development has similarly been identified as an important mechanism through which changes in classroom practice can contribute to student engagement and learning outcomes (Rahmi & Rasanjani, 2025). These findings suggest that the central policy question should extend beyond whether educational resources are available to whether educational processes effectively transform those resources into meaningful student outcomes.

The quality of the educational process is particularly important because students experience schooling through everyday interactions, pedagogical practices, school safety, inclusion, belonging, and institutional climate. A recent meta-analysis confirmed that both school and classroom climate are systematically associated with academic achievement, with school-level climate displaying a particularly meaningful relationship with student performance (Erdem & Kaya, 2024). Evidence from Indonesia likewise indicates that school climate is associated with reading achievement; disruptive behavior can undermine performance, whereas stronger school communities may provide supportive conditions for learning (Pamularsih, 2022). Cross-national PISA evidence further shows that discriminatory school climates are associated with lower mathematics and reading performance, partly through reduced school belonging and weaker valuation of learning (Baysu et al., 2023). Inclusion is therefore not merely a normative dimension of educational quality. Institutional and social inclusion can also shape academic outcomes, particularly for students located within vulnerable or minority groups (Kende et al., 2024). Moreover, broader evidence from school-based social and emotional learning interventions demonstrates that improvements in students' social-emotional competencies, relationships, school functioning, and climate can coexist with improvements in academic achievement (Cipriano et al., 2023). Collectively, these studies provide a strong theoretical basis for treating learning quality, safety, diversity, inclusiveness, and supportive learning conditions as substantive components of the educational process rather than peripheral characteristics of schooling.

However, the relationship between favorable educational processes and student outcomes should not be assumed to be uniform across territories. Regional differences in

socioeconomic conditions, institutional resources, student composition, accessibility, and school environments can produce different pathways from schooling conditions to learning achievement. For example, found that both socioeconomic composition and school climate contribute to achievement disparities between metropolitan and regional students, illustrating that geographically structured inequalities cannot be explained solely by individual characteristics (Perales et al., 2023). This issue is particularly relevant in Indonesia. Using the Indonesian PISA 2022 sample, it was showed that persistent urban–rural differences in mathematics, reading, and science performance and showed that geographical location interacts with socioeconomic status, institutional characteristics, resource shortages, school climate, educational leadership, and parental involvement (Aditia & Széll, 2025). Their findings reinforce the importance of examining educational performance territorially because apparently similar systems of schooling may operate under substantially different institutional and socioeconomic environments.

Despite this growing body of evidence, an important analytical gap remains. Much educational evaluation continues to focus either on separate indicators of school conditions and learning outcomes or on composite measures that summarize several dimensions into an overall performance score. These approaches are useful for monitoring, benchmarking, and identifying broad inequalities, but they may obscure a policy-relevant question: do territories with relatively favorable educational processes also display correspondingly strong student outputs? The literature establishes that school quality, climate, resources, leadership, and inclusion are related to educational achievement, but it simultaneously demonstrates considerable contextual heterogeneity in the strength and direction of these relationships (Erdem & Kaya, 2024; Rawlings et al., 2024; Yang & Lee, 2022). This implies that strong process conditions cannot automatically be interpreted as evidence of strong outcomes. Conversely, relatively favorable student outcomes may sometimes coexist with process conditions that remain vulnerable. Examining this alignment is important because the same overall level of educational performance may conceal fundamentally different policy problems: one territory may require improvement in learning conditions, while another may need to improve the capacity of an already favorable educational process to generate stronger learning outcomes.

This distinction is especially relevant for Bali Province, where education is administered across nine regencies and municipality with diverse territorial and institutional characteristics. The broader research dataset underlying this study organizes educational performance into input, process, output, and outcome dimensions. For the present article, the analytical focus is deliberately narrowed to the process–output interface. The process dimension encompasses learning quality, developmentally appropriate early-childhood learning, foundational learning, school safety, diversity, inclusiveness, early-childhood learning environments, and accreditation-related quality indicators, while direct educational outputs are represented by student literacy, numeracy, and character. This narrower analytical focus represents a substantive departure from evaluating overall regional performance: instead of asking which local government performs best across a multidimensional set of indicators, the present study asks whether relatively favorable educational processes are consistently accompanied by strong student outputs.

Accordingly, this study examines process–output alignment and mismatch in educational performance across Bali’s local governments. It addresses four interrelated questions: how educational process conditions vary across territories; how literacy, numeracy, and student character outcomes differ among local governments; the extent to which process conditions

and student outputs are aligned; and what regional typologies emerge from different combinations of process and output performance. The study contributes to the literature in three respects. First, conceptually, it shifts regional education evaluation from overall performance ranking toward the relationship between educational processes and direct student outcomes. Second, analytically, it introduces a process–output gap perspective that distinguishes alignment from different forms of mismatch rather than reducing regional performance to a single composite position. Third, from a policy perspective, the resulting regional typology is intended to support differentiated interventions by distinguishing territories with consolidated process–output performance, territories experiencing a conversion gap, territories displaying relative educational resilience, and territories facing simultaneous process and output vulnerabilities. Such an approach can strengthen evidence-based educational planning by moving policy discussion from the question of which region performs better toward the more diagnostic question of how effectively educational processes are translated into student outcomes.

Methods

Research Design and Unit of Analysis

This study employed a quantitative evaluative comparative design with a cross-sectional regional approach. The unit of analysis consisted of all nine local-government areas in Bali Province: Badung, Bangli, Buleleng, Gianyar, Jembrana, Karangasem, Klungkung, Tabanan, and Denpasar. Because the analysis covered the complete set of regencies and the city within Bali, the study used a regional census rather than probabilistic sampling. The analytical objective was not to construct an overall ranking of local governments, but to examine the degree of alignment and mismatch between educational process conditions and direct student outputs across territories. Regional comparison is particularly relevant in the Indonesian context because educational achievement varies across geographical, institutional, and socioeconomic settings (Aditia & Széll, 2025).

Data Source and Indicator Selection

The study used aggregated secondary data from *Rapor Pendidikan Indonesia 2025*, which reports educational performance using data principally referring to the 2024 education year. The report integrates information from national assessment, learning-environment surveys, administrative education databases, and other official statistical sources. The indicators were reorganized into two analytical dimensions: educational process and educational output. The Rapor Pendidikan is an official evaluation instrument for the national education system and integrates multiple administrative and assessment sources (Kementerian Pendidikan Dasar dan Menengah Republik Indonesia [Kemendikdasmen], 2025).

The process dimension consisted of nine indicators: (1) Learning Quality; (2) PAUD Accredited at Least B; (3) Age-Appropriate Early-Childhood Learning; (4) Foundational Learning; (5) School Safety Climate; (6) Early-Childhood Safety Climate; (7) School Diversity Climate; (8) School Inclusiveness Climate; and (9) Early-Childhood Inclusiveness and Diversity Climate. The output dimension consisted of three direct student-performance indicators: (1) Student Literacy; (2) Student Numeracy; and (3) Student Character. This analytical separation between educational-process conditions and student outputs is consistent with research that distinguishes school and classroom quality conditions from direct academic outcomes (Erdem & Kaya, 2024; Rawlings et al., 2024). Where an indicator was reported for several education subgroups or administrative authorities within the same local-government territory, all valid

subgroup observations were included in the regional aggregation. Therefore, the resulting values represent territorial educational profiles rather than scores restricted solely to services directly administered by the district/city government. Observations reported as *data unavailable* or *not applicable* were treated as missing and excluded from the denominator.

Ordinal Score Transformation and Regional Indicator Aggregation

The original Rapor Pendidikan indicators were reported using three ordered qualitative performance categories: *Kurang* (Low), *Sedang* (Moderate), and *Baik* (Good). To permit systematic aggregation across indicators and territories, these categories were transformed monotonically into standardized ordinal scores as follows: Because transformation and scoring decisions can materially influence composite-indicator results, the coding rule was defined transparently and applied consistently across all territories (Greco et al., 2019; Kelemen et al., 2024).

$$S(c) = \begin{cases} 0, & c = \text{Kurang} \\ 50, & c = \text{Sedang} \\ 100, & c = \text{Baik} \end{cases}$$

For an indicator reported across multiple valid education subgroups, the regional indicator score was calculated as the arithmetic mean of all valid subgroup scores:

$$I_{ij} = \frac{1}{m_{ij}} \sum_{h=1}^{m_{ij}} S_{ijh}$$

where I_{ij} denotes the standardized score for region i on indicator j ; S_{ijh} is the ordinal score for valid subgroup h ; and m_{ij} is the number of valid subgroup observations available for that region-indicator combination. The 0-50-100 transformation was used as an equal-step ordinal coding scheme to preserve the ordering of the original categories. The resulting scores are therefore interpreted as standardized comparative performance levels, not as absolute interval-scale measures of educational quality. In particular, a score of 100 should not be interpreted as representing twice the educational quality of a score of 50.

Construction of the Process Index and Output Index

To provide comparable regional summaries, two composite indices were constructed using equal weighting. Equal weighting was selected because the purpose of the study was diagnostic comparison of process-output configurations rather than preference-based prioritization of indicators. Each process indicator contributed equally to the Process Index, and each output indicator contributed equally to the Output Index. Equal weighting provides a transparent aggregation rule when no defensible empirical or normative basis exists for assigning different importance to individual indicators (Greco et al., 2019; Shi & Land, 2021).

For each region, the Process Index (PI) was calculated as the mean of the nine process-indicator scores:

$$PI_i = \frac{1}{9} \sum_{j=1}^9 P_{ij}$$

where PI_i denotes the Process Index for region i and P_{ij} denotes the standardized score of process indicator j in region i . The Output Index (OI) was calculated as the mean of the three student-output indicators:

$$OI_i = \frac{1}{3} \sum_{k=1}^3 O_{ik}$$

where OI_i denotes the Output Index for region i and O_{ik} denotes the standardized score of output indicator k in region i . Both indices therefore retain the same 0-100 comparative scale as the underlying standardized indicator scores.

Process Output Gap Measurement

The degree of numerical alignment between educational process conditions and student outputs was examined using the Process Output Gap (POG). For each region, the signed gap was calculated as:

$$POG_i = OI_i - PI_i$$

A positive value indicates that the standardized Output Index is numerically higher than the Process Index, while a negative value would indicate the reverse. To evaluate the magnitude of the discrepancy irrespective of direction, the absolute gap was also calculated:

$$APOG_i = |OI_i - PI_i|$$

The gap is interpreted as a descriptive diagnostic measure of process-output mismatch. It is not treated as an efficiency score and does not imply that weaker educational processes cause stronger outputs or vice versa. This distinction is important because composite performance summaries and formal efficiency measures address different analytical questions and should not be interpreted interchangeably (Greco et al., 2019; Shi & Land, 2021).

Regional Process-Output Typology

A four-quadrant regional typology was developed to identify different configurations of process and output performance. Because the study contains only nine territorial units and the indices are intended for relative regional comparison, the median was used as the internal reference point for both dimensions: The use of an explicitly stated internal benchmark also supports transparency and reproducibility in composite indicator interpretation, where classification and aggregation choices should be made visible to readers (Greco et al., 2019).

$$M_{PI} = \text{median}(PI_i)$$

$$M_{OI} = \text{median}(OI_i)$$

Using the observed regional medians ($M_{PI} = 80.56$ and $M_{OI} = 90.74$), each local-government area was assigned to one of four categories:

- Consolidated Educational Performance : $PI_i \geq M_{PI}$ and $OI_i \geq M_{OI}$.
- Conversion Gap : $PI_i \geq M_{PI}$ and $OI_i < M_{OI}$.
- Educational Resilience : $PI_i < M_{PI}$ and $OI_i \geq M_{OI}$.
- Structural Educational Vulnerability : $PI_i < M_{PI}$ and $OI_i < M_{OI}$.

The term Conversion Gap is positional and relative to the two regional medians. It does not imply that a region's numerical Output Index is lower than its Process Index. Instead, it identifies territories with a comparatively strong process position but a comparatively weaker output position within the Bali distribution.

Exploratory Association between Process and Output

The relationship between the Process Index and Output Index was evaluated using Spearman's rank-order correlation. Spearman correlation was selected as the primary association measure because the composite scores were derived from ordered qualitative categories and because the analysis involved only nine regional observations. The coefficient can be expressed as the Pearson correlation between the rank-transformed Process and Output indices: Spearman's rho is appropriate for rank-based association analysis and is

particularly useful when variables are ordinal, non-normal, or potentially affected by outliers; its behavior relative to Pearson correlation across different distributions and sample sizes has been examined extensively (de Winter et al., 2016).

$$\rho_s = \text{cor}[R(PI_i), R(OI_i)]$$

where $R(PI_i)$ and $R(OI_i)$ denote the ranks of the Process Index and Output Index, respectively. Average ranks were used automatically in the presence of tied values. Statistical significance was evaluated using a two-tailed test at $\alpha = 0.05$. Given the small number of territorial units, the correlation was interpreted primarily as an exploratory indicator of regional process-output alignment, rather than as confirmatory or causal evidence.

Data Processing and Software

Data verification, ordinal score transformation, regional aggregation, index construction, median calculation, and process-output gap calculations were conducted using Microsoft Excel. Spearman's rank order correlation and graphical analyses were performed using jamovi. The analytical workflow proceeded sequentially from verification of the original qualitative categories, transformation into standardized ordinal scores, aggregation of valid subgroup observations, construction of the Process and Output indices, calculation of regional gaps, exploratory correlation analysis, and development of the four quadrant regional typology.

Result

The standardized indicator profiles reveal considerable territorial variation in the educational process dimension across Bali's nine local governments. Although several process indicators display consistently favorable scores, others remain comparatively weak or uneven across regions. The most consistently strong process dimensions are school safety, school inclusiveness, and early childhood inclusiveness and diversity, whereas age appropriate early childhood learning and foundational learning show lower standardized scores in several territories. Learning quality also varies substantially across regions, indicating that the quality of classroom interaction and learning management is not uniformly distributed.

Table 1. Standardized Process and Output Indicator Scores across Bali's Local Governments

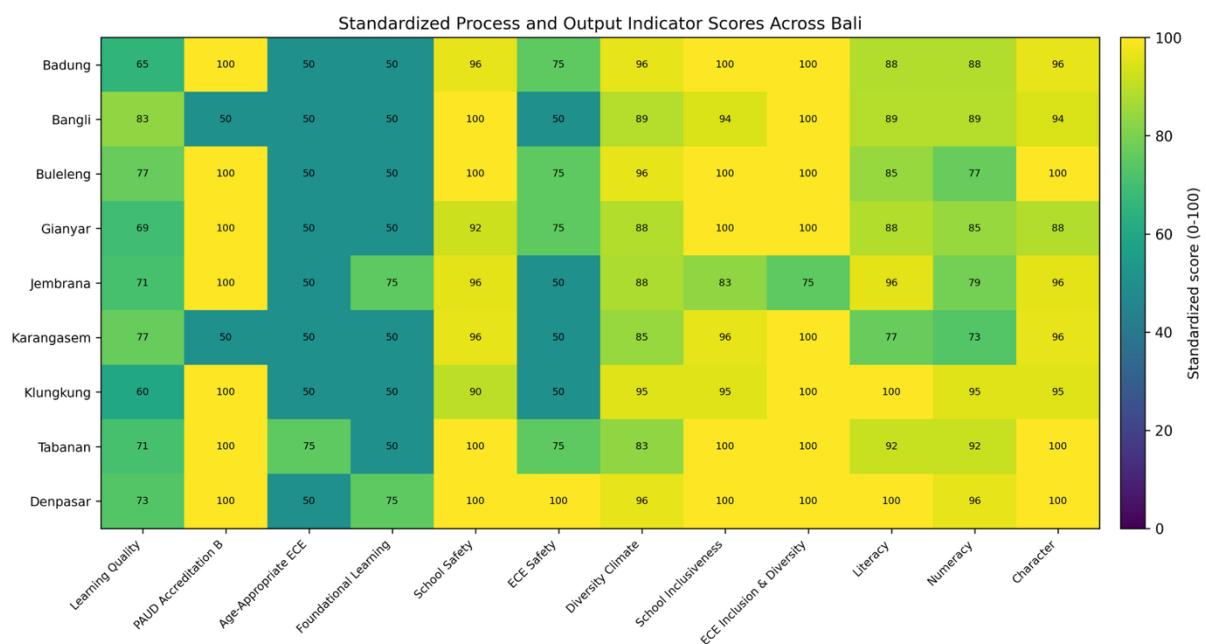
Region	LQ	PAUD-B	ECE-L	FL	SS	ECE-S	DC	SI	ECE-ID	Literacy	Numeracy	Character
Badung	65.38	100.00	50.00	50.00	96.15	75.00	96.15	100.00	100.00	88.46	88.46	96.15
Bangli	83.33	50.00	50.00	50.00	100.00	50.00	88.89	94.44	100.00	88.89	88.89	94.44
Buleleng	76.92	100.00	50.00	50.00	100.00	75.00	96.15	100.00	100.00	84.62	76.92	100.00
Gianyar	69.23	100.00	50.00	50.00	92.31	75.00	88.46	100.00	100.00	88.46	84.62	88.46
Jembrana	70.83	100.00	50.00	75.00	95.83	50.00	87.50	83.33	75.00	95.83	79.17	95.83
Karangasem	76.92	50.00	50.00	50.00	96.15	50.00	84.62	96.15	100.00	76.92	73.08	96.15
Klungkung	60.00	100.00	50.00	50.00	90.00	50.00	95.00	95.00	100.00	100.00	95.00	95.00
Tabanan	70.83	100.00	75.00	50.00	100.00	75.00	83.33	100.00	100.00	91.67	91.67	100.00
Denpasar	73.08	100.00	50.00	75.00	100.00	100.00	96.15	100.00	100.00	100.00	96.15	100.00

Notes: LQ = Learning Quality; PAUD-B = PAUD accredited at least B; ECE-L = age appropriate early childhood learning; FL = foundational learning; SS = school safety; ECE-S = early childhood safety; DC = diversity climate; SI = school inclusiveness; ECE-ID = early childhood inclusiveness and diversity. Scores are standardized ordinal aggregates on a 0-100 scale. Source: Authors' calculations based on *Rapor Pendidikan Indonesia 2025*.

The output dimension is generally stronger and less dispersed than the process dimension. Literacy ranges from 76.92 in Karangasem to 100.00 in Klungkung and Denpasar, while numeracy ranges from 73.08 in Karangasem to 96.15 in Denpasar. Student character is particularly strong across the province, with scores ranging from 88.46 to 100.00. Taken together, these results indicate that regional differences are more pronounced in selected educational process components than in direct student outputs.

Table 1 demonstrates substantial territorial variation in the configuration of educational process indicators, despite generally favorable student-output scores across Bali. The strongest and most consistently high process scores were observed for school safety, school inclusiveness, and early childhood inclusiveness and diversity, with several local governments reaching standardized scores of 100. In contrast, age appropriate early childhood learning and foundational learning frequently remained at 50, indicating that these process dimensions represented comparatively weaker components of the regional educational environment. Learning quality also varied considerably, ranging from 60.00 in Klungkung to 83.33 in Bangli.

Output indicators exhibited a narrower and generally higher range. Literacy performance ranged from 76.92 in Karangasem to 100.00 in Klungkung and Denpasar, while numeracy ranged from 73.08 in Karangasem to 96.15 in Denpasar. Student character was particularly strong across the province, with scores ranging from 88.46 to 100.00. Overall, the descriptive pattern suggests that differences among Bali's local governments were more pronounced in selected educational-process components than in direct student outputs.



Note: Higher values indicate more favorable standardized ordinal performance. Source: Authors' calculations based on *Rapor Pendidikan Indonesia 2025*.

Figure 1. Standardized Educational Process and Output Indicator Scores across Bali

Higher scores indicate more favorable standardized ordinal performance. Original qualitative categories in *Rapor Pendidikan Indonesia 2025* were coded as *Baik* = 100, *Sedang* = 50, and *Kurang* = 0, while unavailable or non-applicable observations were excluded. Regional indicator scores represent the mean of all valid subgroup observations and should be

interpreted as comparative standardized scores rather than absolute measures of educational quality.

Process Output Index and Regional Gaps

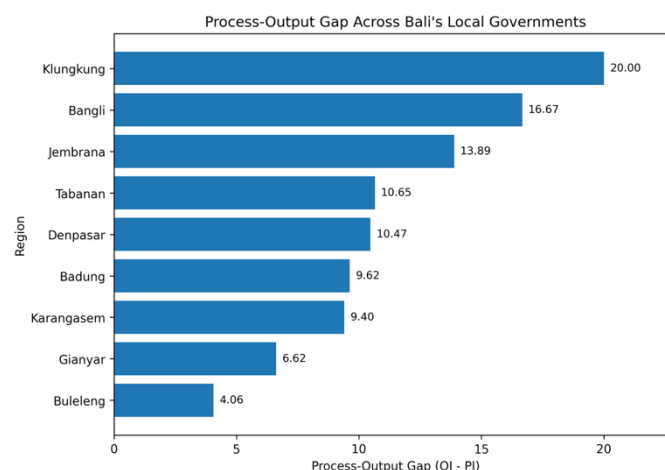
The composite results further clarify the regional configuration of educational process and output performance. Denpasar records the highest Process Index (88.25) and Output Index (98.72), followed by Tabanan, which also shows comparatively high scores on both dimensions. At the opposite end of the distribution, Karangasem records the lowest Process Index (72.65) and the lowest Output Index (82.05).

Table 2. Process Index, Output Index, and Process-Output Gap

Region	Process Index (PI)	Output Index (OI)	P-O Gap	Absolute Gap
Badung	81.41	91.03	9.62	9.62
Bangli	74.07	90.74	16.67	16.67
Buleleng	83.12	87.18	4.06	4.06
Gianyar	80.56	87.18	6.62	6.62
Jembrana	76.39	90.28	13.89	13.89
Karangasem	72.65	82.05	9.40	9.40
Klungkung	76.67	96.67	20.00	20.00
Tabanan	83.80	94.44	10.65	10.65
Denpasar	88.25	98.72	10.47	10.47

Median PI = 80.56; Median OI = 90.74. Source: Authors' calculations based on *Rapor Pendidikan Indonesia 2025*.

In all nine local governments, the Output Index exceeds the Process Index. The process-output gap ranges from 4.06 points in Buleleng to 20.00 points in Klungkung. Buleleng therefore displays the closest numerical alignment between the two composite dimensions, whereas Klungkung shows the largest difference. Bangli (16.67) and Jembrana (13.89) also exhibit relatively large positive gaps. These descriptive differences indicate that stronger student outputs are not uniformly accompanied by equally strong process conditions across all regions. A positive gap should not be interpreted as evidence that weaker educational processes caused stronger outputs; it only represents the numerical difference between two standardized composite dimensions.



Note: The gap is calculated as Output Index minus Process Index (OI - PI). Positive values indicate that the standardized Output Index exceeds the standardized Process Index.

Figure 2. Process Output Gap across Bali's Local Governments

Figure 2 illustrates the magnitude of the process–output gap across Bali’s nine local governments, calculated as the difference between the Output Index and the Process Index (OI – PI). The figure reveals substantial territorial variation in the degree of alignment between educational process conditions and student outputs. Klungkung exhibits the largest positive gap at 20.00 points, followed by Bangli at 16.67 points and Jembrana at 13.89 points. These regions therefore display the most pronounced divergence between their measured educational-process conditions and achieved educational outputs. In contrast, Buleleng records the smallest gap at 4.06 points, followed by Gianyar at 6.62 points, indicating a comparatively closer numerical alignment between the two dimensions. An important feature of the results is that all nine local governments record positive gap values, meaning that the standardized Output Index exceeds the Process Index in every region. However, this pattern should not be interpreted as evidence that weaker educational processes generate better student outcomes. Rather, the gap functions as a descriptive diagnostic indicator showing the extent to which observed student outputs and measured process conditions differ within each territorial educational system. A larger positive gap indicates a greater discrepancy between the two composite dimensions, whereas a smaller gap reflects closer numerical correspondence. Klungkung represents the clearest example of this mismatch. Despite recording a Process Index of 76.67, its Output Index reaches 96.67, producing the largest gap among all local governments. Bangli exhibits a similar pattern, with a relatively modest Process Index of 74.07 but an Output Index of 90.74. Jembrana also shows a notable discrepancy, with process and output scores of 76.39 and 90.28, respectively. These patterns suggest that relatively strong educational outputs may coexist with process conditions that remain comparatively less favorable, highlighting the possibility that contextual, institutional, demographic, or other unmeasured factors contribute to sustaining educational outcomes. By comparison, Buleleng presents the closest process–output alignment, with a Process Index of 83.12 and an Output Index of 87.18. Although its output remains numerically higher than its process score, the limited 4.06-point difference suggests substantially less divergence than in Klungkung, Bangli, or Jembrana. Overall, Figure 2 demonstrates that regional educational performance cannot be understood solely from the level of student outcomes. The degree of correspondence between educational processes and outputs also varies considerably across local governments, providing the empirical basis for the subsequent regional process–output typology.

Association between Educational Process and Output

The association between the two composite dimensions was examined using Spearman's rank-order correlation. The analysis indicates a moderate positive association between the Process Index and Output Index across Bali's nine local governments.

Table 3. Exploratory Association between Process and Output Performance

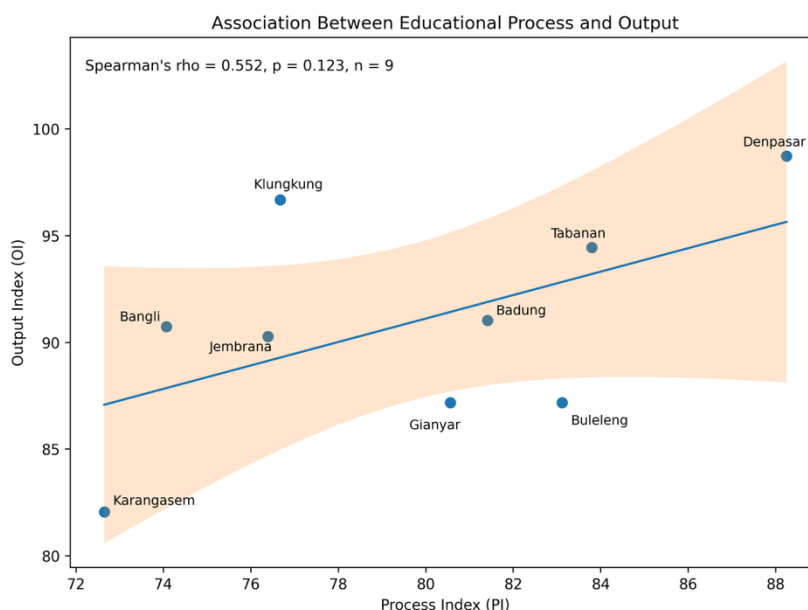
Variables	Spearman's rho	df	p-value	N	Interpretation
Process Index - Output Index	0.552	7	0.123	9	Moderate positive association; not statistically significant

Source: Authors' calculations using Spearman's rank-order correlation in Jamovi.

Spearman's rank-order correlation yields $\rho = 0.552$ ($p = 0.123$, $n = 9$), indicating that regions with relatively stronger educational-process conditions generally tend to exhibit stronger student outputs. However, the association does not reach conventional statistical significance at the 5% level. Given the limited number of regional observations, this coefficient is interpreted as an exploratory measure of territorial process-output alignment rather than confirmatory evidence of a population-level or causal relationship. The moderate coefficient,

together with the variation in regional gap values, shows that stronger process conditions are not uniformly associated with proportionally stronger outputs across all local governments.

Spearman's rank-order correlation indicated a moderate positive association between the Process Index and Output Index across Bali's nine local governments. The positive coefficient indicates that regions with relatively stronger educational-process conditions generally tended to exhibit stronger student outputs. However, the relationship did not reach conventional statistical significance at the 5% level. Given the limited number of regional observations, the correlation is interpreted as an exploratory measure of territorial process-output alignment rather than confirmatory evidence of a population-level or causal relationship. The moderate coefficient, together with the variation observed in regional gap values, indicates that stronger process conditions were not uniformly associated with proportionally stronger educational outputs across all local governments.



Note: Spearman's $\rho = 0.552$, $p = 0.123$, $n = 9$. The fitted line and confidence band are presented only as descriptive visual aids and should not be interpreted as a causal regression model.

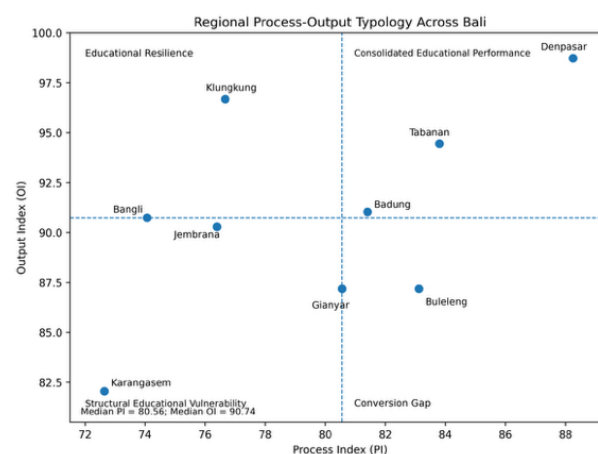
Figure 3. Association between the Process Index and Output Index across Bali's Local Governments

Figure 3 shows a positive relationship between the Process Index and the Output Index across Bali's nine local governments. The upward trend indicates that regions with relatively stronger educational process conditions tend to have higher educational outputs. However, the distribution of points around the trend line shows that this relationship is not uniform across all regions. This visual pattern is consistent with the Spearman correlation result, which indicates a moderate positive association between the Process Index and Output Index ($\rho = 0.552$, $p = 0.123$, $n = 9$).

Regional Process Output Typology

To identify distinct regional configurations, the nine local governments were positioned using the median Process Index (80.56) and median Output Index (90.74) as internal reference points. This classification produces four process-output typologies based on whether each region is located above or below the corresponding regional median. Denpasar, Tabanan, and Badung are classified as Consolidated Educational Performance because both their Process Index and Output Index are at or above the respective medians. Bangli and Klungkung are

classified as Educational Resilience, combining below-median process conditions with at- or above-median output performance. Klungkung represents the clearest example of this configuration, with a Process Index of 76.67 and an Output Index of 96.67, producing the largest positive process-output gap of 20.00 points. Buleleng and Gianyar occupy the Conversion Gap quadrant. Both record Process Index values at or above the regional median but Output Index values below the output median. This typology is therefore positional and relative: it does not imply that the numerical Output Index is lower than the Process Index, but rather that the region's output position is comparatively lower than its process position within the provincial distribution. Finally, Jembrana and Karangasem are classified as Structural Educational Vulnerability because both dimensions fall below their respective medians. Karangasem records the lowest values on both composite dimensions, while Jembrana remains below the regional medians despite a comparatively strong output score in absolute standardized terms.



Note: Quadrants are defined using the median Process Index (80.56) and median Output Index (90.74). Consolidated Educational Performance = high PI/high OI; Educational Resilience = low PI/high OI; Conversion Gap = high PI/low OI; Structural Educational Vulnerability = low PI/low OI. Source: Authors' calculations based on Rapor Pendidikan Indonesia 2025.

Figure 4. Regional Process-Output Typology across Bali's Nine Local Governments

The quadrant analysis revealed four distinct regional process-output configurations. Denpasar, Tabanan, and Badung were classified as Consolidated Educational Performance, as both their Process Index and Output Index were at or above the respective regional medians. This configuration indicates comparatively favorable performance across both dimensions. Bangli and Klungkung were classified as Educational Resilience, characterized by below-median process conditions but at- or above-median student outputs. Klungkung represented the clearest example of this pattern, combining a Process Index of 76.67 with the second-highest Output Index of 96.67 and the largest positive process-output gap of 20.00 points.

Buleleng and Gianyar occupied the Conversion Gap quadrant. Both territories recorded Process Index values at or above the regional median but Output Index values below the median. Their position indicates that relatively favorable process conditions were not accompanied by equally strong relative output positions within the Bali distribution. Finally, Jembrana and Karangasem were classified as Structural Educational Vulnerability, with both process and output scores falling below the corresponding regional medians. Karangasem displayed the lowest scores on both composite dimensions, while Jembrana combined below-

median process conditions with an Output Index approaching, but remaining below, the regional output median.

Discussion

Regional Variation in Educational Process and Output Indicators

The findings indicate that educational quality across Bali is characterized by a heterogeneous configuration of process indicators rather than by a uniform pattern of strengths and weaknesses. School safety, school inclusiveness, and early childhood inclusiveness and diversity generally showed relatively favorable scores, whereas age-appropriate early childhood learning and foundational learning were comparatively weaker in several local governments. This pattern reinforces the view that educational process quality is multidimensional and cannot be represented adequately by a single school-condition indicator. Meta analytic evidence similarly shows that both school and classroom climate are positively associated with academic achievement, although the magnitude of these relationships varies across dimensions and contexts (Erdem & Kaya, 2024; Wang et al., 2020).

The relatively favorable safety, diversity, and inclusiveness indicators are educationally meaningful because supportive school environments can contribute not only to academic functioning but also to students' social and psychological development. Social and institutional inclusion in multi-ethnic schools was associated with stronger intergroup relations and higher achievement among minority students (Kende et al., 2024). Likewise, Bardach et al. (2024), through a meta-analysis of cultural diversity climates, identified positive relationships between several diversity climate approaches and academic, motivational, belonging, and socioemotional outcomes. Indonesian evidence also suggests that participatory and inclusive learning environments can support student achievement (Waruwu et al., 2024). These findings support the interpretation that the relatively strong safety and inclusiveness profiles observed in several Bali regions constitute substantive educational assets.

At the same time, the weaker scores observed for several early childhood and foundational learning process indicators deserve particular attention. Early childhood educational quality concerns not only access to preschool institutions but also the environmental and pedagogical conditions through which children develop. Tamblyn et al. (2023) showed in a systematic scoping review that characteristics of early childhood education and care environments are associated with children's social and emotional development. Accordingly, the relatively modest scores on age appropriate early childhood learning and foundational learning in several local governments should not be overlooked merely because later student outputs are comparatively strong.

The strong character scores observed across most Bali regions further demonstrate that student outputs extend beyond literacy and numeracy. This interpretation is consistent with social and emotional learning research. Cipriano et al. (2023) found that universal school based social and emotional learning interventions were associated with improvements in social emotional competencies, behaviors, school functioning, school climate, and academic achievement. In the Indonesian context, Supriyana & Lestari (2023) similarly emphasize the role of character-development practices in building a supportive school climate. Thus, the strong character results in Bali should be interpreted as an important dimension of educational output rather than as a secondary outcome.

Process Output Index and Regional Gaps

A central finding of this study is that the Output Index exceeded the Process Index in all nine local governments, although the magnitude of the difference varied considerably. Klungkung displayed the largest process-output gap, followed by Bangli and Jembrana, whereas Buleleng showed the closest numerical alignment between the two indices. These positive gaps should not be interpreted as evidence that weaker educational processes generate stronger student outputs. Rather, they indicate that the standardized process and output dimensions do not move in a one-to-one manner across territories. Previous research offers a useful basis for understanding this pattern. Pamularsih (2022), using Indonesian data, showed that different school-climate components were not uniformly related to reading achievement: disruptive student behavior was negatively associated with reading performance, while stronger school-community conditions were positively related to achievement. This suggests that broad process indices may contain components that operate through different mechanisms and with different strengths. Consequently, a territory may record favorable outputs even when some process components remain comparatively weak.

The regional gaps may also reflect territorial, socioeconomic, institutional, and resource differences. Aditia & Széll (2025) found persistent geographical disparities in Indonesian student achievement and showed that location, socioeconomic conditions, institutional characteristics, resource shortages, school climate, and parental involvement jointly shape educational outcomes. International evidence similarly indicates that school resources do not benefit all student groups equally; Yang & Lee (2022) identified heterogeneous relationships between school resources and achievement across socioeconomic and national contexts. Perales et al. (2023) likewise showed that geographic achievement gaps cannot be explained by a single factor because both sociodemographic composition and school climate conditions contribute to regional disparities. Accordingly, the process-output gaps identified in Bali are better interpreted as diagnostic mismatches than as measures of technical efficiency. Their value lies in showing where comparatively strong student outcomes coexist with weaker measured process conditions, or where relatively favorable process conditions are not accompanied by equally strong relative output positions. This distinction supports a more diagnostic approach to regional educational evaluation and provides a basis for differentiated policy responses.

Association between Educational Process and Output

The exploratory Spearman analysis revealed a moderate positive association between the Process Index and Output Index ($\rho = 0.552$, $p = 0.123$, $n = 9$). Substantively, this suggests that local governments with relatively stronger educational process conditions generally tended to report stronger student outputs. However, the association was not statistically significant at the 5% level, and the dispersion visible in the scatterplot indicates that the relationship is not uniform across all territories. This result is broadly compatible with existing research. Erdem & Kaya (2024) found that school climate had a moderate average association with academic achievement, while classroom climate showed a smaller average association and substantial variation across contextual and methodological moderators. Wang et al. (2020) likewise reported small to moderate positive relationships between classroom climate and academic, motivational, and social outcomes. Taken together, these findings support an interpretation in which educational process conditions are relevant to student outputs but do not determine them uniformly across contexts.

The Indonesian context also suggests that strengthening educational processes requires more than improving broad school conditions. Rahmi and Rassanjani (2025) highlight teacher professional development as an important pathway through which changes in teachers' knowledge and practice may contribute to student engagement and learning outcomes. Rakhmawati & Mustadi (2022) similarly report continuing challenges in literacy and numeracy development among Indonesian elementary students, suggesting that favorable institutional conditions must ultimately be translated into effective instructional practices. Therefore, the moderate correlation found in Bali is consistent with a process-output relationship that is plausible but context dependent.

Given the small number of regional observations, the non-significant p-value should not be interpreted as proof that no relationship exists. Instead, the coefficient is more appropriately treated as an exploratory indicator of territorial alignment. The combination of a moderate positive rho and substantial variation in the process output gap indicates that regional educational performance is structured by both general alignment and territory specific deviations.

Regional Process-Output Typology

The four quadrant analysis provides a more differentiated interpretation of regional educational performance. Denpasar, Tabanan, and Badung were classified as Consolidated Educational Performance because both their Process Index and Output Index were at or above the respective regional medians. Bangli and Klungkung were categorized as Educational Resilience, reflecting below-median process positions combined with at- or above-median output positions. Buleleng and Gianyar formed the Conversion Gap group, whereas Jembrana and Karangasem were classified as Structural Educational Vulnerability. The Educational Resilience pattern is particularly evident in Klungkung, where a below-median Process Index coexists with one of the strongest Output Index values and the largest positive gap. This configuration does not imply that weaker processes are advantageous; rather, it suggests that unmeasured contextual or institutional factors may be helping sustain student outcomes. Such regions warrant further investigation to identify potentially transferable local practices while simultaneously strengthening the process dimensions that remain comparatively weak.

The Conversion Gap observed in Buleleng and Gianyar should likewise be interpreted positionally. In this typology, the term refers to a Process Index at or above the regional median combined with an Output Index below the corresponding output median; it does not mean that the numerical Output Index is lower than the Process Index. These regions therefore require greater attention to how relatively favorable process conditions are translated into literacy, numeracy, and character outcomes. Strengthening instructional quality, formative assessment, remediation, and learning monitoring represents a more appropriate policy direction than simply increasing general process inputs.

Jembrana and Karangasem, classified as Structural Educational Vulnerability, require a broader intervention because both their process and output positions fall below the regional medians. Evidence on school climate, inclusion, teacher development, and territorial disparities indicates that improvements are likely to require coordinated rather than isolated interventions (Aditia & Széll, 2025; Erdem & Kaya, 2024; Kende et al., 2024; Rahmi & Rassanjani, 2025). In contrast, regions classified as Consolidated Educational Performance should focus on maintaining their strengths, identifying the mechanisms supporting their performance, and facilitating the transfer of effective practices to other territories. Overall, the typology indicates

that a uniform provincial policy is unlikely to address the different configurations observed across Bali. The same level of student output may coexist with substantially different process conditions, while relatively favorable process conditions do not always correspond to equally strong relative output positions. The principal contribution of the process-output approach is therefore to move regional educational evaluation beyond the question of which territory performs best toward the more policy relevant question of what configuration of educational processes and outputs characterizes each local government.

Conclusion

This study examined the alignment between educational process conditions and student outputs across Bali's nine local-government territories by constructing a Process Index and an Output Index from twelve indicators reported in *Rapor Pendidikan Indonesia 2025*. The findings reveal substantial regional heterogeneity. While school safety, inclusiveness, and diversity-related indicators were generally favorable, several early-childhood and foundational-learning dimensions remained comparatively weaker. Student outputs, particularly character, literacy, and numeracy, were generally stronger and less dispersed across territories. The Output Index exceeded the Process Index in all nine regions, although the magnitude of the process-output gap varied considerably. Klungkung, Bangli, and Jembrana exhibited the largest positive gaps, whereas Buleleng showed the closest numerical alignment between process and output conditions.

The exploratory Spearman analysis indicated a moderate positive association between the Process Index and Output Indeks. Although the relationship was not statistically significant, its positive direction suggests that territories with relatively stronger educational-process conditions tended to exhibit stronger student outputs. However, the regional variation in gap values demonstrates that this relationship is not uniform. Educational outcomes therefore cannot be explained solely by the measured process conditions, and the observed differences may reflect additional contextual, institutional, socioeconomic, or territorial factors that were not captured directly in the composite indices.

The regional typology further identifies four distinct configurations of educational performance. Denpasar, Tabanan, and Badung were categorized as Consolidated Educational Performance; Bangli and Klungkung as Educational Resilience; Buleleng and Gianyar as Conversion Gap; and Jembrana and Karangasem as Structural Educational Vulnerability. These findings indicate that a uniform policy response is unlikely to address the diverse educational conditions across Bali. Consolidated regions should focus on maintaining and disseminating effective practices, resilience regions require strengthening of comparatively weak process dimensions while identifying factors sustaining their strong outputs, conversion-gap regions need greater attention to the translation of favorable process conditions into student learning outcomes, and structurally vulnerable regions require simultaneous improvements in educational processes and direct student-learning support.

Overall, the study contributes to regional educational evaluation by shifting attention from a simple comparison of which territory performs best toward a more diagnostic assessment of how educational processes and outputs are configured within each territory. The process output framework can therefore support more differentiated and context-sensitive educational policy. Nevertheless, the findings should be interpreted as comparative and exploratory because the analysis is based on cross-sectional aggregated data, ordinal score transformation, and a relatively small number of territorial observations. Future research should

incorporate longitudinal data, more detailed school- and student-level indicators, socioeconomic and institutional variables, and multilevel or spatial approaches to better explain why similar educational outputs may emerge from different process conditions across regions.

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