EDUCATION READINESS & EQUITY DASHBOARD (UDISE+ 2023–25)

Tracking Infrastructure, Digital Access, and Learning Outcomes Across Indian States

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PROBLEM STATEMENT & OBJECTIVE

The project aims to evaluate India's educational readiness and equity using the *Unified District Information System for Education Plus (UDISE+ 2023–25)* dataset. While India has achieved significant expansion in school infrastructure and digital access, regional disparities still exist.

Our goal was to measure, compare, and interpret state-wise educational performance across multiple indicators to identify *where infrastructure and digital growth are translating into equitable access and retention*.

Key Objectives:

- To assess physical and digital infrastructure readiness across states.
- To examine the relationship between infrastructure, gender parity, and access (GER, GPI, PTR).
- To analyse year-over-year (YoY) growth and identify policy implications for equitable education.

DATASET OVERVIEW & EXTRACTION

Primary Source:

- *District-Level Education Dataset (UDISE+ 2023–25)*
- Covers ~750 districts across 36 states/UTs for two academic years (2023–24 & 2024–25).

Dataset Features:

Category	Indicators	Description
Infrastructure	Basic Infra Index, Digital Infra Index, Infrastructure Index	Physical & digital facilities
Equity	GPI (Gender Parity Index)	Gender balance in enrolment
Access	GER (Gross Enrolment Ratio), PTR (Pupil-Teacher Ratio)	Participation & teacher availability
Retention	Retention Rate, Dropout Rate	Continuity across years

Challenges Addressed:

- Data inconsistency in district spellings and missing values across years.
- Different scaling of indices across sheets.
- Mismatch in year identifiers and inconsistent district counts.

DATA PRE-PROCESSING & TRANSFORMATION (PYTHON IMPLEMENTATION)

- **Data Cleaning:**
  - Standardized column names (state, district, year, etc.)
  - Handled missing and duplicate rows.
  - Normalized index scales to 0–1 using Min–Max scaling.
- **Feature Engineering:**
  - Derived YoY growth rates using:
    - $Growth\ \% = \frac{(Value\ t2\ - Value\ t1)}{Value\ t1}$ x 100
  - Created new analytical columns:
    - infra_growth_pct, digital_infra_growth_pct, retention_change_pct, PTR_change_pct, GER_growth_pct, GPI_growth_pct
- **Data Integration:**
  - Merged the cleaned yearly datasets into a unified CSV.
  - Validated consistency using groupby(['state','year']).count().
- **Validation:**
  - Verified YoY computations using cross-tab comparisons for 2023–24 and 2024–25.
  - Conducted outlier checks for negative or extreme growth values.
- **Output:**
  A fully structured, multi-year dataset ready for Tableau ingestion — combining both raw indices and derived growth metrics.

TABLEAU IMPLEMENTATION & STORY CREATION PIPELINE

Data Connection:

- Imported final CSV into Tableau.
- Verified data types and created hierarchies (State → District → Year).

Calculated Fields Created:

- *Growth Index Ratios* for infra, GER, GPI, and retention.
- *Custom measures* for "% Change YoY".
- *Composite Infrastructure Score* combining physical and digital indices.

Modelling Logic (Tableau):

- Used dual maps to visualize spatial readiness changes between 2023–24 and 2024–25.
- Designed scatter correlations to examine relationships between:
  - Infrastructure vs GER (access)
  - Digital Infra vs GPI (gender parity)
  - Infra Growth vs GER Growth (causality check)
- Developed state-level heatmap for multi-metric comparison across six dimensions.

Story Creation:

- **Dashboard 1:** Macro-level readiness and infrastructure distribution.
- **Dashboard 2:** Correlation and growth analysis with trendlines and YoY indicators.
- **Complete Story View:** Unified narrative showing how readiness, access, and equity interrelate.

DASHBOARDS AND INSIGHTS

Dashboard 1: Education Readiness & Equity Overview

- Provides a national snapshot of India's education infrastructure readiness.
- *Finding:* While southern and western states maintain high physical and digital infrastructure scores (>0.95), north-eastern regions lag in both dimensions.
- *Policy Link:* Regional development focus needed for digital equity.

Dashboard 2: Performance Relationships & Growth Analysis

- Shows positive correlation between infrastructure and enrolment.
- *Finding:* States with higher infra growth show proportionate GER increases; however, digital expansion alone does not guarantee gender parity.
- *Policy Link:* Combine physical infrastructure with socio-digital inclusion programs.

Dashboard 3: Complete Analysis Story

- Integrates all dashboards with contextual commentary and interlinked insights.
- *Finding:* Balanced progress across infrastructure, PTR, and retention indicators leads to the strongest educational outcomes.

KEY FINDINGS

No.	Insight	Policy Implication
1	States with high Infra & Digital growth show higher GER and Retention	Integrated infra planning directly enhances access & continuity
2	Digital Infra alone shows weak GPI correlation	Gender-specific digital literacy programs required
3	PTR reduction aligns with retention increase	Teacher recruitment policies improve sustainability
4	NE states have lowest Infra growth (<0.93)	Priority funding for connectivity & infrastructure
5	Balanced Infra–GPI–Retention score states perform better overall	Holistic policy yields equitable progress

PUBLIC POLICY RECOMMENDATIONS

1. Balanced Infrastructure Investment Policy

- States with stronger *physical* + *digital infrastructure* show higher enrolment & retention.
- **Policy Action:** Adopt a *Balanced Infrastructure Policy* mandating joint upgrades of classrooms and digital facilities to ensure inclusive learning environments.

2. Gender-Focused Digital Inclusion

- Rapid digitization in some regions correlates with lower GPI.
- **Policy Action:** Launch *Gender-Digital Inclusion Programs*—providing subsidized devices, digital literacy, and community access centres for girls in rural/tribal zones.

3. Teacher–Student Balance & Retention Mission

- Optimal PTR strongly links to high retention rates.
- **Policy Action:** Establish a *National PTR Optimization Mission* for equitable teacher allocation, rural posting incentives, and year-on-year PTR monitoring.

4. Regional Readiness & Connectivity Missions

- North-eastern and central states show lagging Infra Growth %.
- **Policy Action:** Initiate *Regional Education Readiness Missions* with targeted infrastructure funding, school electrification, and broadband access expansion.

PUBLIC POLICY RECOMMENDATIONS

5. Data-Driven Funding & Annual Readiness Index

- Multi-indicator heatmaps reveal inter-state disparities.
- **Policy Action:** Create an *Education Readiness Index (ERI)* for performance-based funding tied to annual improvements in Infra, GER, GPI & Retention.

6. Digital–Physical Integration in Learning

- Digital Infra growth doesn't always increase GER.
- **Policy Action:** Promote *Blended Learning Models* combining smart classrooms with teacher-led physical instruction and training for digital pedagogy.

7. Retention-Linked Support Framework

- States with mid-level infra but low retention need socio-economic support.
- **Policy Action:** Expand existing schemes (e.g., scholarships, meals) into a *Retention Support Framework* linked to continuous attendance and progression data.

8. Predictive Policy Analytics (Future Scope)

- Current dashboard establishes diagnostic foundation.
- **Policy Action:** Extend to *Predictive Readiness Models* using ML to forecast enrollment, retention, and infrastructure impact scenarios.

CONCLUSION

The *Education Readiness & Equity Dashboard (UDISE+ 2023–25)* presents a unified, data-driven perspective of India's educational landscape that is integrating infrastructure, access, and equity into one coherent analytical framework.

By combining physical and digital infrastructure indices with indicators such as GER, GPI, PTR, and Retention Rate, this analysis highlights that the true strength of India's education system lies not in isolated growth but in balanced and synchronized progress across multiple dimensions.

The findings emphasize that:

- Regions with well-developed infrastructure and optimized teacher-student ratios record stronger enrolment and retention outcomes.
- Digital infrastructure, though expanding rapidly, must be coupled with *social inclusion and gender-responsive policies* to ensure equitable access.
- Regional disparities, particularly across north-eastern and central states, remain significant and demand targeted intervention.

The dashboards thus move beyond visualization that is they act as decision-support tools, empowering policymakers to:

- Track year-over-year readiness through measurable indicators,
- Prioritize resource allocation based on data-backed evidence, and
- Align state-level progress with the goals of NEP 2020 and SDG 4 (Quality Education).

In essence, this project transforms static UDISE data into an actionable intelligence framework, bridging the gap between data analytics and public policy.

The roadmap ahead involves scaling this system into predictive policy models, enabling India's educational ecosystem to not only monitor readiness but to *forecast and accelerate equitable growth for every learner, in every state.*