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Regional and Gender Disparities in Higher Education in Nepal: A Quantitative Case Study

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Abstract

National indicators of higher education participation can obscure substantial geographic and gender inequalities within education systems. This study quantifies provincial and gender-based disparities in Nepal's higher education system using reproducible mathematical and statistical techniques applied to University Grants Commission Education Management Information System data and the 2021 national census. Regional disparities were assessed using access ratios based on location quotients, an enrollment–population Lorenz curve, the Gini coefficient, and the Index of Dissimilarity, while gender disparities were examined through the Gender Parity Index (GPI), progression patterns across educational levels, and discipline-specific representation. The findings show that students from Bagmati Province participate in higher education at approximately 2.2 times the rate predicted by the province's population share. Madhesh Province, rather than Karnali Province, recorded the country's lowest relative access ratio at 0.40, indicating participation 60% below proportional representation. The provincial Gini coefficient was 0.31, numerically close to Nepal's income Gini coefficient of 0.33, while the Index of Dissimilarity indicated that approximately one quarter of enrollment would need to be redistributed statistically across provinces for enrollment shares to correspond with population shares. The Gini coefficient declined modestly from 0.35 in FY 2019/20 to 0.31 in FY 2021/22. Nationally, the tertiary GPI increased from 0.26 in 1983 to 1.30 in FY 2023/24, representing a shift from pronounced male advantage to female-majority enrollment. However, substantial pipeline attrition persisted: female representation declined from approximately 57% at enrollment to 41% at the master's level, approximately 16% at the MPhil and PhD levels, and less than 8% among university faculty in the most recent available data. Female representation was also markedly lower in Engineering (24.4%) and Sanskrit studies (14.5%). These findings demonstrate that national gender parity coexists with vertical, disciplinary, and regional inequalities. The study provides a reproducible framework for diagnosing these disparities and identifies province-by-gender disaggregation as an essential data-transparency priority for evaluating compounded disadvantage and informing equitable higher education policy.

Keywords: Educational Inequality; Gender Parity; Higher Education Access; Nepal; Regional Disparity

Introduction

Nepal's higher education system has grown rapidly in absolute terms — from roughly 371,000 students in FY 2016/17 to 633,053 in FY 2023/24 — but aggregate growth figures conceal how unevenly that growth, and the underlying access to opportunity, is distributed. Two axes of disparity are especially consequential for national human-capital policy: where a student is born (which province, and whether it is urban Bagmati or rural Karnali/Madhesh), and who a student is (gender, and how that intersects with degree level and field of study). Recent research has highlighted the growing application of numerical techniques and differential equation-based approaches in addressing complex problems across cultural studies, social systems, and aerospace engineering. These studies demonstrate how mathematical modelling can provide structured methods for analyzing dynamic interactions, optimizing processes, and predicting future outcomes. Sahani and Sah (2025) investigated the optimization of cultural education programs through numerical techniques. The study emphasized the importance of mathematical approaches in improving the effectiveness of cultural education by identifying optimal strategies for resource allocation, program design, and educational outcomes. By applying numerical methods, the authors demonstrated that complex cultural learning systems can be analyzed systematically rather than relying solely on qualitative approaches. This research provides evidence that computational techniques can contribute to better decision-making in educational and cultural planning (Sahani & Sah, 2025). Similarly, Sahani et al. (2025) explored cultural value conflicts within multicultural societies using numerical simulation methods. The study developed a mathematical framework to understand interactions among different cultural values and examined how conflicts may evolve under changing social conditions. The findings suggested that numerical modelling can be useful for analyzing social complexity, identifying patterns of cultural tension, and developing strategies for promoting cultural harmony. This approach expands the role of mathematical simulation beyond traditional scientific fields into social and behavioral research (Sahani et al., 2025). Sahani and Karna (2025) further contributed to this area by examining the optimization of cultural education programs through numerical methods. Their research focused on developing efficient approaches for improving cultural learning outcomes using mathematical optimization techniques. The study showed that numerical models can assist policymakers and educators in designing programs that balance multiple objectives, including cultural awareness, educational effectiveness, and resource efficiency (Sahani & Karna, 2025). In the field of aerospace engineering, differential equations remain fundamental tools for analyzing complex physical phenomena. Sahani et al. (2024) examined analytical frameworks involving differential equations in aerospace engineering. Their study discussed how mathematical models are applied to represent aircraft dynamics, motion analysis, and engineering systems. The research emphasized that differential equations provide essential frameworks for understanding and predicting aerospace behavior under different operational conditions (Sahani et al., 2024). Jha et al. (2023) explored stellar evolution through the application of differential equations, demonstrating the role of mathematical modelling in understanding astronomical processes. The study explained how differential equations are used to describe changes in stars over time, including their formation, development, and eventual transformation. This research highlights the ability of mathematical models to represent long-term dynamic processes in complex natural systems (Jha et al., 2023). Furthermore, Sharma et al. (2024) analyzed rocket motion using differential equation-based approaches. The study demonstrated how mathematical equations can explain rocket dynamics, including velocity changes, acceleration, and motion under varying forces. The research highlighted the importance of differential equations in aerospace applications, particularly in improving understanding of propulsion systems and flight trajectories (Sharma et al., 2024). Overall, the reviewed literature demonstrates that numerical techniques and differential equations serve as powerful analytical tools across diverse disciplines. While cultural studies benefit from numerical optimization and simulation for understanding social systems, aerospace research relies on mathematical modelling for predicting physical behavior. These studies collectively indicate that computational and mathematical approaches can enhance problem-solving, improve decision-making, and provide deeper insights into complex dynamic systems.

This paper treats both axes as measurable quantities rather than impressions. Using standard demographic and economic inequality tools — the location quotient, the index of dissimilarity, the Gini coefficient derived from a Lorenz curve, the Herfindahl-Hirschman Index (HHI), and cohort-based pipeline/attrition ratios — it builds a reproducible, numerically transparent picture of who is, and is not, being reached by Nepal's higher education expansion.

The motivation for this approach is straightforward. National-level summary statistics — total enrollment, overall gender parity, year-on-year growth rates — are the figures most often cited in policy documents, donor reports, and news coverage. They are also the figures most likely to mask internal heterogeneity. A country can simultaneously report a healthy national Gender Parity Index and a severely skewed distribution of that parity across provinces, disciplines, and degree levels. Likewise, a country can report strong overall enrollment growth while that growth is disproportionately captured by one region. Disaggregation is therefore not a cosmetic refinement of the national picture; it is often the only way to see the picture at all. This paper's contribution is to apply a consistent, transparent set of quantitative tools — tools already standard in economic geography, labor economics, and demography — to Nepal's own published administrative data, so that every number in the analysis can, in principle, be reproduced by another researcher working from the same UGC EMIS reports and census tables.

The remainder of the paper is organized as follows. Section 2 provides historical and institutional background on the development of Nepal's higher education system, which is necessary context for interpreting why enrollment is currently so concentrated in Bagmati Province. Section 3 situates the paper within the existing literature on gender and regional disparity in Nepali education. Section 4 documents the data sources used. Section 5 defines the six quantitative indices used throughout the paper. Sections 6 and 7 present the regional and gender analyses respectively. Section 8 discusses where the two disparities plausibly intersect. Section 9 places Nepal's trajectory in a South Asian comparative context. Sections 10 through 14 discuss findings, draw out policy implications, propose directions for future research, acknowledge limitations, and conclude. Two appendices provide fully worked calculations and a glossary of technical terms for readers less familiar with the indices used.

Historical and Institutional Background

Understanding why Bagmati Province currently accounts for nearly half of Nepal's higher-education enrollment requires some awareness of how the system developed. Modern higher education in Nepal traces back to the establishment of Tri-Chandra College in Kathmandu in 1918, which for decades remained essentially the only avenue into higher study in the country. Tribhuvan University, Nepal's first and for a long period only university, began operating in 1959, and for the following quarter-century it was the sole institution responsible for the country's entire higher-education sector. This meant that from the very founding of the modern system, higher education infrastructure was concentrated in the Kathmandu Valley — now part of Bagmati Province — by default rather than by any explicit policy of provincial equity.

The system began to diversify only in the 1980s and 1990s. Mahendra Sanskrit University was established in 1986, followed by Kathmandu University in 1990 and by Purbanchal and Pokhara Universities in 1995 and 1996 respectively. The restoration of multiparty democracy in 1990 is generally credited as the political turning point that enabled this diversification: it was in this context that the University Grants Commission (UGC) was created under the University Grants Commission Act of 1993, becoming operational in 1994 with the specific mandate of coordinating a then-fragmented, rapidly expanding sector, allocating government grants across institutions, and maintaining quality standards nationally. Even so, expansion of new universities into the country's more remote provinces continued slowly: Far-Western University, serving Sudurpaschim Province, was not established until 2010, and Nepal Open University — created specifically to expand distance-learning access to populations otherwise excluded from conventional campus-based study — dates only to 2016. Rajarshi Janak University, based in Janakpurdham in Madhesh Province and the home institution of this paper's authors, was founded in 2017, making it one of the youngest constituent universities in the national system and a direct institutional response to the same provincial access gap this paper quantifies.

This sequencing matters for interpreting the Access Ratio findings in Section 6. Bagmati's roughly 46–49% enrollment share is not simply a function of population size or economic development; it is also a function of a century-long head start in institutional density, compounded by the fact that private campus expansion — which now accounts for the majority of campuses in Bagmati — has itself concentrated disproportionately around the existing public-university infrastructure in the Kathmandu Valley. Provinces such as Madhesh and Karnali, by contrast, have had functioning constituent universities of their own only for a matter of years, not decades. Any policy aiming to close the regional Access Ratio gap identified in this paper is, in effect, competing against more than a century of accumulated locational advantage.

Literature Review

This paper draws on, and seeks to complement, two largely separate strands of existing research on Nepali education: a strand focused on gender, and a much thinner strand focused on regional/provincial disparity. Few existing studies bring the two together quantitatively, which is one of the gaps this paper attempts to address.

Gender and education in Nepal

A substantial qualitative and mixed-methods literature documents the socio-cultural mechanisms behind gender gaps in Nepali education, even as national enrollment statistics have moved toward and past parity. Research on female student dropout from Nepali high schools has identified patriarchal household norms, assessment and school-system factors, and broader social exclusion as key drivers of early departure from schooling, drawing on interviews across multiple ecological regions of the country — the mountains, the hills, and the Tarai — to capture geographic as well as gendered variation in these pressures. Separately, research using Nepal Living Standards Survey data has found that parental household spending decisions systematically favor sons over daughters in education expenditure, and that this bias is reflected in higher rates of private-school enrollment for boys than girls — evidence that formal enrollment-parity statistics can understate the depth of gendered educational disadvantage, since spending disparities affect the quality and type of schooling received even where enrollment rates alone look balanced.

Cross-country indices place Nepal's broader gender-inequality profile in context. Nepal has historically ranked in the bottom half of countries assessed by the UNDP Gender Inequality Index, and more recent comparative assessments continue to find Nepal trailing regional peers specifically on economic participation, even while showing more moderate progress on health and political representation. This pattern — relatively better progress on formal educational access than on economic and leadership outcomes — is consistent with this paper's own finding of a favorable aggregate Gender Parity Index in enrollment sitting alongside a steep attrition of women from the graduate and faculty ranks of the same higher-education system (Section 7.6).

Regional and geographic disparity

Literature specifically quantifying provincial or district-level disparity in Nepali higher-education access is comparatively sparse; most existing regional-equity discussion in Nepal is descriptive or policy-oriented rather than index-based, and tends to focus on Karnali Province as the paradigmatic case of disadvantage, given its mountainous terrain, lower population density, and historically limited campus infrastructure. This paper's Access Ratio findings (Section 6.2) suggest that this Karnali-centric framing, while not wrong, may be incomplete: Madhesh Province, despite having a much larger population and being geographically far more accessible than Karnali, shows a lower population-adjusted access ratio in the most recent data. This is consistent with separate observations in the literature on regional development in Nepal's Tarai belt, where high population density combined with comparatively low per-capita public investment in tertiary infrastructure has been noted as a distinct disadvantage pattern from the sparser, more logistically difficult but proportionally better-served mountain provinces.

Quantitative methods applied here

The specific indices used in this paper — location quotients, Gini coefficients derived from Lorenz curves, indices of dissimilarity, and Herfindahl-Hirschman concentration indices — are all well established in adjacent fields (regional economics, industrial organization, and demography) but are applied relatively rarely, in a fully worked and reproducible form, to Nepali higher-education administrative data specifically. Gender Parity Index tracking itself is well established through World Bank and UNESCO Institute for Statistics reporting, which this paper cross-validates against Nepal's own UGC EMIS figures in Section 7.2. The pipeline/attrition-ratio framework used in Section 7.6 follows the general logic of cohort-based “leaky pipeline” analysis common in international studies of women's underrepresentation in academic and STEM careers, adapted here to Nepal's specific Bachelor's–Master's–MPhil–PhD–faculty progression.

Taken together, the existing literature supports two expectations this paper's data confirm: that gender disparity in Nepali education is real but increasingly concentrated at the upper end of the academic pipeline rather than at initial enrollment, and that regional disparity persists as a structural feature of the system tied to historical institutional concentration rather than to population distribution alone. Where this paper aims to add value is in making both patterns numerically explicit, comparable to one another on common scales (e.g., the 0–1 Gini scale shared with income inequality), and traceable to specific, cited administrative data points rather than general impression.

Data Sources

Table 1 summarizes every data source used in this paper, together with the reference period each source covers. Where two sources reported slightly different figures for the same underlying quantity (most notably the national Gender Parity Index; see Section 7.2), both are reported and the discrepancy is discussed explicitly rather than silently resolved.

Data	Source	Reference period
Provincial enrollment shares	UGC EMIS Report on Higher Education, FY 2019/20 and FY 2021/22	FY 2019/20, FY 2021/22
Provincial campus distribution	UGC EMIS Report on Higher Education, FY 2023/24	FY 2023/24
Provincial population	Nepal 2021 Census (Central Bureau of Statistics)	2021
National gender enrollment (18–22 age cohort)	Journal of Educational Research (Shiksha Shastra Saurabh), citing UGC EMIS 2023/24	FY 2023/24
Tertiary Gender Parity Index, historical	World Bank / UNESCO Institute for Statistics, via TheGlobalEconomy.com	1983–2023
University-level female enrollment share	CDC Journal (Nepal), "A Comprehensive Analysis of Students' Enrollment Trends," Dec. 2023	FY 2019/20 (2078/79 B.S.)
Faculty (discipline)-level gender gaps	UGC EMIS Report on Higher Education 2023/24	FY 2023/24

Data	Source	Reference period
Degree-level gender breakdown (Master's/MPhil/PhD)	UGC Report on Higher Education 2018/19, cited in Kathmandu Post	FY 2018/19
Teaching-staff gender composition	UGC Report on Higher Education 2010/11, cited in Kathmandu Post	FY 2010/11
Institutional and historical background	University Grants Commission, Nepal; general higher-education histories	1918–2017

A methodological note on data provenance is warranted. UGC EMIS reports are the closest thing Nepal has to an authoritative, annually updated census of higher-education enrollment, and this paper treats them as the primary source wherever they are available directly. Where a figure is drawn from a secondary citation of a UGC report (for example, degree-level and faculty gender breakdowns, which are cited via Kathmandu Post opinion pieces rather than directly extracted from the underlying UGC report), this is flagged in the data table above and again at first use in the relevant section, consistent with this paper's general practice of never presenting a dated or secondarily-sourced figure as if it were current, primary data.

Methodology: Index Definitions

This paper uses six indices, chosen because each is standard, well documented in the literature on regional and demographic inequality, and computable directly from published administrative and census tables without requiring any additional survey work. To keep every formula below unambiguous, the following notation is used throughout the paper: for province i, let E_i denote its enrollment share and P_i its population share (both expressed as proportions of the national total); let k index provinces ranked by ascending Access Ratio, with X_k and Y_k the cumulative population and enrollment shares through the k-th ranked province; and let f_s denote the female enrollment share at academic stage s, with f_0 the Bachelor's-level baseline share.

Access Ratio / Location Quotient (LQ)

For province i, the Access Ratio is the ratio of its enrollment share to its population share:

$$LQi = Ei \div Pi$$

LQ = 1 means a province's students are represented in higher education exactly in proportion to its population; LQ > 1 means over-representation; LQ < 1 means under-representation. The location quotient is borrowed directly from regional economics, where it is most commonly used to measure industry concentration relative to a national baseline; its application here treats "enrollment" as the quantity being concentrated and "population" as the baseline against which concentration is measured. It was chosen over a simple enrollment-share comparison because it directly answers the policy-relevant question — "is this province over- or under-represented, and by what multiple?" — in a single, easily interpreted number.

Index of Dissimilarity (D)

A standard segregation/mismatch statistic, repurposed here to measure the share of students who would need to be reallocated across provinces to make enrollment shares match population shares exactly:

$$D = 0.5 \times \Sigma i \mid Ei - Pi \mid$$

D ranges from 0 (enrollment shares exactly match population shares in every province) to a theoretical maximum approaching 1 (all enrollment concentrated in a single province with a negligible population share). It is widely used in demography to measure residential or occupational segregation between two groups; here the two "groups" being compared are enrolled students and the general population, distributed across the same seven provinces.

Gini coefficient (G), via the Lorenz curve

Provinces are ranked by ascending Access Ratio, and the Gini coefficient is computed from the cumulative shares X_k and Y_k defined above using the trapezoidal approximation to the Lorenz curve:

$$G = 1 - \Sigma k \, (Xk - Xk{-}1) \, (Yk + Yk{-}1)$$

G = 0 is perfect equality; G = 1 is maximal inequality (all enrollment concentrated in a single province). This is the same index used to measure income and wealth inequality worldwide, which is precisely why it is useful here: expressing regional educational access inequality on the identical 0–1 scale used for income inequality allows a direct, intuitive magnitude comparison between the two (see Section 6.4).

Herfindahl-Hirschman Index (HHI)

A concentration measure widely used in industrial economics to assess market concentration, applied here to enrollment shares expressed in percentage points:

$$HHI = \Sigma i\, Ei2$$

With shares expressed in percentage points, HHI ranges from 0 to 10,000. An HHI computed on enrollment shares captures concentration in a way the Gini coefficient does not fully capture on its own: it is disproportionately sensitive to a single dominant province (Bagmati), making it a useful cross-check against the Gini and Index of Dissimilarity results.

Gender Parity Index (GPI)

The Gender Parity Index is the ratio of female to male enrollment:

$$GPI = F \div M$$

GPI = 1 is parity; GPI < 1 favors males; GPI > 1 favors females. This is the standard index used by UNESCO and the World Bank for cross-country gender-parity reporting in education, which makes Nepal's own GPI figures directly comparable to those of neighboring countries (Section 9).

Pipeline attrition ratio

For an academic stage s with female share f_s, relative to the baseline (Bachelor's-level) female share f_0:

$$Attritions = fs \div f0$$

A ratio well below 1 indicates women who enter the system exit it disproportionately before reaching that stage. This measure is adapted from the “leaky pipeline” framework commonly used internationally to describe women's progressive underrepresentation moving from undergraduate study through to senior academic and research positions, applied here specifically to Nepal's Bachelor's–Master's–MPhil–PhD–faculty progression.

Part I — Regional (Provincial) Disparity

Population vs. enrollment shares

Province	Population share (2021 census)	Enrollment share FY 2019/20	Enrollment share FY 2021/22
Bagmati	20.97%	49.40%	46.40%
Madhesh	20.97%	7.30%	8.34%
Lumbini	17.56%	12.14%	13.26%
Koshi	17.01%	11.94%	12.99%
Sudurpaschim	9.24%	6.66%	6.86%
Gandaki	8.46%	8.63%	8.32%
Karnali	5.79%	3.94%	3.82%

Two features of Table 2 are worth flagging before the derived indices are presented. First, Bagmati and Madhesh have almost identical population shares (both approximately 21%) yet radically different enrollment shares — 49.4% versus 7.3% in FY 2019/20 — which alone signals that population size cannot explain the enrollment gap between these two provinces; something structural is driving the difference. Second, every non-Bagmati province's enrollment share moved in the same direction between FY 2019/20 and FY 2021/22 — all six increased their share, while Bagmati's fell from 49.40% to 46.40% — indicating that whatever equalization is occurring is happening broadly across the remaining six provinces rather than being concentrated in any single one of them.

Access Ratio (Location Quotient), FY 2021/22

Using $LQ_i = E_i \div P_i$ as defined in Section 5.1:

- Bagmati: 46.40 / 20.97 ≈ 2.213
- Gandaki: 8.32 / 8.46 ≈ 0.983
- Koshi: 12.99 / 17.01 ≈ 0.764
- Lumbini: 13.26 / 17.56 ≈ 0.755
- Sudurpaschim: 6.86 / 9.24 ≈ 0.742
- Karnali: 3.82 / 5.79 ≈ 0.660
- Madhesh: 8.34 / 20.97 ≈ 0.398

Finding: Bagmati Province — home to Kathmandu Valley and the highest concentration of constituent and private campuses — enrolls students at more than double

(2.21×) the rate its population share alone would predict. At the other extreme, Madhesh Province has the lowest Access Ratio in the country (0.40) — lower than Karnali's (0.66) — even though Karnali is the province most frequently described in policy discourse as Nepal's most educationally disadvantaged region. In relative, population-adjusted terms, Madhesh's under-representation is nearly twice as severe as Karnali's. This is a substantively important, non-obvious finding: Karnali's disadvantage is more visible because its absolute numbers are smallest, but Madhesh's disadvantage is more severe once population size is accounted for.

It is worth dwelling on why this finding runs against the conventional policy narrative. Karnali's disadvantage is highly visible in absolute terms — it is Nepal's smallest and most sparsely populated province, its terrain is the most logistically difficult in the country, and it has historically received the most targeted development attention as a result. Madhesh's disadvantage, by contrast, is a relative one: it is a large, densely populated, geographically accessible province sitting in the Tarai plains, immediately adjacent to Bagmati, and yet it converts that population into higher-education enrollment at a rate even lower than remote, mountainous Karnali does. A purely population-based equity lens — asking only "which province has the fewest students in absolute terms?" — would flag Karnali. A rate-based equity lens — asking "which province's residents are least likely, per capita, to be enrolled?" — flags Madhesh instead. Both lenses are legitimate, but they point policy attention in different directions, and only the second is captured by the Access Ratio computed here.

Index of Dissimilarity

Using FY 2021/22 shares:

Province	|Enrollment share − Population share|
Bagmati	|46.40 − 20.97| = 25.43
Madhesh	|8.34 − 20.97| = 12.63
Koshi	|12.99 − 17.01| = 4.02
Lumbini	|13.26 − 17.56| = 4.30
Sudurpaschim	|6.86 − 9.24| = 2.38
Karnali	|3.82 − 5.79| = 1.97
Gandaki	|8.32 − 8.46| = 0.14
Sum	50.87

$D = 0.5 \times 50.87 \approx 25.4\%$

Finding: Roughly one-quarter of all enrolled higher-education students in Nepal are, in effect, geographically “misallocated” relative to a population-proportional benchmark — they would need to be redistributed across provinces for enrollment shares to exactly mirror population shares. Bagmati alone contributes exactly half of the total dissimilarity sum (25.43 of 50.87), meaning that a policy intervention focused solely on reducing Bagmati's over-concentration — without needing to touch the relative standing of the other six provinces at all — could in principle close half of the total measured misallocation.

Gini coefficient of regional access (Lorenz curve)

Ranking provinces by ascending Access Ratio and cumulating population share (X) against enrollment share (Y), FY 2021/22:

Province (ascending LQ)	Cumulative X	Cumulative Y
— (origin)	0.0000	0.0000
Madhesh	0.2097	0.0834
Karnali	0.2676	0.1216
Sudurpaschim	0.3600	0.1902
Lumbini	0.5356	0.3228
Koshi	0.7057	0.4527
Gandaki	0.7903	0.5359
Bagmati	1.0000	1.0000

Applying the Gini formula defined in Section 5.3 across the seven segments:

$$G(\text{FY } 2021/22) \approx 0.314$$

Repeating the identical calculation on FY 2019/20 shares (holding population shares fixed, since census data does not change within this short window) gives:

$$G(\text{FY } 2019/20) \approx 0.348$$

Finding: Regional inequality in higher education access, measured on the same 0–1 scale used for income inequality, declined modestly from 0.35 to 0.31 over two years — roughly a 10% relative improvement — driven mainly by a slight easing of Bagmati's dominance (LQ falling from 2.36 to 2.21) and a small relative gain for Madhesh (LQ rising from 0.35 to 0.40). Notably, Nepal's regional higher-education access Gini (0.31) is now close in magnitude to Nepal's national income Gini coefficient (0.33, 2010 estimate) — a striking cross-domain consistency suggesting that educational access inequality and income inequality sit at broadly similar levels of severity, consistent with a self-reinforcing relationship between the two.

The direction of causality between these two Gini coefficients cannot be established from cross-sectional data of this kind, and this paper does not claim to establish it. Two plausible mechanisms would each be consistent with the observed correlation in magnitude. Under one mechanism, income inequality across provinces limits some provinces' ability to invest in local higher-education infrastructure and limits households' ability to afford tuition, transport, and living costs associated with attending a distant campus, which would push educational-access inequality toward income-inequality levels. Under the other mechanism, unequal access to higher education itself perpetuates income inequality across provinces by limiting human-capital accumulation and access to higher-earning occupations in under-served regions, which would push income inequality toward educational-access-inequality levels. Most plausibly, both mechanisms operate simultaneously in a mutually reinforcing cycle, which is consistent with the persistence of both forms of inequality at broadly similar magnitude over the two-year window observed here.

Herfindahl-Hirschman Index of enrollment concentration

Using FY 2021/22 enrollment shares (in percentage points):

$$HHI_{enrollment} = 46.402 + 13.262 + 12.992 + 8.342 + 8.322 + 6.862 + 3.822$$

$$= 2{,}152.96 + 175.83 + 168.74 + 69.56 + 69.22 + 47.06 + 14.59 = 2{,}697.96$$

For comparison, the HHI implied purely by population distribution is:

$$HHI_{population} = 20.972 + 20.972 + 17.562 + 17.012 + 9.242 + 8.462 + 5.792 = 1{,}667.64$$

$$Ratio = 2{,}697.96 \div 1{,}667.64 \approx 1.62$$

Finding: Enrollment is roughly 62% more concentrated than Nepal's underlying population distribution alone would produce — confirming, through an independent index, that higher education access is disproportionately clustered in already-populous, already-advantaged Bagmati Province rather than simply mirroring the country's demographic geography. For context, an HHI below 1,500 is conventionally read as an "unconcentrated" distribution in antitrust and industrial-economics practice, 1,500–2,500 as "moderately concentrated," and above 2,500 as "highly concentrated." Nepal's enrollment HHI of roughly 2,698 falls solidly within the highly concentrated range — a useful, independently interpretable benchmark that corroborates the Gini and Access Ratio findings above using an entirely different mathematical construction.

Campus type as a partial equalizer

UGC data on campus ownership type by province (FY 2023/24) shows that community colleges — the most heavily subsidized, least market-driven campus type — are more numerous than private campuses in Karnali (29 community vs. 10 private), whereas in Bagmati, private campuses dominate (413 of 624 campuses, or 66.2%). This suggests that where the public/community system reaches remote provinces at all, it does so specifically through the community-college channel rather than through constituent or private expansion — an important structural detail for targeting future public investment. It also implies that private-sector campus expansion, left to market incentives alone, will likely continue to reinforce rather than correct the existing provincial concentration pattern, since private investment naturally follows population density, existing infrastructure, and ability to pay — all of which favor Bagmati over Madhesh or Karnali. Closing the regional Access Ratio gap identified in Section 6.2 is therefore unlikely to happen through market forces alone and plausibly requires continued, deliberate public and community-college investment specifically directed at the lowest-Access-Ratio provinces.

Part II — Gender Disparity

The headline reversal: national Gender Parity Index, 1983–2023

Year	Tertiary GPI
1983 (historical minimum)	0.26
1983–2023 average	0.69
2022	1.11
2023	1.20

Compound annual growth rate of the GPI over this 40-year span:

$$CAGR = (1.20 \div 0.26)1/40 - 1 = (4.615)0.025 - 1 \approx 3.9\% \text{ per year}$$

Finding: Nepal's tertiary GPI has grown at a remarkably steady ~3.9% per year for four decades, crossing the parity line (GPI = 1.0) sometime in the past decade and now standing at 1.20–1.30 depending on the data source (see Section 7.2). In 1983, for every girl enrolled in higher education, roughly 3.8 boys were enrolled (1/0.26); by 2023, for every boy enrolled, roughly 1.2–1.3 girls were enrolled. This is one of the more complete gender reversals recorded in South Asian tertiary education over this period.

A near-constant compound annual growth rate over a 40-year span is itself notable: it suggests the underlying drivers of gender-parity improvement in Nepal — whatever mix of scholarship programs, social change in family investment decisions, and broader development gains produced them — operated with unusual consistency across several very different political and economic periods, including the Panchayat era, the 1990 democracy movement and its aftermath, the decade-long Maoist insurgency (1996–2006), and the post-2015 federal restructuring. Few social indicators in Nepal show this degree of trend stability across such a turbulent 40-year political history, which is itself suggestive evidence that the gender-parity trend is driven by durable structural forces (rising female secondary completion, sustained scholarship targeting, shifting social norms around daughters' education) rather than by any single policy or political period.

Two data sources, one direction, different magnitudes

UGC's own EMIS report for FY 2023/24 gives a national tertiary GPI of 1.30 — female enrollment of 358,140 against male enrollment of 274,913 (358,140 / 274,913 = 1.303) — while the World Bank/UNESCO cross-country series gives 1.20 for 2023. The gap (0.10) most likely reflects definitional differences (age-cohort-adjusted GER ratio vs. raw headcount ratio). Both confirm the same direction and order of magnitude; this paper uses the UGC figure (1.30) as the domestically authoritative source for Nepal-specific claims.

Cross-checking against age-specific enrollment rates: of the population aged 18–22 (1,544,855 males; 1,455,843 females), 24.6% of women in that age band are enrolled in higher education, versus 17.8% of men — a gap of 6.8 percentage points, and a ratio ($24.6/17.8 \approx 1.38$) broadly consistent with the GPI figures above.

National Gross Enrollment Ratio, cross-validated: GER = Total enrolled / Population aged 18–22 = 633,053 / 3,000,698 ≈ 21.1%. This closely matches UGC's own reported national GER of 22%, providing an internal consistency check on the underlying data.

The secondary–tertiary "paradox"

Nepal's secondary-school GPI stood at 0.99 in 2022 (near-exact parity, slightly favoring boys), while the tertiary GPI for the same year was 1.11–1.30. In most education systems, gender gaps that exist earlier in the pipeline persist or widen at higher levels; Nepal shows the opposite pattern — near-parity at secondary level but a pronounced female tilt at tertiary level. A plausible (not proven) contributing factor, supported by independent data on outbound labor and study migration, is that a large and growing share of young Nepali men bypass domestic tertiary enrollment altogether in favor of foreign labor migration (an estimated 300,000 Nepali youth leave annually for study or work), which would mechanically depress the male denominator in domestic tertiary GPI calculations without necessarily reflecting a genuine gain in relative educational opportunity for women.

This mechanical-denominator hypothesis has an important policy implication if correct: a rising domestic tertiary GPI driven substantially by male outmigration is a materially different phenomenon from a rising GPI driven by genuine gains in female access, even though both would produce an identical GPI time series. The former implies that Nepal's effective national human-capital pipeline is shrinking on the male side rather than expanding on the female side, with consequences for national labor-market planning that a GPI figure alone cannot reveal. Testing this hypothesis rigorously would require cohort-linked migration and enrollment microdata that are not publicly available in the sources consulted for this paper; it is presented here, as in the original analysis, explicitly as a hypothesis rather than a confirmed finding.

Dispersion in female enrollment share across universities

University-level female enrollment shares (FY 2019/20, or 2078/79 B.S.):

University	Female share
Far Western University	61.65%
Tribhuvan University	54.66%
Purbanchal University	52.38%
Kathmandu University	46.57%

University	Female share
Pokhara University	43.79%
Nepal Open University	11.34%

Mean and dispersion ($n = 6$): $\bar{x} = (61.65+54.66+52.38+46.57+43.79+11.34) / 6 = 270.39 / 6 \approx 45.07\%$. $\sigma^2 \approx 260.3 \rightarrow \sigma \approx 16.13$ percentage points. Coefficient of variation = $\sigma / \bar{x} \approx 35.8\%$

Finding: A coefficient of variation of nearly 36% indicates very high dispersion in female representation across institutions — almost entirely driven by one extreme outlier, Nepal Open University, at just 11.34% female enrollment. Excluding this outlier, the remaining five "conventional" universities average 51.8% female enrollment (range 43.8%–61.7%), a comparatively narrow and consistently female-majority band. The Nepal Open University gap is consistent with a distance-learning/digital-access gender divide — a pattern documented globally in online and technology-mediated education — rather than the general pattern seen at conventional campuses.

This finding is particularly notable given that Nepal Open University was established specifically to expand access for populations otherwise excluded from conventional, campus-based higher education — a mission that, on the regional-access dimension addressed in Section 6, plausibly benefits under-served provinces disproportionately. That the same institution shows the most severe gender imbalance of any university in the country suggests that whatever access barriers distance/online learning solves on the regional dimension, it may simultaneously introduce or fail to solve on the gender dimension — plausibly because digital device access, household internet connectivity, and the domestic time autonomy needed to study independently are all themselves gendered resources in much of rural Nepal. This is precisely the kind of intersection between two forms of disadvantage that Section 8 discusses in more general terms.

Discipline-level gender gaps: the STEM/Sanskrit gap index

Against a national female enrollment share of 56.6% (358,140/633,053, FY 2023/24), selected disciplines show:

Discipline	Female share	Gap vs. national average
Sanskrit	14.50%	56.6 − 14.5 = 42.1 points
Engineering	24.40%	56.6 − 24.4 = 32.2 points
Science & Technology	39.17%	56.6 − 39.2 = 17.4 points

Finding: Even in a system with an overall female-majority enrollment, technical and traditional-scholarly disciplines remain heavily male-dominated. The Sanskrit gap (42.1 points) is the largest of the three — plausibly reflecting the discipline's historical association with traditional male priesthood/scholarly roles rather than a purely technical or economic barrier, a distinct mechanism from the Engineering gap (32.2 points), which more likely reflects the well-documented global pattern of gendered self-selection away from technical fields, reinforced by the same digital/technical-access barriers implicated in the Nepal Open University finding above.

These two gaps, though numerically similar in magnitude, likely call for different policy responses. The Sanskrit gap is rooted in a specific religious and cultural tradition of scholarly transmission that has historically excluded women from formal study; closing it plausibly requires deliberate, targeted outreach and scholarship support aimed at women specifically within that discipline's traditional feeder institutions (traditional gurukul and Sanskrit pathshala systems). The Engineering gap, by contrast, mirrors a pattern seen across almost every country in the world regardless of religious or cultural tradition, and the international literature on closing it points toward earlier-stage interventions — secondary-school STEM encouragement, female engineering faculty visibility, and targeted scholarships — rather than discipline-specific cultural outreach.

The academic pipeline: female share by degree level

Using UGC's FY 2018/19 report (the most recent with full degree-level gender disaggregation):

Stage	Male	Female	Total	Female share
Master's	25,728	17,884	43,612	17,884/43,612 ≈ 41.0%
MPhil	908	167	1,075	167/1,075 ≈ 15.5%
PhD	1,697	340	2,037	340/2,037 ≈ 16.7%

Taking the national Bachelor's/overall enrollment female share (≈56–57%) as the pipeline baseline (f_0), the attrition ratio at each subsequent stage is:

- Master's: 41.0 / 56.6 ≈ 0.72 (women retain about 72% of their baseline representation)
- MPhil: 15.5 / 56.6 ≈ 0.27 (retain about 27%)
- PhD: 16.7 / 56.6 ≈ 0.30 (retain about 30%)

And, using the most recent (though dated) faculty data available — 1,322 female vs. 15,365 male faculty (FY 2010/11) — female share of teaching staff was 7.9%, an attrition ratio of 7.9/56.6 ≈ 0.14 relative to the same baseline.

Finding: Nepal's higher education system exhibits a textbook "leaky pipeline": women hold a clear numerical majority at enrollment (≈57%) but retain only about 30% of that relative representation by the PhD level, and — on the last available data — under 15% of it among teaching faculty. The MPhil and PhD shares are both drawn from small absolute populations (1,075 and 2,037 students respectively), so year-to-year percentage swings at these two stages should be read with appropriate statistical caution; the faculty figure is now over a decade old, and UGC's more recent EMIS reports do not appear to publish an updated breakdown — a data-transparency gap that itself limits accountability for closing this gap.

The magnitude of the drop between MPhil/PhD-level student representation (≈16–17%) and faculty representation (7.9%) deserves particular attention, since it suggests attrition does not stop even after a woman has completed doctoral-level study. If the pool of potential future faculty is itself only 16–17% female at the PhD level, a faculty female share of 7.9% implies that PhD-holding women are converted into faculty positions at roughly half the rate of their male PhD-holding counterparts — pointing toward attrition mechanisms operating specifically at the hiring and early-career retention stage, separate from and additional to the attrition already occurring earlier in the degree pipeline. Because the faculty figure is fourteen years old at the time of writing, this paper cannot confirm whether this hiring-stage gap has since narrowed, widened, or remained stable, which is itself the clearest single data-transparency recommendation this paper makes (Section 11).

Part III — Where Region and Gender Likely Compound

This paper's two quantitative pillars — provincial Access Ratios and gender pipeline ratios — are each robustly grounded in published UGC and census data. A fully intersectional analysis (e.g., female Access Ratio specifically for Madhesh or Karnali) would require province-by-gender disaggregated enrollment data that UGC's public EMIS reports do not currently break out in a consistently reportable form. This is a genuine limitation rather than a gap this paper papers over.

What can be said, with appropriate caution, by combining this paper's findings with independent demographic evidence: Madhesh and Karnali — the two provinces with the lowest Access Ratios (0.40 and 0.66 respectively) — are also provinces where independent UNICEF-cited data indicates child marriage before age 18 affects roughly one-third of women aged 20–24 nationally, a rate generally understood to be unevenly distributed toward Nepal's Tarai and far-western regions. If early marriage rates are indeed higher in these two provinces, the true female Access Ratio in Madhesh and Karnali is plausibly lower than the province-wide (gender-blended) figures reported in Section 6.2 — but this paper does not have the disaggregated data to confirm that quantitatively, and presents it here explicitly as a hypothesis for future research rather than a finding.

A second, related compounding channel worth noting is institutional: because advanced (Master's, MPhil, PhD) programs are themselves disproportionately concentrated in Bagmati-based institutions (Section 6.6), a woman from Madhesh or Karnali who wishes to pursue graduate study faces a double displacement — first from her home province to reach any higher-education institution at all, and then, if she wishes to continue past the Bachelor's level, a further displacement toward the small number of Bagmati-based institutions offering graduate programs. Each of these displacements independently carries costs (relocation, living expenses, distance from family and social support networks) that fall disproportionately on women in a context where, as documented in the literature reviewed in Section 3.1, household investment decisions and social norms around unmarried women's independent relocation are themselves gendered. The two disparities are therefore plausibly not merely additive but multiplicative for a subset of the population sitting at their intersection — women from Nepal's lowest-Access-Ratio provinces seeking graduate-level education.

Regional Comparison: Nepal in the South Asian Context

Placing Nepal's gender-parity trajectory alongside its South Asian neighbors helps clarify how unusual, or how typical, the reversal documented in Section 7.1 actually is. Gender Parity Index tracking for secondary and tertiary enrollment across South Asia, compiled by the World Bank from UNESCO Institute for Statistics data, shows considerable variation across the region: several South Asian countries have, like Nepal, moved from historic male-favoring enrollment ratios toward parity or female-majority tertiary enrollment over the past two to three decades, while others continue to show male-favoring ratios at the tertiary level even where secondary-level parity has been achieved. Nepal's specific pattern — near-exact secondary parity (GPI ≈ 0.99) combined with a pronounced female-majority tertiary GPI (1.20–1.30) — places it among the more advanced cases of tertiary-level gender reversal in the region, a pattern this paper's Section 7.3 partly attributes to male outmigration for foreign labor rather than to female-specific gains alone.

On the regional/geographic dimension, by contrast, Nepal's pattern of enrollment concentration in a single dominant metropolitan province is not unique to Nepal; comparable capital-region concentration in higher-education access has been observed in several South Asian and broader developing-country contexts, generally attributed to the same combination of historical institutional path-dependency and private-sector investment following existing population and infrastructure density that this paper identifies in Section 2 and Section 6.6 for Nepal specifically. What distinguishes Nepal's case, and what this paper's Access Ratio and Gini findings make explicit, is the specific magnitude of that concentration (a Gini of 0.31, an HHI more than 60% above the population-implied baseline) and the identification of Madhesh, rather than the more commonly assumed Karnali, as the most severely under-served province in relative terms.

A caution is warranted here: cross-country comparison of Gini coefficients, location quotients, and HHI values for higher-education access is not standard practice in the way that GPI cross-country comparison is, since these indices are far less commonly computed and published for other countries' education systems. This paper is therefore unable to state with confidence whether Nepal's regional-access Gini of 0.31 is high, low, or typical relative to other South Asian countries, since no directly comparable published figures were located for this specific index applied to higher-education access elsewhere in the region. This represents an opportunity for future comparative research (Section 12) rather than a claim this paper can currently substantiate.

Discussion

Three points emerge from placing the regional and gender analyses side by side:

• The two disparities move in opposite directions over time. Gender disparity in enrollment has not just closed but reversed (GPI 0.26 → 1.30 over 40 years); regional disparity remains large (Gini ≈ 0.31) and is closing only slowly (from 0.35 two years earlier). Gender policy interventions (scholarships prioritizing girls, social shifts in family investment in daughters' education) appear to have been substantially more effective, over a longer horizon, than regional/provincial equalization efforts.

• Both disparities are "hidden" by favorable headline aggregates. A national GPI of 1.30 and national enrollment growth of 71% both sound like unambiguous progress; neither aggregate reveals that (a) Madhesh remains more relatively excluded than the "obviously" disadvantaged Karnali, or (b) female representation collapses by two-thirds between Bachelor's and PhD level. Policy built on national aggregates alone risks declaring victory prematurely on both fronts.

• Both disparities share a common structural driver: concentration of quality provision in Bagmati/Kathmandu. The same institutions with the highest Access Ratio advantage (Bagmati-based constituent and private campuses) are also disproportionately where advanced (Master's/MPhil/PhD) programs are concentrated — meaning a Madhesh or Karnali-origin woman faces compounding, rather than merely additive, barriers to reaching the upper end of the academic pipeline: a geographic barrier to reach any HEI, and a gender-pipeline barrier to advance within it.

A fourth point, following from the historical review in Section 2 and the comparative discussion in Section 9, is that the two disparities appear to respond to different categories of intervention on different timescales. The gender reversal took roughly four decades of steady, incremental change to move from a GPI of 0.26 to above parity, driven by a broad mix of social and policy change that this paper cannot fully disentangle but that plausibly includes rising female secondary completion, scholarship targeting, and shifting household investment norms. Regional concentration, by contrast, is tied to institutional infrastructure that was built up over more than a century (Section 2) and has proven far stickier: a two-year Gini improvement of only 0.35 to 0.31 suggests that, absent a substantially more aggressive and geographically targeted public-investment program, closing the regional gap on a similar 40-year horizon to the gender reversal would represent a comparatively slow rate of progress relative to the scale of the gap identified.

Policy Implications

Target Madhesh explicitly, not only Karnali

Current policy discourse and targeted-scholarship programs often frame Karnali as the paradigm case of regional educational disadvantage. This paper's Access Ratio analysis shows Madhesh is, in relative terms, more excluded — a finding with direct implications for where equity scholarships and campus-expansion investment should be prioritized. Because Madhesh's population is more than three times larger than Karnali's, even a modest percentage-point improvement in Madhesh's Access Ratio would translate into a substantially larger absolute number of additional students reached than an equivalent percentage-point improvement in Karnali, suggesting a potentially higher marginal return on investment directed at Madhesh specifically, without this being read as an argument for reducing continued investment in Karnali.

Track the Gini and Access Ratio over time as a standing indicator

These are cheap, reproducible statistics from data UGC already publishes annually; formalizing them as an official annual "Regional Access Equity Index" would let policymakers see whether interventions are actually narrowing the gap, not just whether enrollment is growing. Because the underlying UGC EMIS and census data already exist, the marginal cost of computing and publishing these indices annually is minimal relative to the policy value of a standing, comparable, year-on-year equity benchmark.

Address the MPhil/PhD/faculty pipeline specifically, not just Bachelor's-level access

Because national gender aggregates already look favorable, targeted graduate-level fellowships, faculty hiring targets, and mentorship programs for women in Engineering, Science & Technology, and Sanskrit are likely to have far higher marginal impact on genuine gender equity than further undergraduate-level interventions. Undergraduate-level gender interventions, while historically valuable in producing the 1983–2023 GPI reversal documented in Section 7.1, are increasingly working against a system that is already female-majority at that level; the more binding constraint now sits further along the pipeline.

Publish updated, disaggregated faculty gender data

The most recent public breakdown is from FY 2010/11. Given a system that is now majority-female at the student level, the absence of an updated faculty gender breakdown is itself a policy-relevant transparency failure. A modernized, annually updated faculty gender breakdown — ideally disaggregated further by rank (lecturer, reader, professor) — would allow the hiring-stage attrition hypothesis raised in Section 7.6 to be tested directly rather than inferred from data now well over a decade old.

Commission province-by-gender disaggregated enrollment data

This is the single most valuable missing dataset for testing this paper's central open hypothesis — that regional and gender disadvantage compound rather than simply add. Without it, the intersectional discussion in Section 8 must remain a hypothesis rather than a confirmed finding, regardless of how plausible the supporting demographic evidence (child-marriage prevalence, institutional concentration) makes it appear.

Recommendations for Future Research

• Province-by-gender disaggregated enrollment panels. As discussed in Sections 8 and 11.5, this is the single highest-value dataset currently missing from public UGC reporting, and would allow the intersectional hypothesis in Section 8 to move from hypothesis to tested finding.

• A longer annual panel for the regional Access Ratio and Gini series. This paper computes the regional Gini at only two points in time (FY 2019/20 and FY 2021/22); an annual series extending both backward (using earlier UGC EMIS reports, where available) and forward would allow a proper trend regression and would let researchers test whether the modest 2019/20–2021/22 improvement represents a genuine trend or a single-period fluctuation.

• Direct testing of the male-outmigration hypothesis (Section 7.3). Cohort-linked data connecting foreign labor/study migration records to domestic enrollment records, even at an aggregate province-year level, would allow the mechanical-denominator hypothesis proposed in this paper to be tested rather than left as a plausible but unconfirmed explanation for the secondary–tertiary GPI paradox.

• Updated faculty gender and rank data. As discussed in Section 11.4, a modern faculty gender breakdown, ideally by academic rank and by province, would allow direct testing of whether the apparent hiring-stage attrition identified in Section 7.6 has persisted, worsened, or improved since the FY 2010/11 data used in this paper.

• Cross-country comparison of regional-access concentration indices. As discussed in Section 9, this paper was unable to benchmark Nepal's regional Gini, Index of Dissimilarity, and HHI against comparable figures elsewhere in South Asia because such figures do not appear to be routinely published for other countries' higher-education systems. Computing comparable indices for neighboring countries using their own administrative and census data would allow Nepal's regional concentration to be assessed as high, low, or typical in a genuinely comparative sense.

• Discipline-level intersectional analysis. Combining the discipline-level gender gaps identified in Section 7.5 (Engineering, Sanskrit, Science & Technology) with provincial origin data, where it becomes available, would test whether the Sanskrit and Engineering gender gaps are uniform across provinces or are themselves regionally concentrated.

Limitations

• The regional analysis uses two enrollment-share years (FY 2019/20, FY 2021/22) against a single fixed population benchmark (2021 census); a longer annual panel would allow a proper trend regression rather than a two-point comparison.

• University-level female-share data (Section 7.4) is drawn from FY 2019/20 (2078/79 B.S.), the most recent year for which a full university-by-university breakdown was available in the source consulted; more recent EMIS reports may show some drift.

• Degree-level gender breakdowns (Section 7.6) are from FY 2018/19; faculty gender data is from FY 2010/11. Both are the most recent publicly available breakdowns found, and both are flagged in-text as dated.

• The intersectional (Section 8) discussion is explicitly hypothesis-generating, not data-confirmed, given the absence of province-by-gender enrollment tables in public UGC reporting.

• The South Asian comparative discussion in Section 9 is limited by the absence of directly comparable published regional-access concentration indices (Gini, Index of Dissimilarity, HHI) for other countries in the region; only the Gender Parity Index comparison in that section rests on directly comparable cross-country data.

• The male-outmigration hypothesis offered in Section 7.3 as a partial explanation for the secondary–tertiary GPI paradox is not tested directly against cohort-linked migration data in this paper and should be read as a plausible contributing factor rather than a demonstrated cause.

Conclusion

Applying standard, transparent inequality and demographic indices — Access Ratios, an Index of Dissimilarity, a Gini coefficient, an HHI, a Gender Parity Index, and pipeline attrition ratios — to Nepal's own UGC and census data produces a considerably more precise and, in places, counter-intuitive picture than national aggregates alone. Regional access inequality (Gini ≈ 0.31) is comparable in magnitude to Nepal's income inequality and is easing only slowly, with Madhesh — not the more commonly cited Karnali — the most relatively under-served province. Gender inequality in raw enrollment has reversed entirely (GPI 1.30), yet a steep and specific pipeline attrition means women's representation collapses by roughly two-thirds between enrollment and the PhD level, and further still among faculty. Both patterns are invisible in the headline statistics most commonly cited about Nepali higher education, underscoring the value of applying explicit, reproducible mathematics rather than relying on national averages alone.

Placed in historical context (Section 2), the persistence of Bagmati-centered regional concentration is unsurprising: it is the product of more than a century of institutional path-dependency, only partially offset by three decades of multi-university expansion policy. Placed in South Asian comparative context (Section 9), Nepal's gender-parity reversal appears to be among the more complete in the region, even as its regional concentration pattern appears structurally similar to — if numerically more pronounced than — patterns observed elsewhere in the developing world. The paper's central recommendation is not a single policy lever but a measurement one: that Nepal's higher-education policy community adopt the kind of disaggregated, index-based tracking demonstrated here as a standing practice, so that future assessments of progress on both regional and gender equity rest on the same transparent, reproducible footing as the analysis presented in this paper.

Appendix A: Worked Calculations

This appendix reproduces, in fully expanded step-by-step form, the two most computationally involved derivations in the paper — the FY 2021/22 regional Gini coefficient (Section 6.4) and the FY 2019/20 university female-enrollment coefficient of variation (Section 7.4) — so that a reader unfamiliar with either the Lorenz-curve/Gini method or basic dispersion statistics can follow every intermediate step.

Gini coefficient step-by-step (FY 2021/22)

Step 1: Rank the seven provinces by ascending Access Ratio (computed in Section 6.2): Madhesh (0.398), Karnali (0.660), Sudurpaschim (0.742), Lumbini (0.755), Koshi (0.764), Gandaki (0.983), Bagmati (2.213).

Step 2: Convert each province's population and enrollment share from percentages to proportions (divide by 100), and cumulate both in the ranked order from Step 1, starting from the origin $(X_0, Y_0) = (0, 0)$:

Segment	Population share (proportion)	Cumulative X	Enrollment share (proportion)	Cumulative Y
Origin	—	0.0000	—	0.0000
Madhesh	0.2097	0.2097	0.0834	0.0834
Karnali	0.0579	0.2676	0.0382	0.1216
Sudurpaschim	0.0924	0.3600	0.0686	0.1902
Lumbini	0.1756	0.5356	0.1326	0.3228
Koshi	0.1701	0.7057	0.1299	0.4527
Gandaki	0.0846	0.7903	0.0832	0.5359
Bagmati	0.2097	1.0000	0.4640	1.0000

Step 3: For each of the seven segments (Madhesh through Bagmati), compute the pairwise products defined in the Gini formula (Section 5.3):

$$\Delta X_k = X_k - X_{k-1} \qquad \text{and} \qquad Y_k + Y_{k-1}$$

then multiply the two for each segment:

Segment	ΔX	$Y_k + Y_{k-1}$	$\Delta X \times (Y_k + Y_{k-1})$
Madhesh	0.2097	0.0834 + 0 = 0.0834	0.01749
Karnali	0.0579	0.1216 + 0.0834 = 0.2050	0.01187
Sudurpaschim	0.0924	0.1902 + 0.1216 = 0.3118	0.02881
Lumbini	0.1756	0.3228 + 0.1902 = 0.5130	0.09008
Koshi	0.1701	0.4527 + 0.3228 = 0.7755	0.13193
Gandaki	0.0846	0.5359 + 0.4527 = 0.9886	0.08364
Bagmati	0.2097	1.0000 + 0.5359 = 1.5359	0.32218

Step 4: Sum the final column: 0.01749 + 0.01187 + 0.02881 + 0.09008 + 0.13193 + 0.08364 + 0.32218 = 0.68600

$$G = 1 - 0.686 = 0.314$$

This matches the value reported in Section 6.4. This step-by-step expansion also makes visible why Bagmati contributes the largest single term (0.322, nearly half the total sum) — it is both the segment with the largest ΔX (tied with Madhesh) and the segment with by far the largest $Y_k + Y_{k-1}$, since it is the final, cumulative segment of the Lorenz curve.

Coefficient of variation step-by-step (university female shares, FY 2019/20)

Step 1: List the six observations: 61.65, 54.66, 52.38, 46.57, 43.79, 11.34 (percentage points).

Step 2: Compute the mean: $\bar{x}$ = (61.65 + 54.66 + 52.38 + 46.57 + 43.79 + 11.34) / 6 = 270.39 / 6 = 45.065

Step 3: Compute each squared deviation from the mean:

University	Value	Deviation $(x - \bar{x})$	Squared deviation
Far Western University	61.65	16.585	275.06
Tribhuvan University	54.66	9.595	92.06
Purbanchal University	52.38	7.315	53.51
Kathmandu University	46.57	1.505	2.27
Pokhara University	43.79	-1.275	1.63
Nepal Open University	11.34	-33.725	1137.37

Step 4: Sum the squared deviations: 275.06 + 92.06 + 53.51 + 2.27 + 1.63 + 1137.37 = 1561.90. Divide by n = 6: $\sigma^2 = 260.32$. Take the square root: $\sigma = \sqrt{260.32} \approx 16.13$.

Step 5: Coefficient of variation = $\sigma / \bar{x} = 16.13 / 45.065 \approx 0.358$, or 35.8%, matching the value reported in Section 7.4. Note from Step 3 that the Nepal Open University observation alone contributes 1137.37 of the total 1561.90 sum of squared deviations — approximately 73% — which is the precise numerical basis for this paper's claim that the high overall dispersion is “almost entirely driven by one extreme outlier.”

Appendix B: Glossary of Terms

Access Ratio / Location Quotient (LQ): The ratio of a province's enrollment share to its population share; LQ = 1 indicates proportional representation.

Cumulative distribution (Lorenz curve): A plot of cumulative population share against cumulative enrollment share, ranked by ascending Access Ratio, used to derive the Gini coefficient.

EMIS: Education Management Information System — UGC Nepal's annual administrative data-collection and reporting system for higher education.

Gender Parity Index (GPI): The ratio of female to male enrollment; GPI = 1 indicates parity, values above 1 indicate a female majority.

Gini coefficient (G): A 0-to-1 summary measure of inequality derived from a Lorenz curve; commonly used for income inequality and, in this paper, adapted to regional educational-access inequality.

Gross Enrollment Ratio (GER): Total enrollment divided by the population of the officially corresponding age group, expressed as a percentage.

Herfindahl-Hirschman Index (HHI): A concentration measure computed as the sum of squared shares; originally used to assess market concentration in industrial economics.

Index of Dissimilarity (D): A measure of the share of one group that would need to be redistributed across categories to match the distribution of a reference group; here applied to enrollment versus population shares across provinces.

Pipeline attrition ratio: The ratio of the female share at a given academic stage to the female share at the baseline (Bachelor's) stage; used to quantify the extent of the "leaky pipeline."

UGC: University Grants Commission, Nepal's autonomous statutory body responsible for coordinating universities, disbursing grants, and maintaining higher-education standards, established in 1993 and operational since 1994.

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