Trends in Gender Gaps in Skills-Adjusted Mean Years of Schooling

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1. Introduction

Education is widely recognized as a cornerstone of human development. It shapes health, livelihoods, and social participation, while also contributing to economic growth and societal resilience. Conventional indicators—such as mean years of schooling or attainment distributions—have played a central role in monitoring global progress. Yet these measures capture only the quantity of formal education and overlook how much individuals actually learn and what skills they possess. This limitation matters for two main reasons. First, time spent in school does not necessarily translate into functional competencies: many young people around the world fail to reach minimum proficiency in reading and mathematics despite several years of schooling. Second, skills are not fixed at the end of formal education; they can erode over the life course ("use it or lose it") but can also be strengthened through informal learning and work experience (Reiter 2022, Hanushek et al. 2025,).

Existing skill-based indicators largely rely on school-based assessments of children and adolescents (Altinok et al. 2018). While such measures are essential for monitoring progress toward education goals, they are restricted to narrow age groups still in education and do not reflect the competencies of adults who participate in the labor market and wider society. To overcome this limitation, Lutz et al. (2021) introduced the Skills-in-Literacy Adjusted Mean Years of Schooling (SLAMYS) indicator. By combining educational attainment with evidence on adults' functional literacy skills, SLAMYS provide a measure of human capital that is both demographically consistent and directly relevant for current economic and social outcomes. Functional literacy skills are particularly suitable for this purpose: they are transferable across domains, have consistently been shown to matter for health, socio-economic outcomes, and civic engagement, and are the best-documented skill dimension with internationally comparable data available across a wide range of countries).

This paper introduces a substantially updated version of the SLAMYS dataset. The new release extends estimates through 2025, disaggregates results by gender and broad age groups (20–39 and 40–64), and draws on a significantly expanded empirical basis. In addition to newly released Cycle 2 data from the OECD Programme for the International Assessment of Adult Competencies (PIAAC), we incorporate recent waves of the Demographic and Health Surveys (DHS) and, for the first time, the Multiple Indicator Cluster Surveys (MICS). These additions improve coverage, enhance comparability, and enable more detailed analyses of inequality in skills across world regions.

The analytical focus of this paper is on gender gaps in skills-adjusted human capital. While women in many regions now match or surpass men in years of schooling (van Langen et al. 2006, Evans et al 2021), it is less clear whether this convergence also extends to functional literacy skills. At the same time, unequal opportunities in work, health, and civic life continue to exist between women and men (Thévenon et al 2012, Ganguli et al. 2014). Examining SLAMYS by gender therefore provides crucial insights into whether rising levels of education have translated into more equal human capital, and how educational expansion has shaped opportunities for women and men across generations.

The remainder of the paper is structured as follows: Section 2 describes the data and methods, Section 3 presents the analysis of gender gaps in skills, and Section 4 discusses the main findings and their implications.

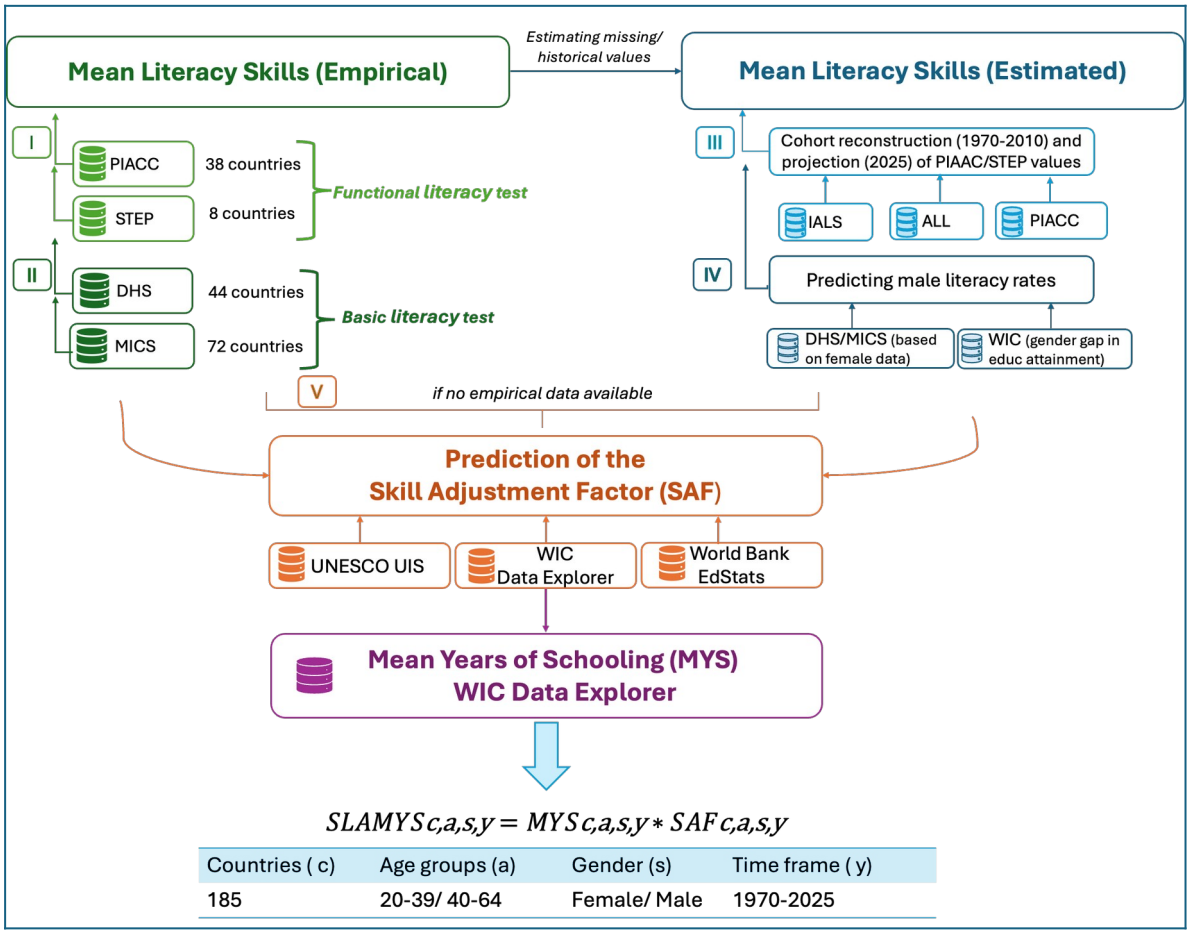
2. Data and methods: extending SLAMYS

The Skills-in-Literacy Adjusted Mean Years of Schooling (SLAMYS) indicator combines the quantity and quality dimensions of education by adjusting mean years of schooling (MYS) for empirically observed differences in adult literacy skills. For each country *c,* age group *a*, gender *g*, and year *y*, SLAMYS is defined as

$$SLAMYS_{c,a,g,y} = MYS_{c,a,g,y} \times SAF_{c,a,g,y,}$$

where the skills-adjustment factor *SAF* represents the ratio of a population's average literacy proficiency to an international benchmark. Following Lutz et al. (2021), the benchmark is the population-weighted OECD mean literacy score calculated from PIAAC 2015 data. This provides a stable, empirically grounded reference that reflects the average performance of adults in advanced education systems rather than an arbitrary ideal or top performer. A value of one therefore indicates parity with the OECD average, while values above or below one denote higher or lower average skill performance relative to that standard. The indicator builds on the original SLAMYS framework and follows the same demographic logic of combining educational attainment with functional competencies. The present study extends the dataset to 2025, adds gender and age-group disaggregation (20–39 and 40–64), and substantially broadens the empirical basis. Figure 1 summarises and visualizes SLAMYS estimation process and data sources.

Figure 1: SLAMYS Estimation Process



The quantity component – mean years of schooling - is sourced from the Wittgenstein Centre Human Capital Data Explorer version 3.0 (KC et al., 2024), which provides estimates of population by educational attainment levels and mean years of schooling by age and sex in five-year intervals from 1970 to 2025. Estimates for 2020 and 2025 correspond to the medium (SSP2) scenario of the most recent global human-capital projections. Estimates for 1970 to 2015 correspond to the past reconstruction (back projection) (KC. et al. 2025).

The quality component—functional literacy skills—draws on an expanded set of international adult assessments, including the OECD Programme for the International Assessment of Adult Competencies (PIAAC, Cycles 1 and 2), the World Bank's Skills toward Employment and Productivity (STEP) survey, and earlier OECD studies such as the International Adult Literacy Survey (IALS) and the Adult Literacy and Life Skills (ALL) survey. To improve coverage in low- and middle-income countries, we further incorporate recent waves of the Demographic and Health Surveys (DHS) and, for the first time, the Multiple Indicator Cluster Surveys (MICS), both of which include a short reading test assessing whether respondents can read a complete sentence in the local language.

Empirical skills-adjustment factors (SAFs) were calculated for 2015 and 2020 using microdata from PIAAC Cycles 1 and 2 and STEP[1].Literacy scores were expressed relative to the 2015 population-weighted OECD mean, which serves as the fixed international benchmark. The benchmark was computed separately for the two broad age groups (20–39 and 40–64) and applied uniformly across gender to preserve comparability.

Because direct assessments of adult literacy in earlier years are unavailable for most countries, we reconstructed literacy skills along cohort lines. To do so, we pooled IALS (1994–1998), ALL (2003–2008), and PIAAC Cycle 1 data for countries that participated in multiple literacy assessments to estimate a standard life-course pattern of skill acquisition and decline. Skills typically rise until about age 35, remain stable through midlife, and decline thereafter. These age patterns were estimated separately for women and men and for two broad educational attainment groups (lower secondary or less, and upper secondary or higher), reflecting systematic differences in both the level and rate of skill change. Applying these empirically derived functions along cohort lines for all countries that participated in PIAAC or STE allows interpolation of literacy scores for earlier and later periods, producing consistent series from 1970 to 2025. Detailed specifications of the cohort reconstruction model are provided in Reiter (2022); further methodological information is available in the Supplementary Information (SI).

To extend coverage to low- and middle-income countries, we integrated tested literacy data from all available DHS and MICS waves conducted between 2005 and 2025. Literacy rates from both sources were harmonized into a single series, and when both surveys covered the same country-year, their mean value was used. Following Lutz et al. (2021), individuals were classified as literate only if they could read an entire sentence correctly. In surveys limited to female respondents, male literacy rates were predicted from female literacy using a regression model described in the SI. Skills-adjustment factors were then calculated by expressing literacy rates relative to the 2015 OECD benchmark, consistent with the approach for PIAAC and STEP. Because DHS and MICS capture only basic reading ability, a correction factor of 0.8 was applied to align their scale with that of functional literacy assessments[2].

[1] STEP data, which cover only urban populations, were adjusted to national level using urban–rural literacy ratios derived from DHS and MICS. Further details can be found in the SI.

[2] This adjustment is based on empirical comparisons in countries covered by both survey types and ensures consistency in scaling across instruments with differing measurement precision. Further information can be found in the SI.

For countries without empirical skills assessments, skills-adjustment factors (SAFs) were predicted using ordinary least-squares regressions estimated on the subset of countries with observed data. The dependent variable is the SAF, while predictors include adult illiteracy rates (UNESCO), the share of adults with at least upper-secondary education, the old-age dependency ratio as a proxy for demographic transition, and a Quality of Education Index (QEI) derived from the World Bank's Global Dataset on Education Quality. Because the QEI reflects the learning outcomes of students, its effect on adult skills is introduced with a 25-year lag to maintain demographic consistency. Period dummies capture temporal shifts in education quality not explained by these covariates. Predicted SAFs were then multiplied by corresponding MYS values to generate SLAMYS for all countries and years. Although SAFs were predicted for the full panel, the final dataset prioritizes empirically grounded estimates: wherever available, PIAAC or STEP-based values were used; if such data were missing, DHS/MICS-derived estimates were applied; model-based predictions were used only in the absence of empirical observations.

3. Gender gaps in skills

3.1 Gender gaps in skills-in-literacy adjusted years of schooling

The extended SLAMYS dataset provides estimates for 185 countries, distinguishing men and women in the age groups 20–39 and 40–64 over the period 1970–2025, reported in five-year intervals. Because SLAMYS are benchmarked on OECD average, the interpretation of the results depends on the SLAMYS values relative to MYS:

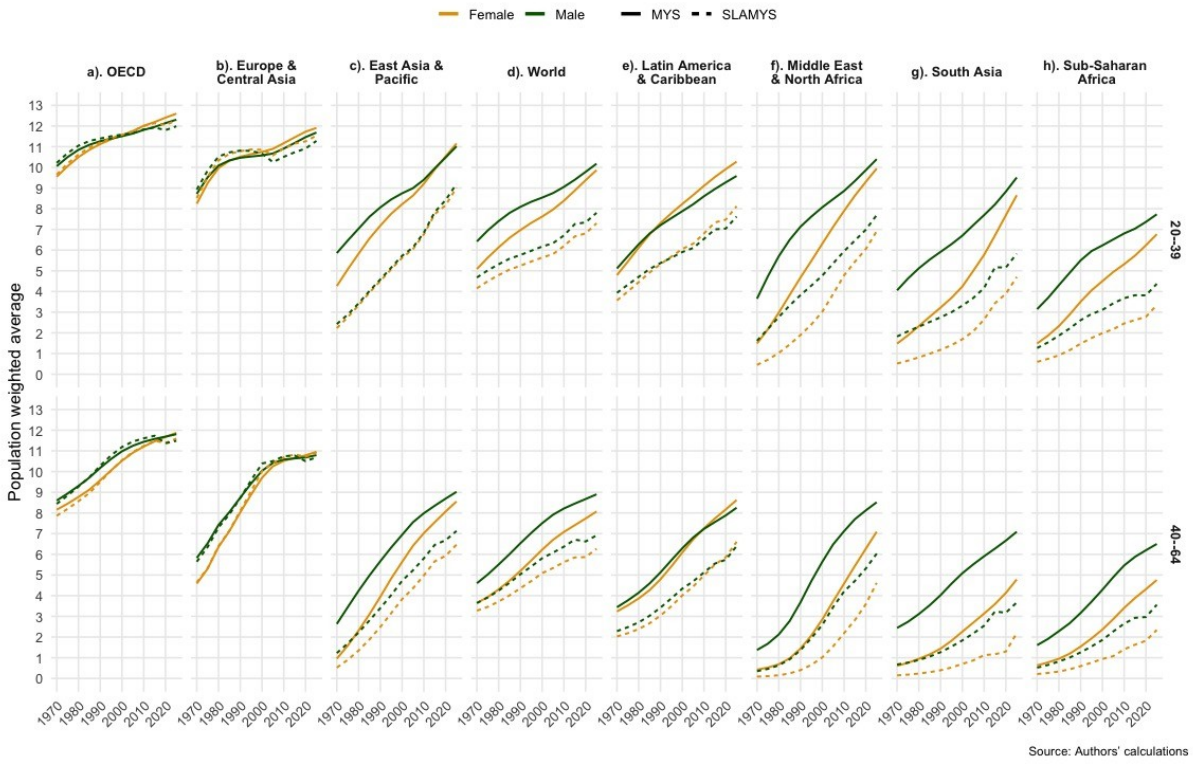
- SLAMYS > MYS: Skills exceed the 2015 OECD literacy benchmark, suggesting high skill acquisition per year of schooling.
- SLAMYS ≈ MYS: Skills align with the 2015 OECD average, indicating a proportional relationship between attainment and skills.
- SLAMYS < MYS: Skills fall below the OECD benchmark, signaling a mismatch between schooling quantity and quality.

Figure 2 illustrates three key dimensions of gender differences: global patterns, regional heterogeneity in the pace of educational and skill expansion, and distinct patterns of gender advantage. Regions are arranged in descending order based on their SLAMYS values over time.

At the global level (Figure 2, panel d), men still outperform women in both education quantity (MYS) and quality (SLAMYS), yet the gap has been narrowing over time. For men aged 20–39, averages increased from 4.7 (SLAMYS) and 6.4 (MYS) in 1970 to 7.8 and 10.2 in 2025, while women's averages rose from 4.1 and 5.1 to 7.3 and 9.9, respectively, indicating convergence between the

genders in both indicators. Among those aged 40–64, the gap between indicators remains wider and relatively stable over time, with males reaching 6.9 (SLAMYS) and 8.9 (MYS) in 2025, compared to 6.3 and 8 for females. These trends demonstrate that the expansion of schooling (MYS) has outpaced improvements in literacy-adjusted skills (SLAMYS) across both genders and age groups.

Figure 2: SLAMYS and MYS from 1970-2025 in descending order according to SLAMYS value



These global patterns hide substantial regional variation in gender gaps. The pace of educational expansion, both in quantity and quality, differs markedly across regions and between genders. Although men started from higher baseline values, women experienced over time on average faster relative gains in both SLAMYS and MYS.

Across nearly all regions, the 40–64 age group shows stronger proportional increases than the 20–39 group, reflecting improvements from lower initial levels. Growth was modest in the OECD (panel a) and Europe and Central Asia (panel b), with SLAMYS and MYS rising about 1.4 times, while women in Europe and Central Asia achieved slightly higher gains (2.3 times). In Latin America and the Caribbean (panel e), both indicators roughly doubled, and female SLAMYS among the older cohort nearly tripled.

Progress was far more pronounced in Asia and Africa. In East Asia and the Pacific and South Asia, female SLAMYS rose between four- and ninefold for the younger cohort and up to fourteenfold among the older one, while male increases were about half as large. Sub-Saharan Africa followed a

similar trend, with female SLAMYS increasing 5.6 times for the younger group and eleven times for the older, compared with roughly 3–7 times for men.

The Middle East and North Africa stand out for the most rapid advances. Among women, SLAMYS and MYS increased up to fifteen- and sevenfold, while for men the rise was about five- and threefold. Among the 40–64 age group, female SLAMYS surged 53 times and MYS 17 times, indicating exceptional progress and a narrowing gender gap over time.

Third, the pattern of gender advantages differs across world regions, shifting in favor of either women or men depending on regional educational trends. In three regions, the OECD (panel a), Europe and Central Asia (panel b), and Latin America and the Caribbean (panel d), women have surpassed men in both SLAMYS and MYS across age groups, though the timing and magnitude of this reversal vary by region. In East Asia and the Pacific (panel c), women exceed men in MYS by 2025, while remaining slightly behind in SLAMYS. In contrast, in other highly populated regions such as those including India (South Asia) and Nigeria (Sub-Saharan Africa), female levels continue to rise but remain below male values. Sub-Saharan Africa (panel h) shows the largest gender disparities and the lowest overall levels in both indicators, being the only region where MYS does not exceed 8 years and SLAMYS remains below 5 for the 20–39 age group in 2025.

Furthermore, Europe and Central Asia, as well as Latin America and the Caribbean, were the first regions where women aged 20–39 achieved higher MYS and SLAMYS values, around 1995, followed roughly a decade later (around 2005) by the OECD.

However, the OECD (panel a) and Europe and Central Asia (panel b) display the smallest indicator gaps, reflecting a closer alignment between educational quantity and quality and greater gender parity. The OECD stands out with the highest values across time, ranging from 7.9 to 12.3 for SLAMYS and 8.2 to 12.6 for MYS across both age groups and genders. It is also the only region where SLAMYS exceeded MYS for an extended period (1970–2015), followed by a slight decline. Notably, OECD women aged 20–39 attain the highest SLAMYS and MYS levels globally.

After analyzing the time trends for MYS and SLAMYS across world regions, we now focus on the most recent cross-sectional snapshot for 2025. Figure 3 shows box plots of SLAMYS for 2025 by gender and age group (20–39 and 40–64), illustrating regional distributions and highlighting gender differences and within-region heterogeneity in educational quality.

OECD countries exhibit the highest levels, with median values around 12.5 (males) and 12.8 (females) for the 20–39 cohort and 11.8 (males) and 12.0 (females) for the 40–64 cohort, accompanied by relatively narrow interquartile ranges, indicating low dispersion and cross-country

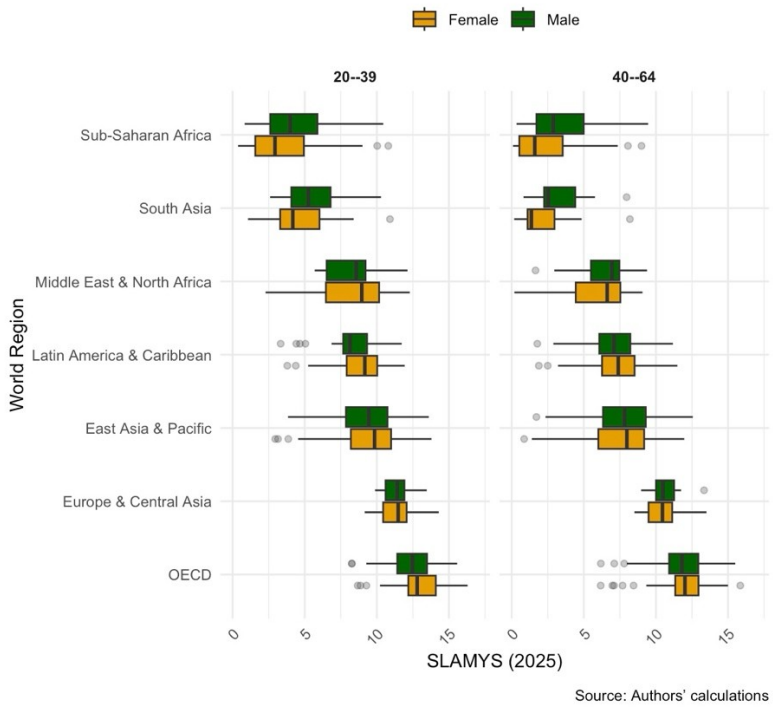
consistency in education quality. Only few countries, such as Colombia and Costa Rica, appear as mild lower outliers in both age groups and Japan as an upper outlier with the highest SLAMYS value of 15.8 for the age group 40-64. Europe & Central Asia show slightly lower medians for both genders (≈11.3 for 20–39; ≈10.5 for 40–64) and similarly tight distributions. In both regions, variability is low for men and women alike.

By contrast, East Asia & Pacific and Latin America & the Caribbean present wider interquartile ranges, with medians between 7–9, reflecting larger within-region disparities. Outliers such as Cambodia, Timor-Leste in East Asia and Pacific and Haiti and Guatemala in Latin America and the Caribbean, fall below the regional lower bounds for both genders, while higher-performing countries reach near-OECD levels. In both regions, women tend to show slightly higher dispersion than men, suggesting uneven progress in female SLAMYS.

In the Middle East and North Africa, median SLAMYS values reach about 9 for younger women and 8.5 for younger men but decline to roughly 6–7 among older adults. The distributions are wide, especially for women, indicating strong age- and country-specific variation. Yemen appears as a lower outlier among older men, while several Gulf countries perform far above the regional median.

South Asia and Sub-Saharan Africa display the lowest median SLAMYS values—around 4–5 for the 20–39 age group in South Asia and ≤3 for the 40–64 group in both regions—along with the widest ranges, indicating pronounced inequality across countries. Female distributions are again more dispersed, with upper outliers such as Sri Lanka and Zimbabwe contrasting sharply with countries where women's SLAMYS remains extremely low. Male values are slightly higher and more compact, reflecting greater consistency in men's educational outcomes.

Figure 3: Regional and gender differences in SLAMYS distributions across age groups, 2025



Results from Figures 2 and 3 highlight pronounced heterogeneity across and within global regions, underscoring the importance of a country-level analysis to assess how gender disparities in SLAMYS have evolved over time. Figure 4 presents world maps comparing the differences between male and female SLAMYS in 1970 and 2025, the first and last years of observation in the dataset, for both age groups (20–39 and 40–64).

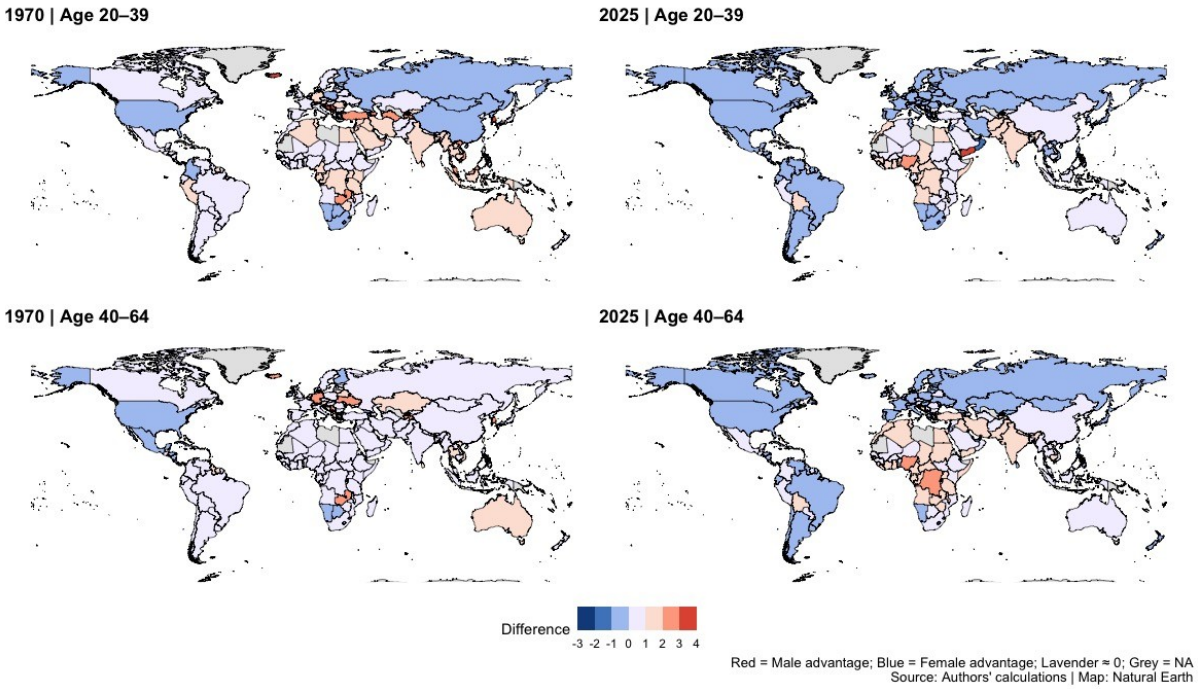
In 1970, gender differences strongly favored men. Among younger adults (20–39), nearly 50% of countries had a male advantage of 0–1 SLAMYS**,** and an additional 37% showed larger male advantages exceeding one year. Only about 13% of countries displayed a female advantage**.** Among older adults (40–64), the imbalance was even more pronounced, with over two-thirds (68%) of countries showing a male advantage under one year and about 20% exceeding one year.

By 2025, the gender gap had narrowed substantially, reflecting global progress in women's education. For the younger cohort, nearly half of countries (49%) now fall within a –1 to 0 range, meaning parity or a slight female advantage, while 29% remain within a 0–1 male advantage. Only a small share (≈7%) of countries display large gaps (greater than one SLAMYS), showing a major global shift toward equality.

For the older age group (40–64), convergence is also evident: 74% of countries exhibit near parity (–1 to +1), compared with just 12% in 2025. Yet, a residual male advantage persists in about 22% of countries, and only 4% show a clear female advantage. This suggests that historical gender disparities

in education continue to influence older cohorts, while younger generations have largely achieved parity.

Figure 4: Differences in SLAMYS between males and females at a global level according to age group for 1970 & 2025



3.2 Gender gaps in skills-in-numeracy adjusted years of schooling

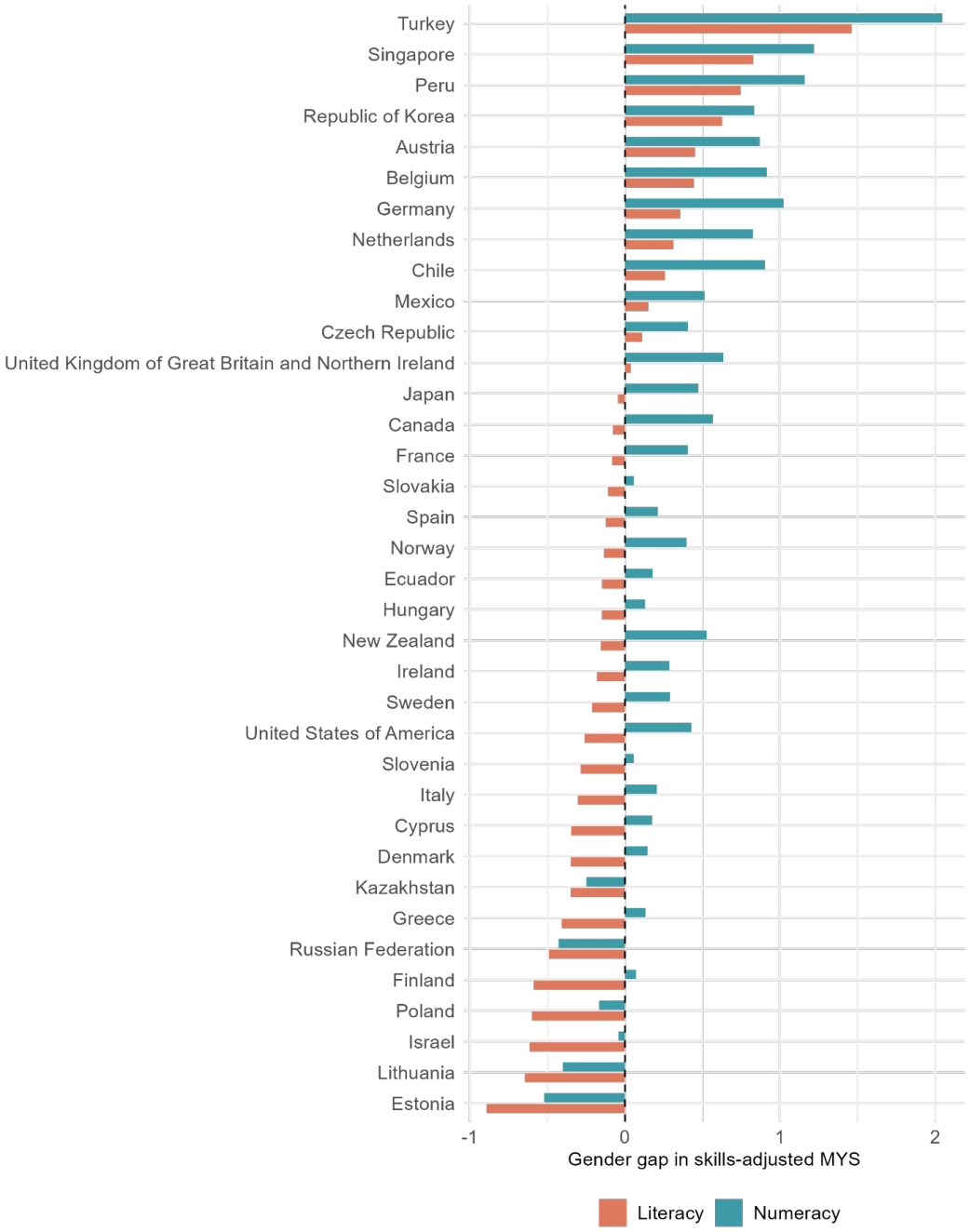
The global SLAMYS estimates presented above rely on functional literacy skills, as this is the only domain with sufficiently broad and comparable data across countries and over time. Large-scale sources such as STEP, DHS, and MICS measure literacy but not numeracy. Numeracy-based SLAMYS can therefore only be calculated for countries that participated in PIAAC Cycle 1 and/or Cycle 2, and only for the years 2015 and 2020. Because gender differences are known to vary across domains—with women typically performing relatively better in literacy and men in numeracy—we complement the global literacy-based analysis with a comparison to numeracy-based SLAMYS for those countries and years with available PIAAC data. Applying the same methodology to PIAAC numeracy scores, we calculate SLAMYS for all participating countries and contrast the resulting gender gaps with those based on literacy.

Figure 5 presents this comparison for the year 2015. Overall, the two indicators are strongly correlated ($r = 0.97$), yet the gender gaps reveal important differences. A consistent pattern emerges in which the choice of skill domain affects both the magnitude and, in some cases, the sign of the gender gap. Where women's human capital exceeds that of men, the literacy-based SLAMYS tends to show larger gaps than the numeracy-based measure. Conversely, in countries where men have an advantage, the numeracy-based SLAMYS tends to accentuate this gap. For example, in Estonia, Lithuania, or

Finland women are clearly ahead in literacy, while numeracy gaps are smaller or even tilt toward men. By contrast, in Turkey, Singapore, or Peru, where men score higher overall, the gaps are more pronounced when measured with numeracy rather than literacy.

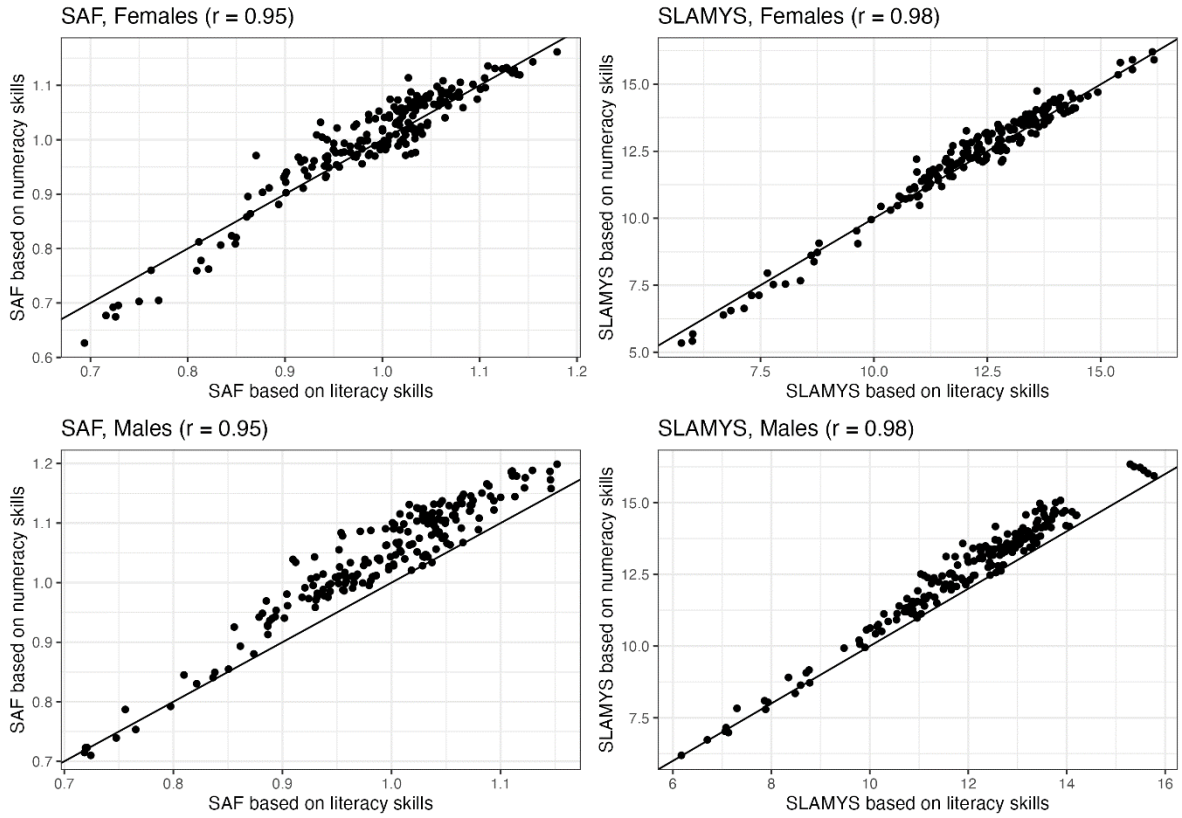
In some countries with relatively small gender differences overall, the choice of domain even leads to reversals. For instance, in Spain, the United States, or Denmark, literacy-based SLAMYS place women slightly ahead, while numeracy-based estimates put men in the lead. This illustrates that, although the two domains are closely correlated, they capture different aspects of skill inequality.

Figure 5. Gender gap in skills-adjusted mean years of schooling, literacy and numeracy comparison, 2015.



Supplementary analyses, where we directly plotted numeracy-based against literacy-based SLAMYS (see Figure 6), show that the differences between the two measures are more pronounced in countries with higher overall skill levels. This suggests that for lower-income countries, where average skill levels remain lower, the choice of domain is less consequential. In other words, the global SLAMYS estimates presented in this paper—which rely on literacy—are unlikely to be substantially biased for the many countries where only literacy data are available.

Figure 6. Relationship between SAF/skills-adjusted mean years of schooling based on literacy and numeracy scores, 1970-2025.



Taken together, these results underscore the importance of considering the skill domain when studying gender gaps in human capital. Literacy remains the most appropriate and widely available basis for a globally comparable indicator such as SLAMYS. At the same time, the comparison with numeracy highlights that gender inequalities are not uniform across domains and that focusing exclusively on a single skill may obscure important dimensions of inequality. In fact, our findings suggest that literacy-based estimates may paint an overly optimistic picture of women catching up with or surpassing men, while numeracy reveals a more persistent male advantage.

4. Summary and conclusion

Overall, the results demonstrate a significant narrowing of gender gaps in SLAMYS between 1970 and 2025. While men initially held a clear advantage across all regions and age groups, women have made faster relative progress, particularly in younger cohorts and in regions that started from lower baseline levels like the Middle East and North Africa. The OECD and Europe & Central Asia now show near-complete parity and high overall achievement, whereas South Asia and Sub-Saharan Africa continue to display the largest disparities and lowest SLAMYS values. Regional and within-region heterogeneity remains substantial, with female distributions generally showing greater dispersion, reflecting uneven progress across countries. At the global scale, by 2025 nearly three-quarters of countries exhibit gender parity or a slight female advantage in SLAMYS among younger adults, while residual male advantages persist mainly among older cohorts. These findings highlight both the success of global educational expansion and the persisting regional and generational inequalities in the quality of learning outcome.

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