

The Paradox of Educational Progress in Timor-Leste: Demographic Pressure, Spatial Attrition, and Post-Pandemic System Stress

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Abstract. Timor-Leste has expanded secondary and tertiary participation while simultaneously experiencing a contraction at the foundation of its education system. This article investigates that paradox through an integrated secondary analysis of the 2015 and 2022 Population and Housing Censuses, the 2022 Thematic Report on Education, the February 2026 UNESCO Institute for Statistics data release, and national education planning documents. The analysis combines level-specific net attendance ratios, spatial disparity ratios, school-life-expectancy changes, over-age enrolment trends, and a demographic capacity scenario aligned with the National Education Strategic Plan. Primary net attendance declined from 80.8% in 2015 to 75.2% in 2022, whereas secondary attendance rose from 32.8% to 40.1% and tertiary attendance from 16.3% to 18.3%. The urban-rural attendance ratio widened sharply across the education ladder: 1.12 at primary, 1.79 at secondary, and 4.80 at tertiary level. Although the proportion of primary pupils at least two years over-age fell from 30.8% in 2014 to 18.1% in 2023, age distortion remains a system-level bottleneck that shifts congestion upward. Meeting the 2030 policy targets would increase the school-going population by approximately 115,776 learners, or 31.2%, relative to the 2022 baseline used in the national projection. The findings support a “foundation-friction-resilience” interpretation: pandemic-era entry contraction and territorial inequalities create friction, while higher-level gains reflect resilience among learners already inside the system. The article argues for sequenced policy: remedial absorption at school entry, accelerated progression for over-age learners, municipality-sensitive infrastructure planning, and protected education financing.

Keywords: Timor-Leste; educational transition; spatial inequality; over-age enrolment; demographic pressure; SDG 4



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1. Introduction

Education systems in young and post-conflict states rarely move along a single, linear trajectory. Expansion can coexist with exclusion, gender parity can coexist with territorial inequality, and improvements at one level may conceal contraction at another. Timor-Leste illustrates this complexity with unusual clarity. Since the restoration of independence, the country has rebuilt institutions, expanded schooling, raised literacy, and established an ambitious national commitment to free and compulsory basic education. Yet the 2022 Population and Housing Census reveals a system whose progress is structurally uneven. Primary participation weakened between the 2015 and 2022 censuses, even as secondary and tertiary attendance improved. This is not a minor statistical irregularity. It suggests that the

education system has become more effective at retaining and advancing some learners already inside the system while becoming less reliable at absorbing children at the point of entry. Such a pattern challenges conventional accounts of educational development that treat enrolment expansion as a uniform process and calls for a system-level explanation of where progress is generated, where it is blocked, and how demographic growth changes the feasibility of policy commitments (General Directorate of Statistics [GDS] et al., 2017; INETL, 2024; Ministry of Education, 2020; World Bank, 2021).

The global literature provides strong reasons to treat foundation-level contraction as a strategic risk. Initial access determines the size and composition of every subsequent cohort, while delayed entry, repetition, and temporary withdrawal create age distortion that accumulates across grades. Over-age learners face greater risks of dropout, weak peer integration, and premature labour-market entry; grade retention also carries substantial social and fiscal costs (Goos et al., 2021; Manacorda, 2012; Woldehanna et al., 2021). The COVID-19 pandemic intensified these vulnerabilities. Evidence from multiple settings shows that school closures and household shocks reduced participation, weakened learning, and disproportionately affected disadvantaged learners (Azevedo et al., 2021; Engzell et al., 2021; Kaffenberger, 2021; UNESCO et al., 2021). Timor-Leste's 2022 census was conducted after the main period of closures, but the age profile of attendance and the decline in primary net attendance indicate that the shock may have persisted through delayed school entry and incomplete re-entry. The relevant question is therefore not simply whether attendance recovered, but whether recovery occurred evenly across age groups, education levels, and territories.

Territory is central to this question. Timor-Leste remains predominantly rural, while educational infrastructure, tertiary institutions, qualified personnel, and economic opportunities are concentrated in and around Dili. Spatial inequality is therefore not merely a difference in outcomes; it is an institutional architecture that shapes how far learners can travel through the system. The 2022 census shows modest urban advantage at primary level, a much larger gap at secondary level, and an extreme divergence at tertiary level. This widening pattern resembles an attrition funnel: geographical disadvantage has a cumulative effect, becoming more restrictive as education becomes more specialized, costly, and spatially concentrated. Research on educational exclusion consistently shows that location, wealth, disability, and infrastructure interact rather than operate independently (Filmer, 2008; Mizunoya et al., 2018; UNICEF & UNESCO, 2015; UNESCO, 2020). A national average can therefore overstate system performance when higher-level gains are driven by a relatively small urban population.

The challenge is amplified by demography. Timor-Leste's population reached approximately 1.34 million in 2022, with a young age structure and continued population growth. The education thematic report projects that achieving the quantitative targets of the National Education Strategic Plan would raise the combined school-going population from 370,947 learners in the 2022 projection baseline to 486,723 by 2030. The implied increase of 115,776 learners, or 31.2%, is not simply an enrolment target. It represents a capacity shock involving classrooms,

teachers, textbooks, water and sanitation, transport, disability-accessible facilities, administrative data systems, and recurrent financing. International experience indicates that rapid enrolment expansion without corresponding improvements in instructional capacity can produce overcrowding, low learning, and hidden exclusion within schools (Education Commission, 2016; UNICEF, 2019; World Bank, 2018). Policy feasibility therefore depends on whether Timor-Leste can absorb more learners while correcting the structural frictions already visible in the 2022 system.

This article addresses three questions. First, how did educational participation change between 2015 and 2022 across primary, secondary, and tertiary levels, and what does the pattern imply about system resilience? Second, how do urban-rural disparities and over-age enrolment reshape the apparent gains in national participation? Third, what capacity implications follow from aligning the 2022 baseline with the 2030 targets of the National Education Strategic Plan? The contribution is both empirical and conceptual. Empirically, the article integrates census indicators, UNESCO time series, and policy projections that are often examined separately. Conceptually, it develops a foundation-friction-resilience framework. “Foundation” refers to entry and age-appropriate participation; “friction” refers to over-age progression, spatial barriers, and constrained capacity; and “resilience” refers to gains among cohorts who remain in the system despite those constraints. This framework avoids treating Timor-Leste either as a success story or as a crisis case. Instead, it identifies the mechanisms through which both progress and contraction are produced within the same education system.

2. Analytical framework

Educational transition is commonly represented as a sequence from entry to participation, completion, and progression. Such representations are useful, but they can obscure the fact that the stages are interdependent. A decline in timely primary entry reduces future secondary cohorts; repetition increases the number of learner-years required to produce one graduate; weak secondary access narrows the tertiary pipeline; and territorial concentration changes who can continue even when national capacity increases. The framework used here therefore treats education as a stock-and-flow system. The stock consists of learners currently enrolled at each level, while flows include entry, repetition, promotion, dropout, re-entry, and graduation. System performance cannot be inferred from one stock measure alone. A higher secondary attendance ratio may reflect genuine expansion, improved retention, demographic changes in the denominator, or the progression of previously enlarged primary cohorts. Conversely, lower primary net attendance may coexist with high gross attendance when large numbers of over-age children remain enrolled. The difference between net and gross indicators thus provides substantive evidence about age distortion rather than a technical nuisance (Lewin, 2007; UNESCO Institute for Statistics [UIS], 2026).

The first component of the framework is foundation. Foundation has two dimensions: access at the expected age and successful transition through the early grades. This distinction matters in Timor-Leste because participation in primary education is high in gross terms but lower when restricted to the official age group.

A system can appear close to universal access while still enrolling many learners late. Late entry is consequential because it compresses the remaining period before adolescence, increases the likelihood that schooling competes with work and family responsibilities, and produces classrooms with wide age ranges. Research on retention and repetition shows that making learners spend additional years in the same grade rarely generates benefits commensurate with the costs and often predicts later disengagement (Goos et al., 2021; Manacorda, 2012). The foundation concept therefore prioritizes timely entry, regular progression, and recovery mechanisms for learners who missed entry during a shock.

The second component is friction. Friction refers to institutional and social conditions that slow, redirect, or terminate educational progression. In the present analysis, three forms are central. Age friction is produced by delayed entry and repetition. Spatial friction arises from the unequal distribution of schools, teachers, transport, and tertiary institutions. Capacity friction occurs when enrolment growth outpaces the system's ability to provide adequate learning conditions. These frictions can reinforce one another. Rural children are more likely to enter late; late entrants are more likely to be over-age; over-age learners are more exposed to household work and dropout; and municipalities with weak infrastructure have less capacity to offer second-chance pathways. The cumulative character of friction is consistent with the "leave no one behind" principle, which requires analysts to examine intersecting disadvantages rather than national averages alone (UNDP, 2018; UNESCO, 2020).

The third component is resilience. In education research, resilience is sometimes used at the level of individual learners, but it also has a system-level meaning: the ability to maintain, restore, or adapt educational participation under shock. A resilient system does not merely return aggregate enrolment to its previous level. It identifies groups that failed to return, prevents temporary interruption from becoming permanent dropout, and protects instructional quality during rapid expansion. The rise in Timor-Leste's secondary and tertiary net attendance ratios between 2015 and 2022 may be interpreted as evidence of resilience among older cohorts and of accumulated expansion before the pandemic. However, resilience that is concentrated among those already inside the system is incomplete. The framework therefore distinguishes continuum resilience from entry resilience. Continuum resilience is the ability to retain and advance enrolled learners; entry resilience is the ability to bring age-eligible children into school on time after a disruption.

Demographic pressure links the three components. A young population can create a demographic dividend when education raises productivity and supports transition into decent work. The same age structure can create a service-delivery burden when schools cannot absorb growing cohorts. The decisive variable is not population growth alone but the ratio between learner growth and system capacity. The 2030 scenario in Timor-Leste combines increased attendance with an intended reduction in over-age enrolment. This is desirable, but it requires simultaneous expansion and restructuring: more children must enter, while the age composition of classes becomes younger and progression becomes faster. The task is therefore more complex than building classrooms in proportion to population growth. It requires

forecasting by age, municipality, level, and teacher specialization, as well as protecting recurrent expenditure. Theoretical accounts of education-led development emphasize human capital gains, but those gains depend on learning and completion, not enrolment alone (Psacharopoulos & Patrinos, 2018; World Bank, 2018).

Together, foundation, friction, and resilience provide an interpretive model for the empirical analysis. A foundation failure is indicated by declining age-appropriate participation or reduced school-life expectancy at young ages. Friction is indicated by large net-gross gaps, persistent over-age enrolment, and widening spatial ratios. Resilience is indicated by improved participation at later levels and sustained progress in literacy or completion. The model does not assume that one mechanism causes all observed changes. Instead, it organizes evidence from different data sources and helps distinguish a temporary shock from a structural bottleneck. It also supports sequenced policy design. Foundation problems require rapid absorption and early-grade support; friction requires progression reform and territorial investment; resilience requires protecting the pathways that are already producing gains.

A system perspective also requires separating participation from learning. Attendance indicators measure whether learners are present in an educational pathway, not whether they acquire foundational skills. This distinction is particularly important when expansion is rapid or classes contain wide age ranges. The World Development Report 2018 framed the global problem as a learning crisis in which schooling does not automatically produce learning (World Bank, 2018). For Timor-Leste, limited comparable assessment data prevent a direct national learning analysis, but the structural indicators remain informative. Over-age enrolment, class congestion, teacher deployment, and interrupted entry are conditions that can reduce instructional time and make age-appropriate pedagogy difficult. The framework therefore treats participation as a necessary but insufficient condition. Policies that improve NAR while allowing learning conditions to deteriorate would resolve an access indicator without resolving educational capability.

The framework further distinguishes resilience from selectivity. A system may appear resilient because the learners who remain enrolled continue to progress, while less advantaged learners are filtered out. In that case, higher participation at later levels is real but socially selective. The expanding secondary and tertiary bands in Timor-Leste may include both broadening opportunity and survival bias. Census aggregates cannot identify the proportion attributable to each mechanism, but spatial evidence provides a diagnostic clue: when national tertiary participation rises while rural tertiary participation remains below 10%, expansion is not yet system-wide. Resilience should therefore be evaluated by distribution as well as level. A resilient education system maintains participation across groups and territories, not only among learners best positioned to withstand shocks.

3. Data and methods

The study uses a secondary quantitative design based entirely on public, anonymized aggregate data. Four sources were integrated. The first is the Timor-

Leste 2022 Population and Housing Census Thematic Report on Education, which provides attendance, literacy, age, sex, municipality, urban-rural, disability, and vulnerability indicators, together with comparisons to the 2015 census and a projection scenario to 2035 (INETL, 2024). Census interpretation followed international principles on enumeration, age reporting, and population-based indicators (United Nations, 2017). The second is the 2022 Population and Housing Census Main Report, used to verify population totals, age structure, urbanization, and census methodology (INETL, 2023). The third is the February 2026 UIS national dataset and methodological background document. The UIS release harmonizes education indicators from national administrative records, household surveys, population series, and partner sources and applies updated SDG 4 definitions (UIS, 2026). The fourth source is the updated National Education Strategic Plan and associated education-sector planning documents, used to interpret policy targets and capacity requirements (Ministry of Education, 2020; World Bank, 2022).

Table 1. Integrated data sources and analytical functions

Source	Coverage / reference period	Principal variables	Analytical function
2022 Census Thematic Report – Education	National census; 2015–2022 comparison and projections	Attendance, literacy, age, sex, residence, municipality, disability	Core system diagnosis and disaggregation
2022 Census Main Report	National population, 2022	Population size, age structure, urbanization, census methodology	Denominator and demographic validation
UIS February 2026 release	Annual series, indicator-dependent	Over-age enrolment, intake, expenditure, SDG 4 metadata	Time-series triangulation and international definition alignment
NESP / Education Sector Plan	Targets to 2030	Participation targets, policy priorities, costed actions	Policy-feasibility and capacity interpretation

Note. All sources are public and report anonymized aggregate data. UIS = UNESCO Institute for Statistics; NESP = National Education Strategic Plan.

The unit of analysis is Timor-Leste's national education system, disaggregated by education level, residence, municipality, year, and age where available. The main indicator is the net attendance ratio (NAR), which measures the proportion of the official age group attending the corresponding level and is more appropriate than gross ratios for assessing timely participation. Gross attendance and the UIS over-age indicator are retained to identify age distortion, while school life expectancy at ages 5 and 10 estimates expected remaining years of education. Education expenditure as a share of GDP and total government spending is used only to contextualize system capacity because missing years and source revisions limit causal interpretation. Three derived measures were calculated: level-transition

retention as the ratio between successive NARs, urban-rural disparity as the urban-to-rural NAR ratio, and demographic capacity growth between the 2022 baseline of 370,947 learners and the 2030 projection of 486,723. The projected increase is 115,776 learners, or 31.21%. Transition retention is treated only as a descriptive measure because the compared NARs represent different age groups. Temporal analysis is limited to the 2015 and 2022 censuses and consistent UIS series, including primary over-age data for 2014–2023. The term “post-pandemic contraction” describes temporal context rather than causality because the aggregate data cannot separate school closures from income shocks, migration, registration problems, disasters, or administrative changes.

Validation involved cross-checking indicator definitions with UIS metadata, verifying presentation figures against the census report, recalculating derived values, and prioritizing official documentation when inconsistencies arose. Accordingly, the analysis uses the official primary NAR of 80.8% in 2015 and 75.2% in 2022 rather than the alternative 83.3% shown in one slide, and it retains the exact projection values of 370,947 and 486,723. A sensitivity check showed that either 2015 baseline leads to the same conclusion of a substantial decline, although the estimated decrease is 5.6 points using 80.8% and 8.1 points using 83.3%. No significance tests were applied because both censuses sought full population enumeration; measurement error, non-response, question changes, age misreporting, and coverage differences are more relevant than sampling error. Interpretation therefore focuses on effect magnitude and consistency across attendance, school-life-expectancy, age, and intake indicators. The study is limited by its aggregate design, which cannot trace individuals, establish causality, or measure learning quality. Attendance also differs from enrolment, completion, and proficiency; disability may be underreported; urban-rural categories conceal local variation; fiscal indicators do not show efficiency or distribution; and the 2030 scenario represents required capacity rather than a forecast. Claims are therefore confined to system diagnosis and policy feasibility.

4. Results

The first result is an asymmetric shift across education levels. Primary NAR fell by 5.6 percentage points, from 80.8% in 2015 to 75.2% in 2022. Over the same period, secondary NAR increased by 7.3 points, from 32.8% to 40.1%, and tertiary NAR increased by 2.0 points, from 16.3% to 18.3%. The pattern is therefore not a general collapse. It is a contraction at the foundation accompanied by continued expansion in the middle and upper parts of the system. The descriptive secondary-to-primary participation ratio rose from 40.6% to 53.3%, showing that the secondary participation band widened relative to the primary band. By contrast, the tertiary-to-secondary ratio declined slightly from 49.7% to 45.6%, indicating that secondary expansion was faster than tertiary absorption. These ratios are not cohort transition probabilities, but they reveal where the education ladder became relatively wider or narrower.

Table 2. Vertical change in participation and expected schooling, 2015–2022

Indicator	2015	2022	Change	System interpretation
Primary net attendance ratio (%)	80.8	75.2	–5.6 pp	Foundation contraction
Secondary net attendance ratio (%)	32.8	40.1	+7.3 pp	Middle-level expansion
Tertiary net attendance ratio (%)	16.3	18.3	+2.0 pp	Continued upper-level expansion
School-life expectancy from age 5 (years)	15.2	14.2	–1.0	Lower expected duration from entry age
School-life expectancy from age 10 (years)	11.5	10.5	–1.0	Reduced remaining participation

Note. pp = percentage points. Net attendance ratios are level-specific and are not cohort transition rates. Source: INETL (2024).

Figure 1 makes the asymmetry visible. A conventional national narrative might emphasize the 7.3-point secondary gain and the historic increase in tertiary participation. Yet the same figure shows that the largest absolute change occurred at primary level and moved in the opposite direction. School-life-expectancy data reinforce the diagnosis. Expected schooling from age 5 declined from 15.2 years in 2015 to 14.2 in 2022, while expected remaining schooling from age 10 fell from 11.5 to 10.5 years. A one-year contraction in both measures is substantial because school life expectancy aggregates attendance across subsequent ages. The decline is consistent with a disruption concentrated among younger children and with incomplete absorption of children who reached school-entry age during the pandemic period. It also implies that later-level gains cannot be assumed to continue unless the primary intake base is restored.

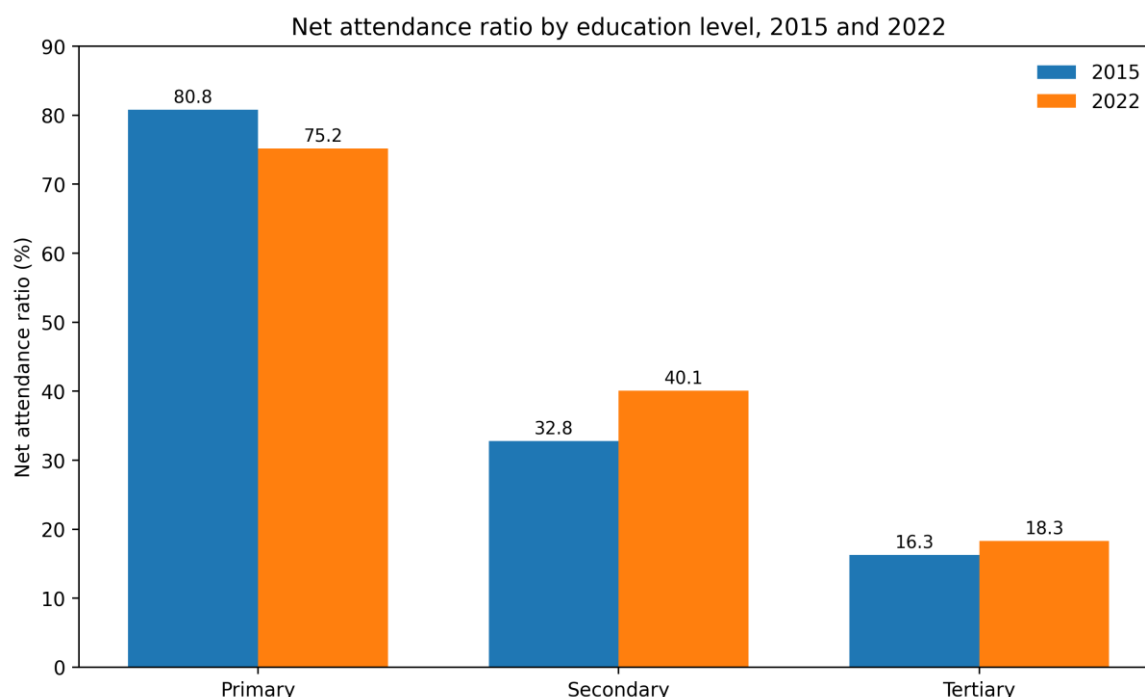


Figure 1. Asymmetric change in net attendance ratios, 2015–2022

Note. Values are census net attendance ratios. Source: INETL (2024). Figure prepared by the authors.

The second result is the progressive widening of spatial inequality. In 2022, primary NAR was 81.4% in urban areas and 72.8% in rural areas, an urban-rural ratio of 1.12. At secondary level, the corresponding values were 59.1% and 33.0%, producing a ratio of 1.79. At tertiary level, urban NAR reached 37.9%, compared with only 7.9% in rural areas, a ratio of 4.80. The education ladder therefore operates very differently by residence. Rural disadvantage is moderate but already visible at primary level, becomes large at secondary level, and becomes exclusionary at tertiary level. The pattern is not explained by a single dropout point. It reflects cumulative constraints involving distance, transport, household costs, curriculum specialization, boarding or relocation, and the concentration of higher education institutions in Dili.

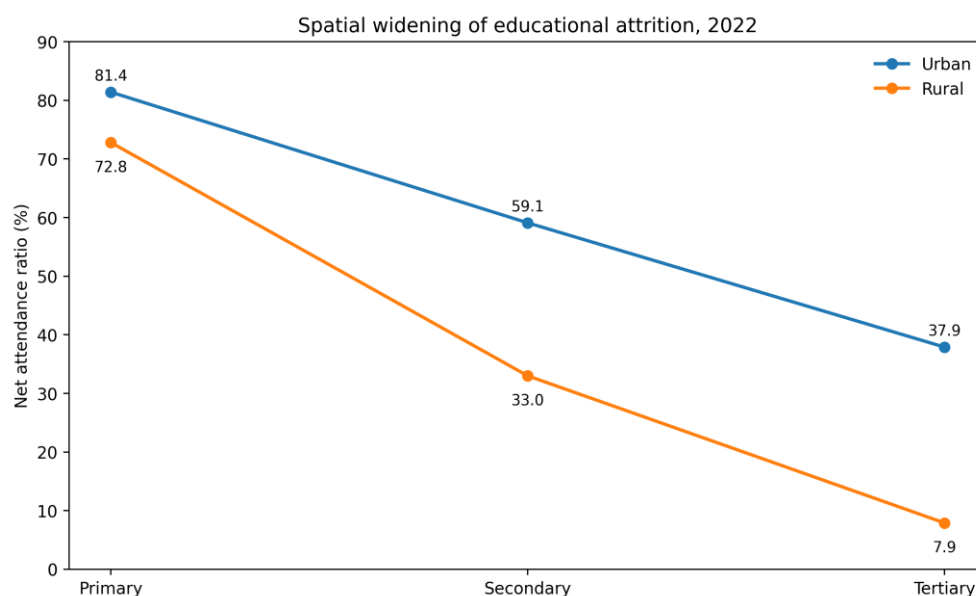


Figure 2. Widening urban-rural attrition across education levels in 2022

Note. The ratio rises from 1.12 at primary level to 4.80 at tertiary level. Source: INETL (2024); calculations by the authors.

Municipal differences further demonstrate that the rural category is not homogeneous. Dili recorded primary NAR above 81%, while Oecusse was close to the mid-60s in the municipal profile. At higher levels, Dili contains a disproportionate share of the national tertiary student population. The spatial pattern is thus both urban-rural and capital-periphery. A learner in a remote administrative post encounters a sequence of shrinking options: fewer nearby secondary schools, higher transport costs, less access to specialized teachers, and eventual relocation requirements for tertiary study. The national tertiary NAR of 18.3% is consequently compatible with near exclusion in many rural areas. National expansion has occurred, but its geography is highly concentrated.

The third result concerns age distortion. UIS data show that the percentage of primary pupils at least two years over-age declined from 30.8% in 2014 to 28.6% in 2015, 20.2% in 2020, 19.1% in 2022, and 18.1% in 2023. This is meaningful progress. However, nearly one in five primary pupils remaining two or more years above the official age in 2023 still represents a large stock of delayed progression. The census report also identifies substantial gaps between gross and net attendance at multiple levels and notes that many learners older than 11 remain in primary school. Age distortion therefore persists even after a decade of improvement. The falling over-age rate and declining primary NAR should be read together: the system may be reducing the stock of older pupils while failing to fully replace it with timely new entrants.

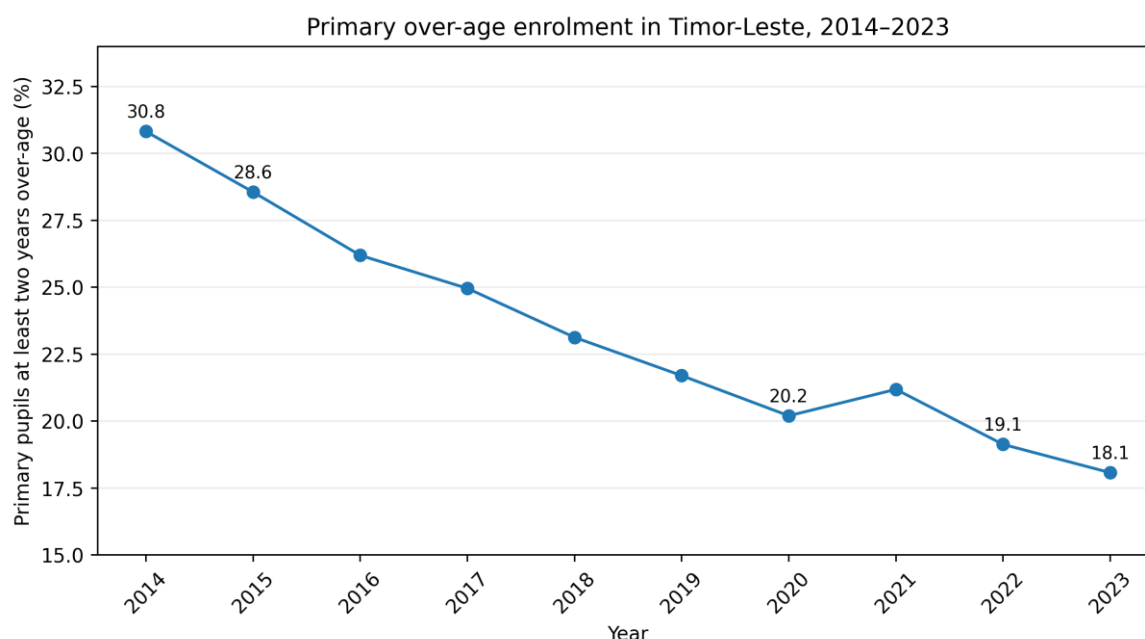


Figure 3. Primary pupils at least two years over-age, 2014–2023

Note. Percentage of primary pupils at least two years above the official age for grade. *Source:* UIS February 2026 release.

This interaction creates a transitional risk. Reducing over-age enrolment can temporarily lower total attendance if accelerated progression, graduation, or dropout is not matched by stronger age-appropriate entry. In a well-functioning transition, the age distribution becomes younger while NAR rises. In Timor-Leste, the 2022 evidence suggests partial decongestion without complete foundation recovery. The gross intake ratio to the last grade of primary education adds support: the UIS series fell from 101.3% in 2015 to 86.5% in 2022 before recovering to 93.2% in 2023. Because gross intake can exceed 100% when over-age learners are present, the decline may reflect both reduced age distortion and weaker throughput. The two processes cannot be fully separated with aggregate data, but both require policy attention.

The fourth result is a demographic-capacity challenge. The projection aligned with NESP targets increases the school-going population from 370,947 in 2022 to 486,723 in 2030. This requires space for 115,776 additional learners in eight years. A simple average would imply net absorption of roughly 14,472 additional learners per year, but the actual requirement will be uneven across levels and municipalities. Early childhood education must expand from a very low base; primary education must recover timely entry; secondary education must continue to grow; and tertiary education must absorb larger cohorts while reducing its urban concentration. The scenario also assumes a shift toward age-appropriate enrolment, which changes class composition and teacher demand rather than merely increasing headcounts.

Fiscal context makes this requirement more demanding. UIS data indicate that government education expenditure fell from 8.47% of GDP in 2015 to 2.97% in 2021, before rising to 5.24% in 2023. As a share of total government expenditure, the UIS-calculated series remained below 9% in the available years and declined to 6.28% in

2024 and 4.33% in 2025. These figures are subject to revisions and do not measure efficiency, but they show that the demographic expansion scenario cannot rely on an automatically growing fiscal envelope. Protecting basic infrastructure and teacher recruitment will require explicit prioritization, better execution, and territorial targeting. Otherwise, the system may meet numerical enrolment targets by increasing class size and reducing instructional quality.

Table 3. Spatial attrition and 2030 capacity pressure

Indicator	Urban / 2022 baseline	Rural / 2030 scenario	Ratio or change	Implication
Primary NAR (%)	81.4	72.8	1.12 urban/rural	Moderate entry-level spatial gap
Secondary NAR (%)	59.1	33.0	1.79 urban/rural	Strong transition bottleneck
Tertiary NAR (%)	37.9	7.9	4.80 urban/rural	Extreme capital-periphery concentration
Projected learners	370,947	486,723	+115,776 (+31.2%)	Major infrastructure and teacher-capacity shock

Note. The final row compares the 2022 projection baseline with the NESP-aligned 2030 scenario rather than urban and rural categories. Source: INETL (2024); derived ratios by the authors.

Taken together, the results form a coherent system diagnosis. Timor-Leste has demonstrated continuum resilience through increased secondary and tertiary participation and a long-term reduction in over-age enrolment. Yet entry resilience weakened, territorial attrition intensified with each education level, and the 2030 scenario introduces a major capacity shock. The paradox is therefore produced by different mechanisms operating at different points in the system rather than by contradictory data.

The consistency check across independent indicator families strengthens this interpretation. Primary NAR, school-life expectancy, and the gross intake ratio to the last grade all deteriorated around the same period, whereas the over-age series continued its longer-term improvement. These measures capture different processes: NAR concerns age-appropriate attendance, school-life expectancy summarizes the expected duration of participation under current rates, the intake ratio reflects access to the terminal primary grade, and over-age prevalence records accumulated delay among pupils who remain enrolled. Their joint movement is therefore more informative than any single indicator. The evidence does not imply that every component of primary education weakened, but it identifies a specific vulnerability in the timely flow of children through the foundational cycle. This triangulation also reduces the likelihood that the diagnosis is an artefact of one denominator or one administrative definition.

A fifth result concerns gender and the composition of resilience. In 2022, females had slightly higher attendance across the broad 3-34 age range, and female

advantage was especially pronounced in tertiary education. The census report recorded a tertiary NAR gender parity index of approximately 1.52. This suggests that the later-level gains are not driven by male dominance; young women have become central to educational expansion. At the same time, the primary contraction affected both sexes. The policy implication is that restoring foundation access should not be framed as correcting a single-sex deficit. Timor-Leste must protect female gains while identifying the reasons boys and young men become less represented at later levels. Gender parity has shifted from a problem of female exclusion to a more differentiated challenge involving level, age, work, and transition.

The combined evidence also reveals a distinction between stock improvement and flow vulnerability. The over-age stock has declined, literacy among younger cohorts has improved, and secondary participation has expanded. These are accumulated achievements. Yet the flow into primary school weakened around the 2022 observation, and projected demand will rise rapidly. A system can therefore possess stronger educational stocks while facing a more fragile future flow. This distinction explains why the results should not be interpreted as internally inconsistent. They describe different temporal layers of the same system.

5. Discussion

The central finding is that educational progress in Timor-Leste is vertically uneven: secondary and tertiary participation expanded while primary participation contracted. Higher-level gains may reflect earlier cohorts, whereas weaker primary entry threatens the future education pipeline. The foundation-friction-resilience framework explains this lag between declining entry resilience and continuing progression. Although school closures, reduced household income, migration, and disrupted readiness likely contributed to the decline (Azevedo et al., 2021; Kaffenberger, 2021), they interacted with delayed entry, weak birth registration, remoteness, teacher shortages, and limited infrastructure. Recovery therefore requires targeted identification, community outreach, flexible placement, and accelerated readiness support. Following UIS guidance on integrating census, administrative, population, and household data (UIS, 2026), monitoring should combine on-time entry, age-for-grade distribution, repetition, re-entry, completion, and foundational learning.

Spatial attrition is equally serious. The urban-rural participation ratio rises from 1.12 at primary level to 4.80 at tertiary level, showing that geographical disadvantage intensifies across educational stages. This pattern reflects the growing influence of distance, cost, institutional scarcity, and programme specialization (Filmer, 2008; UNESCO, 2020), reinforced by the concentration of higher education in Dili. Policy should therefore combine transport, accommodation, connectivity, scholarships, regional centres, and blended learning rather than rely only on new institutions. Funding formulas should also include school-age population, remoteness, poverty, disability access, and teacher-deployment costs. Over-age enrolment further records cumulative delays from late entry, repetition, interruption, and re-entry. Because repetition increases cost and disengagement without consistently improving achievement (Goos et al., 2021), Timor-Leste needs

diagnostic assessment, tutoring, accelerated education, and formally certified equivalency pathways.

The projected 31.2% increase in learners by 2030 requires phased expansion of classrooms, teachers, materials, maintenance, and specialist provision. Initial pressure will fall on early grades before shifting to secondary education, so planning must reflect training lead times and municipality-level population change. Expansion without instructional capacity risks producing “schooling without learning” (Education Commission, 2016; World Bank, 2018). Financing must therefore protect a minimum education share, cost programmes by level and municipality, and link expenditure to measurable outputs. This aligns with the emphasis on fiscal sustainability and spending effectiveness in Timor-Leste (World Bank, 2021). Reform should proceed through three overlapping phases: remedial absorption for missed entrants, un-bottlenecking of repetition and transition losses, and protected parity across territories and genders. Expanding tertiary access before repairing primary entry would otherwise deepen selectivity.

The study shows that aggregate progress can conceal opposing trends across education levels. Current tertiary growth may coexist with a weakening primary pipeline, making education indicators better understood as interacting stocks and flows. It also reveals the operational scale of reform: more than 115,000 additional learners may require accommodation by 2030 across highly unequal territories. SDG 4 monitoring should therefore combine UIS time series, census denominators, administrative progression data, household equity indicators, and national policy targets. No single source adequately captures access, progression, vulnerability, and learning. Future studies should link school and population records, estimate cohort transition probabilities, model travel-time barriers, and test costed scenarios under different fertility, migration, and expenditure assumptions. Such work could transform the foundation-friction-resilience framework from a diagnostic concept into a predictive planning model.

Gender and data governance complete the reform agenda. Strong female participation at secondary and tertiary levels should be protected through safe transport, gender-based violence prevention, reproductive-health support, and re-entry pathways for adolescent mothers. Emerging male underrepresentation also requires investigation because it may reflect employment, migration, repetition, or weak perceived returns to schooling. The objective is high participation for both sexes, not the reversal of female gains. Timor-Leste’s digital census, earlier education surveys, and the UIS multi-source architecture provide a basis for responsive planning (World Bank, 2013). Municipality-level dashboards should report entry, promotion, repetition, dropout, re-entry, disability access, teacher vacancies, travel distance, and learning outcomes. Privacy-protected cohort identifiers and clear distinctions between net and gross participation would help direct scarce resources toward actual educational need rather than outdated enrolment patterns.

6. Conclusion

Timor-Leste’s education system is neither simply progressing nor regressing; it is moving unevenly across the educational continuum. Between 2015 and 2022,

secondary and tertiary net attendance increased, while primary net attendance and school-life expectancy declined, urban–rural disparities widened, and almost one in five primary pupils remained at least two years over-age in 2023 despite improved age-for-grade alignment. These patterns reveal continuum resilience above a weakened foundation: the system has preserved upward mobility for many learners already enrolled but has become less reliable in ensuring timely entry and geographically equitable progression. The proposed foundation–friction–resilience model explains this configuration by distinguishing timely entry and early retention, delays and territorial bottlenecks, and the continued expansion of participation at later levels. The Timor-Leste case demonstrates that these dimensions can move independently, making national averages or celebratory accounts of secondary expansion insufficient measures of system health. Educational progress must therefore be assessed through the interaction between entry, progression, age alignment, and territorial equity rather than through enrolment growth alone.

The 2030 agenda intensifies this challenge because the system may need to accommodate approximately 115,776 additional learners, or 31.2% above the 2022 baseline, while simultaneously reducing age distortion and spatial inequality. Policy should therefore be sequenced: restore timely entry through local child identification and school-readiness support, provide accelerated and remedial pathways for over-age learners, allocate teachers, infrastructure, and transport according to territorial need, and protect education financing through a credible medium-term expenditure framework. These interventions should be translated into annual municipality-level targets rather than implemented as uniform national campaigns. Although the study relies on aggregate secondary data and cannot establish individual causal pathways, its integration of census, projection, and internationally harmonized indicators reveals a policy configuration that would otherwise remain obscured. Future research should connect EMIS records with cohort progression, geospatial accessibility, household vulnerability, and direct learning measures to support anticipatory planning. The central policy test is therefore not how many learners are counted, but whether children enter school on time, progress without avoidable delay, and retain a realistic pathway to secondary and tertiary education regardless of where they live.

Declarations

Ethics approval and consent to participate: Not applicable. The study used publicly available, anonymized, aggregate census and administrative data.

Consent for publication: Not applicable.

Data availability: The data are available from the Timor-Leste National Institute of Statistics, the UNESCO Institute for Statistics Bulk Data Download Service, and the cited public reports.

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Author Contributions

Domingos da Costa: Conceptualization, methodology, formal analysis, interpretation of results, and writing—original draft. **Maria Imaculada Soares:** Data curation, investigation, validation, visualization, and writing—review and editing. **José Manuel Guterres:** Statistical analysis, resources, project administration, validation, and writing—review and editing.

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