What Works Hub for Global Education

Achieving universal foundational learning could increase global GDP by $196 trillion over 20 years

Insight Note

Michelle Kaffenberger
What Works Hub for Global Education

Brad Wong and Bryce Everett
Mettalytics

Victoria Egbetayo
Gates Foundation

January 2026

Blavatnik School of Government, University of Oxford

UK International Development
Partnership | Progress | Prosperity

Achieving universal foundational learning could increase global GDP by $196 trillion over 20 years

Insight Note

Michelle Kaffenberger
University of Oxford
michelle.kaffenberger@bsg.ox.ac.uk

Brad Wong
Mettalytics
brad@mettalytics.com

Bryce Everett
Mettalytics
bryce.everett@mettalytics.com

Victoria Egbetayo
Gates Foundation
victoria.egbetayo@gatesfoundation.org

The What Works Hub for Global Education is an international partnership, funded by the UK government's Foreign, Commonwealth & Development Office and the Bill & Melinda Gates Foundation, working out how to effectively implement education reforms at scale.

Kaffenberger, M., Wong, B., Everett, B. & Egbetayo, V. 2026. Achieving universal foundational learning could increase global GDP by $196 trillion over 20 years. What Works Hub for Global Education. Insight note. RI_2026/001. **https://doi.org/10.35489/BSG-WhatWorksHubforGlobalEducation-RI_2026/001**

Abstract

This study models the global impacts of achieving universal foundational learning, defined as 90% of children able to read at minimum proficiency by age 10, across 114 countries between 2031 and 2050. The analysis estimates the effects on economic growth, tax revenue generation, education, employment, health and gender equality. The results indicate that if universal foundational learning were achieved it would generate **$196 trillion in additional economic output** – equivalent to GDP per capita being more than **27% higher** by 2050 and over **$21 trillion in extra tax revenue** (2023 USD). These economic and fiscal outcomes are paired with major human development benefits: **368 million more children completing primary school, 423 million progressing to secondary, 49 million more young people in persistent employment, 12 million child deaths averted, and 16 million fewer child marriages** over 2031–2050. The findings highlight that universal foundational learning is not only a core education goal but also provides substantial cross-sectoral co-benefits, accelerating progress toward multiple Sustainable Development Goals.

Achieving universal foundational learning could increase global GDP by $196 trillion over 20 years

Insight Note

Contents

1 Introduction

Around the world, hundreds of millions of children go to school without mastering basic literacy and numeracy skills (Azevedo et al., 2021; World Bank, 2023). Without the ability to read a simple sentence or perform straightforward mathematics by age 10, children face cascading disadvantages: they are less likely to complete primary school and more likely to struggle to progress to secondary education, face higher unemployment early in their careers, and earn less throughout their working lives (Kaffenberger, Melville and Agarwal, 2025).

At a societal level, improving learning outcomes boosts economic growth and output and reduces youth unemployment (Lee and Newhouse, 2013; Angrist et al., 2021). And implications extend further still. Being able to read and complete primary school is linked to female empowerment, reduced fertility, and substantially lower child mortality (Kaffenberger and Pritchett, 2021).

A growing body of evidence – including a recent synthesis by the What Works Hub for Global Education (Kaffenberger, Melville and Agarwal, 2025) – has documented these wide-ranging relationships. Yet the question remains: **how large would the benefits be if countries succeeded in ensuring foundational learning for every child?**

This analysis attempts to address that question. Using new modelling across 114 countries, we estimate the impacts of achieving universal foundational learning – proxied as 90% of children being able to read at age 10 – on economic growth, tax revenues, educational attainment, youth employment, child mortality and child marriage.[1] Following the literature that emphasises cognitive skills rather than years of schooling as the driver of long-run economic performance, we focus on the returns and impacts of **learning** (eg Hanushek & Woessmann, 2008; 2012; Angrist et al., 2021), rather than the broader returns-to-schooling literature.

Our analysis simulates an immediate and persistent boost to childhood literacy from current levels to 90% of 10-year-olds being able to read at minimum proficiency, and it models the resulting **outcomes over a generation, 2031–2050**, when many of the medium and long-term impacts would fully materialise.

1 Because even in the best-resourced, highest-capacity contexts some children remain unable to master foundational skills, whether due to physical or learning disabilities or systemic factors, we proxy universal as 90% achievement.

This study includes 114 countries for which learning poverty statistics are available, and indicate reading proficiency below 90%. (World Bank and UNESCO Institute of Statistics, 2022).The majority are low- and-middle-income countries, though there are a handful of high-income countries which have not yet reached the universal threshold (Table 1). As has been documented previously, the largest learning gaps are generally in low-income and lower-middle-income countries (Azevedo et al., 2021; World Bank, 2023). The rest of this note provides an overview of impacts at a global level for all 114 countries in aggregate. The accompanying Annex A provides results by country, income grouping and region, while Annex B provides further details on the approach.

Table 1: Learning Levels and Number of Countries Included in the Analysis

Income Group	Proportion of Age 10 Children Who Can Read	Number of Countries in the Analysis
Low-Income	10.3%	17
Lower-Middle-Income	34.6%	41
Upper-Middle-Income	63.9%	35
High-Income	75.5%	21
All Countries	41.4%	114

Source: Analysis by authors based on World Bank and UNESCO Institute of Statistics, (2022). Population estimates from UN Population Division (2024).

2 Methods in Brief

To simulate what happens if countries lift foundational learning to a universal level, defined here as 90% of 10-year-olds reading at minimum proficiency, we first source data on learning proficiency from the World Bank's Learning Poverty Database (World Bank and UNESCO Institute of Statistics, 2022). We estimate the share of 10-year-olds proficient at reading by the simple identity, *Share proficient = 1* - learning poverty.

Because many effects are modelled in test-score units, we then empirically map learning poverty to Harmonized Learning Outcomes (HLO) – a consistent and standardised metric for measuring learning levels across the world (Angrist et al., 2021). This lets us: (i) express changes in a common test-score metric, and (ii) impute proficiency where learning-poverty data are missing but HLO exists.

We then model how the simulated change in the share proficient at reading would impact a range of economic, fiscal and social indicators. The relationship between learning changes and these indicators are drawn from various sources, many of which were recently summarised in a What Works Hub for Global Education Evidence Brief (Kaffenberger, Melville and Agarwal, 2025). A high-level overview of our analysis is presented in Table 2 with **full description of methods in Annex B**. Most of the effects used are correlational due to the relatively limited causal evidence on the broader impacts of learning. As more rigorous evidence becomes available, modelling exercises like this will become more robust.

Table 2: Impacts, Effect Sizes and Data Sources Used in this Analysis

Impact Modelled	Effect Size Used	Details and Source of Effect Size
Economic Output	7.2% increase in GDP per capita growth for every 1% increase in Harmonized Learning Outcome	Based on associations between HLO and economic growth across 107 countries (Riahi et al., 2017; Angrist et al., 2021)
Tax Revenue	Every 1 unit increase in economic output increases tax revenues as per country specific tax-to-GDP ratios	Based on country specific tax-to-GDP ratios (World Bank, 2024)
Primary School Completion	40% reduction in primary dropout per standard deviation increase in test scores	Based on associations between learning attainment and drop-out rates in six countries (No, Sam and Hirakawa, 2012; Zuilkowski, Jukes and Dubeck, 2016; Kaffenberger, Sobol and Spindelman, 2023)
Secondary School Enrolment	25% reduction in secondary dropout per standard deviation increase in test scores	Based on associations between learning attainment and drop-out rates in Ethiopia, India, Peru and Vietnam (Cueto, Felipe and León, 2020)
Youth Employment	3.5–5.3 percentage point reduction in youth unemployment per standard deviation increase in test scores	Based on associations between test scores and youth employment across 67 countries (Lee and Newhouse, 2013)
Child Mortality	Maternal literacy reduces child mortality by 30% compared to no maternal literacy	Based on an instrumental variable approach estimating impacts of literacy on under-five mortality across 54 countries (Kaffenberger and Pritchett, 2021)
Child Marriage	Each additional year of secondary schooling reduces the probability of child marriage by 12.2%	Based on an instrumental variable approach estimating impacts of years of schooling on child marriage across 15 countries (Wodon et al., 2018)

3 | Broader Economic and Fiscal Impacts

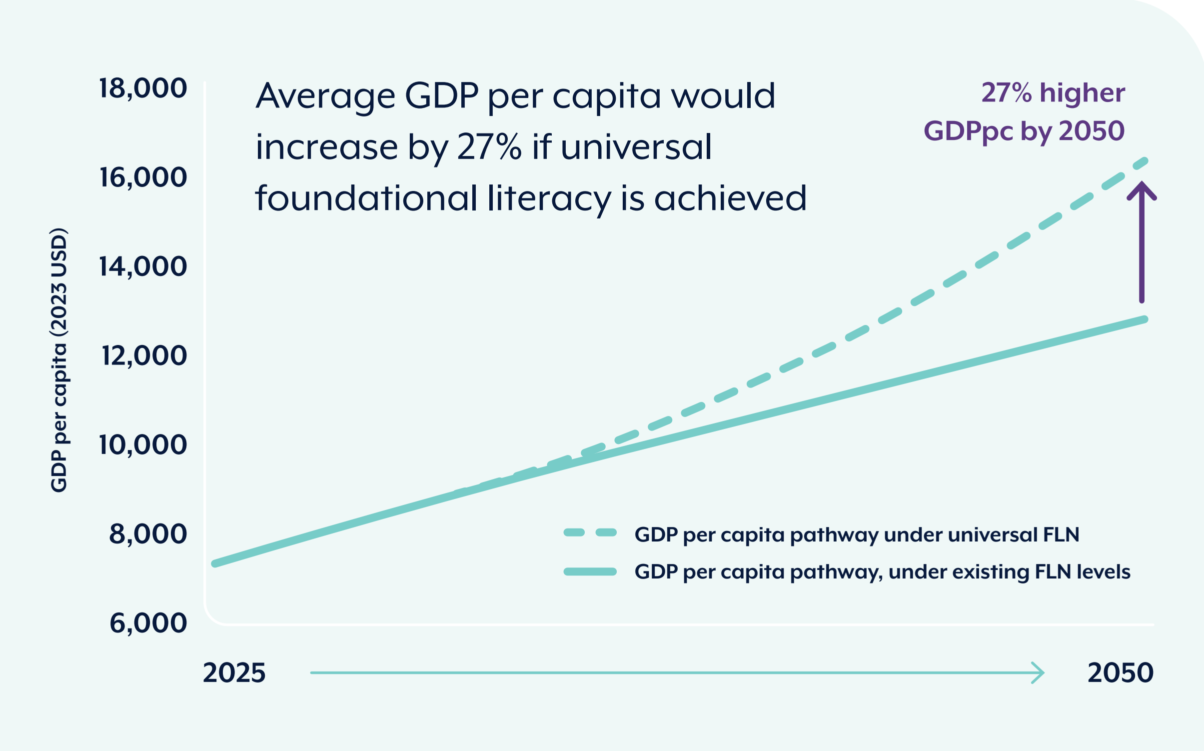
$196 trillion increase in economic output and 27% higher GDP per capita by 2050

Few investments shape a nation's prosperity more than education. When children learn more, countries grow faster (Hanushek and Woessmann, 2008, 2012; Angrist et al., 2021). Strong foundational skills create a workforce that is more productive, more innovative, and better equipped to adapt to technological change. This is the essence of human capital: just as roads and electricity fuel growth, so too does a population that is able to read and reason with numbers.

Our modelling shows that raising foundational learning to universal levels could generate an extraordinary **$196 trillion in additional economic output between 2031–2050**. These gains are a direct result of improvements in learning with impacts compounding over time. As more skilled cohorts enter the labour market, economic output rises against an increasingly productive economic base, fuelling a virtuous cycle. By 2050, the 114 countries covered in this analysis would see **GDP per capita 27% higher on average** than it otherwise would have been (Figure 5). The largest absolute economic gains would be seen in upper-middle-income and lower-middle-income countries (Annex A, Table A2) which have relatively large economic output, and for which gains can still be made from reaching universal learning. In terms of regions, South Asia and East Asia and the Pacific experience the largest output gains.

To provide some country examples (Annex A provides results for all 114 countries): India, where 43% of 10-year-olds can read proficiently, would see a $38 trillion increase in economic output over 20 years, raising 2050 GDP per capita by 47%. In Kenya, where currently only 21% of 10-year-olds can read, achieving universal learning proficiency would generate a 68% increase in GDP per capita by 2050, and $2 trillion in additional economic output over the analysis period. Vietnam, where reading proficiency is already very high at 82%, would see an 8.2% increase in GDP per capita ($738 billion in economic output gains) if it were able to boost foundational learning levels to 90%.

Figure 1: Estimated Increase in GDP per capita (population weighted) if Universal Foundational Learning Achieved in 114 Countries (2023 USD, 2031–2050)



Source: Analysis by authors based on HLO outcomes from Angrist et al. (2021). GDP per capita data from World Development Indicators, economic growth projections from Riahi et al. (2017), and population projections from UN Population Division.

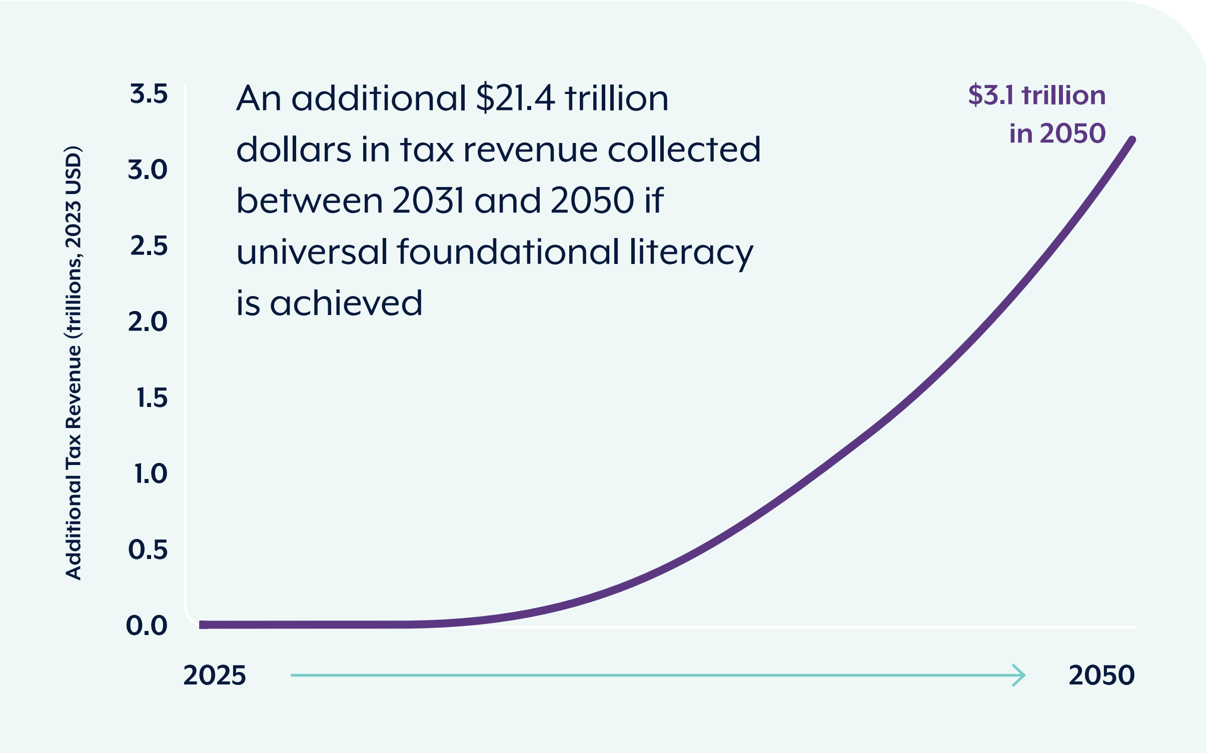
$21.4 trillion in additional tax revenue

Higher growth does not just benefit individuals – it also strengthens governments' ability to provide for their citizens. When economies expand, tax revenues rise, creating fiscal space for countries to invest in health, education, infrastructure and other public goods that drive development forward.

Our modelling indicates that achieving universal foundational learning would generate an additional **$21.4 trillion in tax revenue between 2031 and 2050** (Figure 6). The largest absolute gains would accrue in **upper-middle-income countries ($9.8 trillion)**, followed by **lower-middle-income countries ($9.1 trillion)**, reflecting both the scale of their economies and the size of their learning gaps.

In short, foundational learning is a fiscal multiplier: by boosting GDP, it equips governments with the resources needed to reinvest in people and systems, setting in motion a virtuous cycle of stronger learning, healthier populations, and sustained economic progress.

Figure 2: Estimated Additional Tax Revenue Collected if Universal Foundational Learning Achieved in 114 Countries between 2031 and 2050 (2023 USD, billions)



Source: Analysis by authors based on tax-to-GDP ratios and GDP data from World Development Indicators, economic growth projections from Riahi et al. (2017), and population projections from UN Population Division.

4 | Education and Employment Impacts

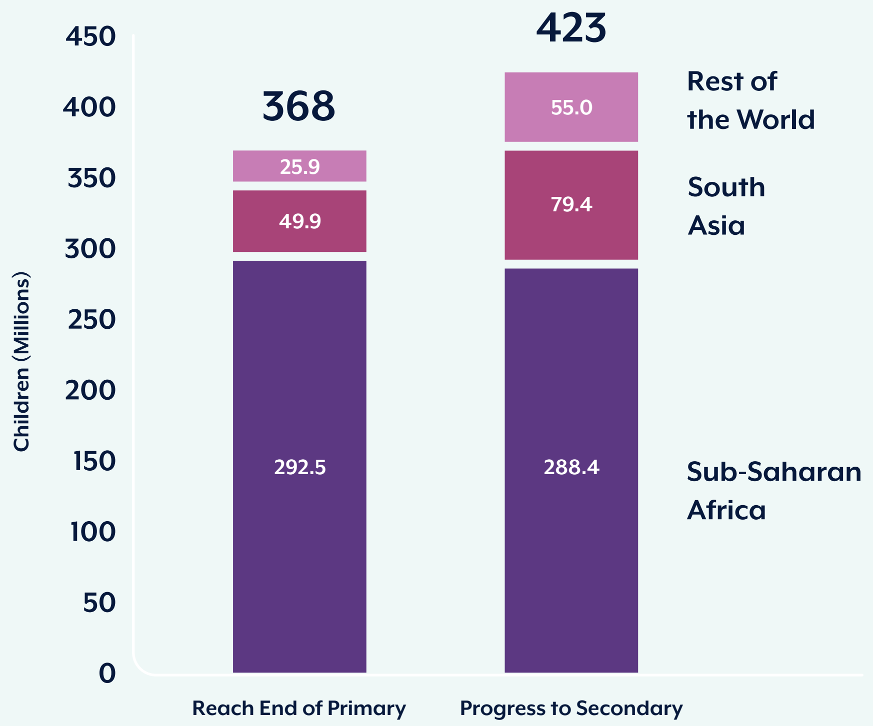
368 million more children reach the end of primary school

One of the most immediate impacts of achieving universal foundational learning would be an increase in the number of children completing primary school. According to UNESCO, around 78 million primary-aged children were out of school in 2023 (UNESCO, 2025). Many more start but do not reach the final grade.

Learning plays a decisive role in whether children stay the course. When students acquire basic skills early on, they are more likely to remain engaged, less likely to repeat grades, and better able to keep pace with the curriculum (Glewwe and Muralidharan, 2016; Kaffenberger, Sobol and Spindelman, 2023; Stern et al., 2024). Better learning therefore creates a virtuous cycle: stronger foundations improve progression through school, which in turn reinforces further learning and attainment.

Our analysis suggests that if 90% of children worldwide could read at age 10, **an additional 18.4 million children would reach the end of primary school each year**. Importantly, 52% of these children reside in low-income countries, while a further 44% are in lower-middle-income countries (Annex A, Table A2), showing how the greatest impacts from universal learning would accrue to the most vulnerable. Over the period 2031–2050, this adds up to **368 million more children completing primary school**, of which 292.5 million would be in sub-Saharan Africa and a further 49.9 million in South Asia (Figure 3). For instance, universal foundational learning would mean an extra 42 million children completing primary school in Nigeria, and an extra 34 million children completing primary school in Pakistan over 20 years (see Annex A for country specific results). Foundational skills not only improve learning but also sustain participation in primary education.

Figure 3: Estimated Number of Additional Children Reaching the End of Primary and Secondary if Universal Foundational Learning Achieved in 114 Countries (2031–2050)



Source: Analysis by the authors based on learning attainment impacts on dropout rates from No, Sam and Hirakawa (2012), Zuilkowski, Jukes and Dubeck (2016), Cueto, Felipe and León (2020), and Kaffenberger, Sobol and Spindelman (2023). Enrollment rates and persistence to last grade of primary data from World Development Indicators. Population projections from UN Population Division.

423 million more children progress to secondary school

Improving foundational learning also unlocks greater opportunities for children to enter and succeed in secondary education. In 2023, **194 million adolescents of lower- and upper-secondary school age were out of school** worldwide, with the largest gaps concentrated in Sub-Saharan Africa and South Asia (UNESCO, 2025).

The reasons why foundational skills shape secondary attainment mirror those for primary completion. When children master reading and numeracy early, they are less likely to repeat grades, more likely to pass primary school exit exams, and better prepared for the academic and social transition to secondary education (Kaffenberger, Sobol and Spindelman, 2023).

Strengthening foundational learning thus creates a pipeline effect: it sustains engagement through primary and greatly increases the probability of entering – and persisting in – secondary school.

Our modelling suggests that achieving universal foundational learning would bring **21.1 million additional children into secondary education each year.** Over the 2031–2050 period, this amounts to **423 million more adolescents receiving at least one year of secondary schooling** (Figure 1). The largest gains are concentrated in Sub-Saharan Africa and South Asia with **288 million** and **79 million more students**, respectively, progressing to secondary each year. These are the regions with the largest enrolment gaps, and where the transformative impacts of secondary attainment on earnings, empowerment and future opportunities are greatest.

49 million more youth are persistently employed

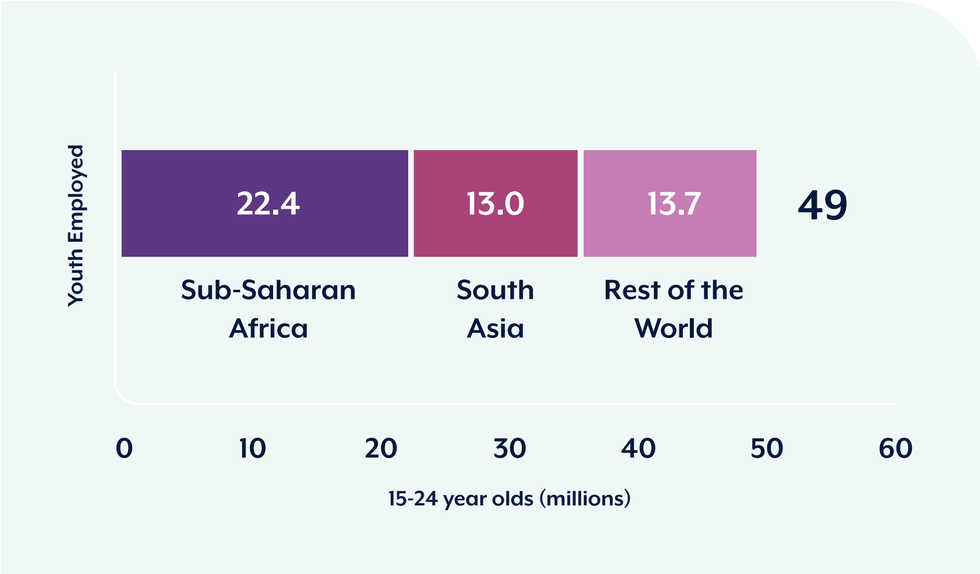
The cascading effects of foundational learning reach all the way into the labour market. Young people are consistently the least likely to be employed: in 2023, the global youth unemployment rate was around **13%, three times higher than adults**, and one in five youth were not in education, employment or training (ILO, 2024). Many countries also face a skills mismatch, where employers cannot find qualified candidates even as large numbers of young people remain jobless (ILO, 2024).

Foundational skills help close this gap. Children who master reading and numeracy are more likely to progress through school, develop the competencies employers value, and transition smoothly into work. Evidence shows that better literacy and numeracy are directly linked to higher chances of employment and higher wages in adulthood (Lee and Newhouse, 2013; Kaffenberger, Melville and Agarwal, 2025).

Our analysis suggests that achieving universal foundational learning would put **49 million more young people into persistent employment** by 2050, with 22 million in Sub-Saharan Africa and 13 million in South Asia (Figure 2). Some of the largest youth employment gains would be experienced in India (7.8 million more youth employed over 20 years), Nigeria (6.2 million), Pakistan (3.4 million), Ethiopia (3.0 million) and China (2.0 million) (Annex A, Table A1).

By income region, **11.2 million more youth would be employed in low-income countries** and 28.2 million in lower-middle-income countries (Annex A, Table A2). In this case, lower-middle-income countries have the largest gains because they experience a greater magnitude of youth unemployment – meaning that there is more benefit to be gained from universal foundational learning.

Figure 4: Additional Youth Persistently Employed if Universal Foundational Learning Achieved in 114 Countries (2031–2050)



Source: Analysis by the authors based on associations between test scores and youth employment from Lee and Newhouse (2013). Youth unemployment data and employment-to-population ratios from World Development Indicators. Population projections from UN Population Division.

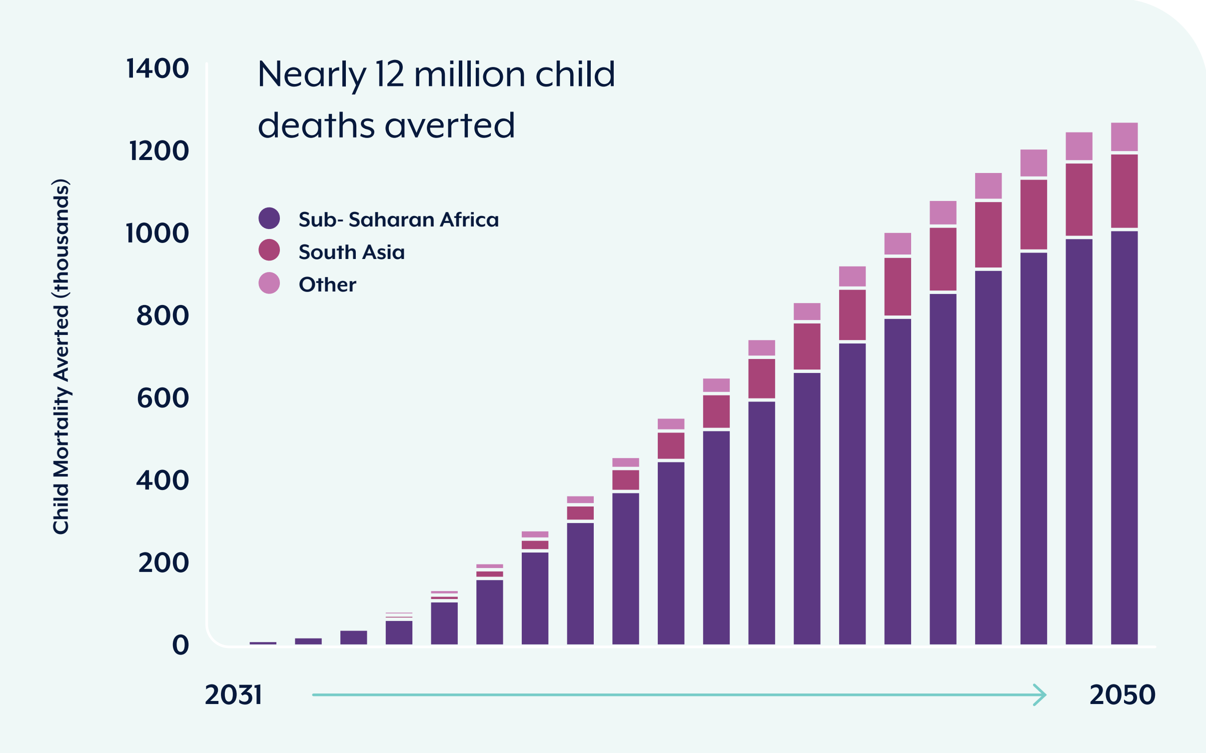
5 Broader Social Impacts

Nearly 12 million child lives saved

When mothers are more educated, their children are more likely to survive (Gakidou et al., 2010; Shrestha, 2019; Kaffenberger and Pritchett, 2021). Mothers who can read are better able to acquire health knowledge which is essential for improving their children's health care (Glewwe, 1999).

Our modelling suggests that raising foundational learning to universal levels could avert **11.9 million child deaths between 2031 and 2050**. The greatest gains are concentrated where mortality burdens remain highest: in **low-income and lower-middle-income countries**, and especially in **Sub-Saharan Africa**, which accounts for the largest share of averted deaths (Figure 3). 17 of the top 20 countries with the greatest potential for saving child lives due to foundational learning gains are in Sub-Saharan Africa, including Nigeria (3.3 million child deaths averted over 20 years), Democratic Republic of the Congo (1.4 million) and Ethiopia (430,000).

Figure 5: Child Mortality Averted if Universal Foundational Learning Achieved in 114 Countries (2031–2050)



Source: Analysis by the authors based on the impacts of maternal literacy on under-five mortality from Kaffenberger and Pritchett (2021). Under-five mortality data from World Development Indicators and age-specific fertility rates from UN Population Division.

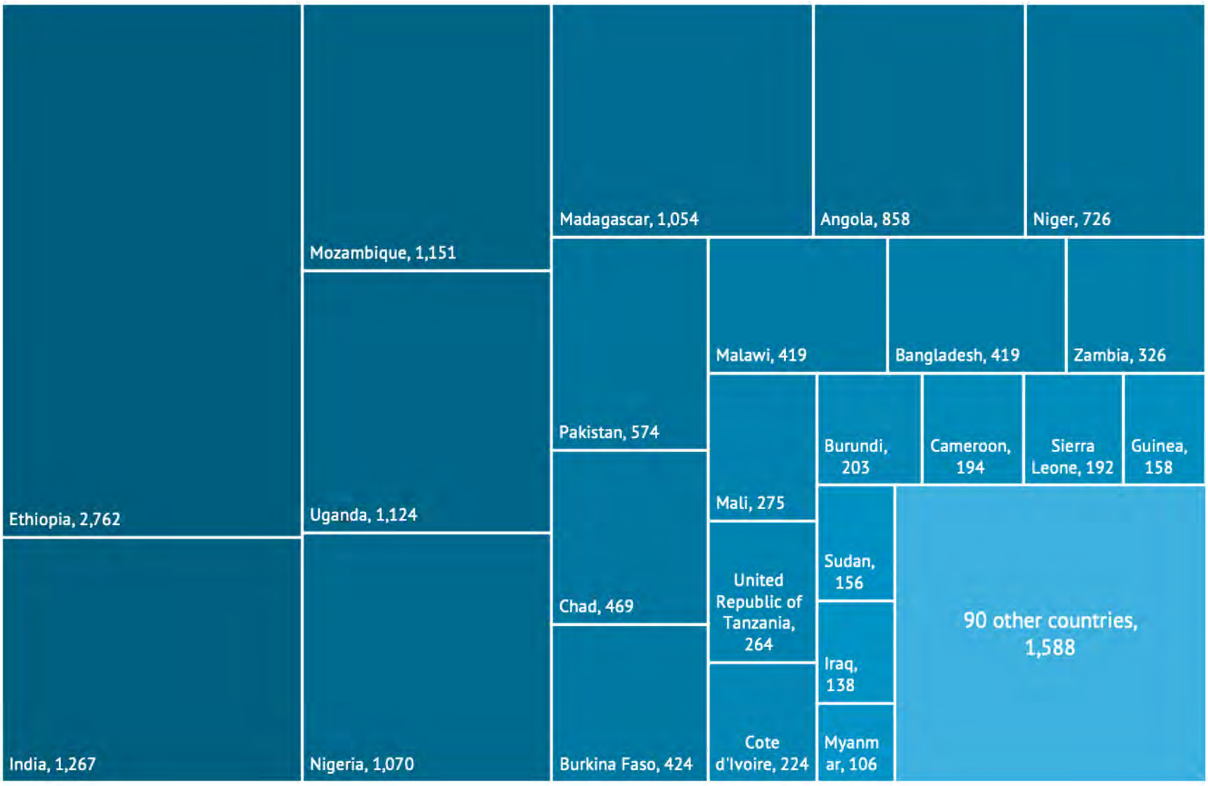
16 million fewer adolescent girls enter into early marriages

Globally, an estimated 12 million girls are married before the age of 18 each year (UNICEF, 2023). The consequences are profound: early marriage is associated with poor health outcomes, lower educational attainment, reduced employment, lower decision-making authority and autonomy and increased risk of intimate partner violence (Parsons et al., 2015).

Evidence shows that when girls stay in school longer, they are significantly less likely to be married as adolescents (Girls Not Brides, 2025). Improved foundational learning underpins this effect by helping girls complete primary school, transition to secondary, and find employment. Households also respond to opportunity: when families perceive that daughters have improved chances of employment, they are more likely to invest in girls' education and delay marriage (Heath and Mobarak, 2015).

Our modelling indicates that achieving universal foundational learning would avert **16.1 million child marriages over 2031–2050** through the increased secondary education channel. This result is likely conservative, with the true figure higher, as additional gains occurring directly via increased learning are not modelled due to lack of data. Impacts are concentrated in **24 countries** – almost all of which are in Sub-Saharan Africa and South Asia – where child marriage rates are highest and learning levels are relatively low (Figure 4). These gains reinforce that achieving universal foundational learning is a powerful lever to advance gender equality.

Figure 6: Estimated Number of Early Marriages Averted if Universal Foundational Learning Achieved in 114 Countries (thousands of girls, 2031–2050)



Source: Analysis by the authors based on learning data from Azevedo et al. (2021) and the reduction in early marriage from additional secondary schooling from Wodon et al. (2018). Average child marriage prevalence in 15 countries from Girls not Brides (2025) and the proportion of girls married before age 18 from UNICEF (2023).

6 Conclusion: Where to go from here

The case for foundational learning is compelling. Ensuring that every child can read with understanding and work confidently with numbers by age 10 is both a worthy education goal, and a driver of broader development. This analysis shows that achieving universal foundational learning would transform lives and societies: **$196 trillion in additional output and over $21 trillion in tax revenue** between 2031 and 2050. These gains are matched by profound social benefits: **368 million more children completing primary school, 423 million gaining secondary education, 49 million more young people in steady employment, 12 million child deaths averted, and 16 million fewer child marriages** (Table 3).

Table 3: Summary of Impacts if Universal Learning is Achieved in 114 Countries, 2031–2050

Category of Impact	Metric	Impact over 2031–2050
Broader Economic and Fiscal Impacts	Economic Output	$196.2 trillion in additional economic output (2023 USD) 27% higher GDP per capita by 2050 (population weighted)
	Tax Revenue	$21.4 trillion in additional tax revenue (2023 USD)
Education and Employment	Primary School	368.4 million more children reach the end of primary school
	Secondary School	422.8 million more children progress to any form of secondary school
	Youth Employment	49.1 million more youth in employment
Broader Social Impacts	Child Mortality	11.9 million additional child deaths averted
	Child Marriage	16.1 million fewer child marriages

Taken together, the evidence demonstrates that foundational learning is one of the most important investments available to governments and donors. It tackles multiple Sustainable Development Goals simultaneously, advancing education, health, gender equality, decent work, and poverty reduction, while also fuelling inclusive and sustained economic growth. Few interventions deliver such broad and lasting dividends.

Importantly, there is robust evidence that certain interventions are effective, low-cost and can be delivered at scale. These include structured pedagogy, teaching at the right level and computer assisted learning that tailors instruction to learning levels (Angrist et al., 2023). By acting now, countries can unlock a future where every child learns, every young person has a chance to thrive, and every nation builds the foundations of shared prosperity.

A | Annex A: Country, Income Grouping and Regional Results

Table A1: Results by Country, 2031–2050

Country	% of 10-year-olds who can read	Additional children reaching last year of primary	Additional children reaching any form of secondary	Additional youth employed	Additional child mortality averted	Additional child marriages averted	Additional economic output (billions, USD)	% increase in GDP per capita in 2050	Additional tax revenue (billion, USD)
Albania	89.8%	458	162	94	0	2	0.8	0.3%	0.1
Algeria	32.1%	1,004,801	1,270,586	156,154	22,672	5,890	2,190.8	65.8%	262.9
Angola*	11.5%	21,011,580	23,206,072	581,226	250,417	857,836	1,460.7	151.7%	147.4
Argentina	40.9%	341,069	421,138	268,182	3,930	7,964	3,629.9	40.8%	362.3
Armenia	72.8%	2,622	3,223	5,326	66	21	52.2	16.8%	11.7
Austria	85.0%	819	1,458	9,272	8	11	304.1	5.3%	78.7
Azerbaijan	62.5%	9,281	23,644	39,217	821	433	215.7	26.5%	33.3
Bahrain	69.8%	283	4,648	4,952	54	65	185.3	19.3%	5.2
Bangladesh	48.8%	12,910,294	6,766,071	1,640,943	107,512	418,509	4,752.6	45.3%	363.2
Belize	23.6%	16,325	21,253	5,243	154	869	40.6	85.1%	8.7
Benin	44.2%	2,852,304	2,459,186	168,894	91,494	82,506	239.5	46.8%	28.7
Botswana	49.2%	29,302	88,057	12,220	2,159	3,309	119.4	41.7%	22.3
Brazil	53.1%	3,337,191	2,613,142	1,321,531	23,400	83,526	8,341.7	29.3%	1,171.3
Bulgaria	81.8%	3,713	0	3,756	28	0	133.5	8.4%	27.3
Burkina Faso	26.1%	9,657,398	6,775,346	200,220	140,551	424,042	341.3	53.6%	62.7
Burundi	4.2%	6,720,842	8,753,775	378,887	55,731	202,913	54.8	51.7%	8.6
Cambodia	10.0%	1,538,015	2,984,714	423,625	11,560	65,180	829.8	84.9%	101.3
Cameroon	28.1%	4,951,868	5,342,390	286,262	177,521	194,228	944.4	74.7%	107.1
Chad	5.6%	3,624,975	6,340,888	380,707	441,477	468,795	322.8	70.4%	38.7
Chile	72.8%	4,767	41,256	32,299	213	1,237	820.0	16.7%	145.3
China	81.8%	1,346,930	7,534,097	1,994,879	2,161	25,736	23,084.0	8.2%	1,763.2
Colombia	48.6%	606,706	706,568	313,529	6,513	20,171	1,990.5	33.2%	349.7
Comoros	14.0%	122,168	104,953	6,332	2,694	2,650	23.4	49.0%	2.8
Congo	30.0%	797,162	1,024,782	49,349	17,318	34,131	260.3	70.5%	16.9
Costa Rica	66.0%	11,073	39,874	15,059	362	832	252.6	19.1%	35.1
Cote d'Ivoire	20.1%	5,987,232	7,123,607	386,011	210,505	224,223	1,966.7	67.4%	260.1

Cyprus	89.8%	33	21	61	0	0	1.9	0.3%	0.5
Czechia	85.8%	803	0	4,884	8	0	208.3	4.5%	26.3
Democratic Republic of the Congo	3.4%	13,700,003	0	1,699,823	1,380,857	0	1,481.0	40.2%	169.0
Dominican Republic	22.3%	156,196	433,362	137,191	16,354	16,654	1,215.6	67.6%	175.7
Ecuador	34.1%	503,768	162,906	168,191	3,946	4,412	942.4	48.7%	123.4
Egypt	43.9%	64,755	2,337,856	440,643	56,376	45,065	4,147.5	47.2%	519.2
El Salvador	30.9%	66,293	145,840	66,878	836	3,505	249.5	53.0%	51.7
Eswatini*	65.1%	30,628	49,668	1,927	757	115	18.7	24.4%	4.6
Ethiopia	9.6%	60,674,538	56,179,697	2,989,344	430,631	2,762,131	3,316.1	59.5%	130.4
Gabon	69.3%	151,785	134,040	3,311	1,448	2,175	64.7	19.9%	6.1
Gambia*	8.7%	309,950	440,367	34,162	9,056	12,410	52.7	79.7%	6.3
Georgia	86.5%	2,282	223	1,684	16	3	19.0	3.8%	4.5
Germany	84.6%	52,648	45,477	86,950	124	340	2,755.3	5.8%	303.4
Ghana*	5.8%	1,981,592	3,533,091	559,984	71,828	69,397	1,717.5	77.1%	211.2
Guatemala	21.5%	1,302,905	2,062,327	313,962	12,798	74,223	1,545.8	69.2%	178.8
Guinea	17.3%	2,527,318	2,779,844	131,684	197,818	157,701	499.4	58.2%	59.9
Guyana*	15.3%	22,076	20,349	8,237	700	802	258.5	96.9%	31.0
Haiti*	25.2%	453,819	472,584	79,724	37,970	8,591	285.8	47.7%	34.3
Honduras	20.7%	374,512	803,405	163,992	7,575	33,325	519.9	69.9%	78.3
India	43.9%	872,849	44,580,538	7,756,891	424,708	1,267,246	37,361.7	47.3%	2,516.1
Indonesia	47.2%	771,760	4,066,605	1,959,694	51,885	80,869	11,732.2	41.1%	1,297.3
Iran (Islamic Republic of)	58.5%	477,678	1,374,298	182,406	5,615	28,000	1,880.8	30.2%	138.4
Iraq*	35.8%	705,825	4,063,371	223,070	41,978	138,309	2,897.0	66.0%	39.0
Israel	85.6%	2,053	0	11,682	35	0	386.4	4.7%	85.5
Jamaica*	45.5%	134,966	21,508	15,663	752	706	109.9	46.5%	28.2
Jordan	37.8%	95,334	271,021	38,561	4,017	3,273	909.6	60.6%	155.1
Kazakhstan	89.6%	2,081	0	2,254	19	0	19.8	0.5%	2.4
Kenya	20.7%	1,295,747	4,024,099	649,405	143,182	61,368	2,016.9	67.9%	282.2
Kuwait	48.9%	86,025	0	11,798	234	0	1,129.8	39.9%	135.6
Kyrgyzstan	35.5%	43,098	64,097	63,329	3,429	719	189.2	62.0%	37.1
Lao PDR	2.3%	762,214	1,034,316	206,758	15,226	38,487	361.4	98.1%	43.8
Lesotho	3.1%	474,043	704,257	31,821	9,262	11,513	38.3	65.6%	11.6
Liberia*	6.9%	1,585,808	1,184,892	148,581	43,927	35,995	60.4	28.5%	7.5
Madagascar	4.8%	20,777,558	22,256,490	1,067,397	359,428	1,053,533	311.2	50.9%	29.9
Malawi*	10.1%	7,299,171	9,109,958	487,637	53,025	419,003	243.5	46.0%	32.9

Malaysia	58.0%	99,210	745,899	202,864	2,359	12,314	2,222.9	30.2%	279.5
Mali	9.6%	5,473,103	4,201,422	602,649	411,819	275,252	499.0	69.5%	59.6
Malta	89.8%	12	14	19	0	0	0.5	0.2%	0.1
Mauritania	5.2%	1,300,962	1,660,692	37,185	20,830	74,153	278.1	102.1%	33.4
Mauritius	59.5%	4,057	6,158	3,884	104	231	60.6	29.6%	12.5
Mexico	52.4%	547,579	1,672,700	938,960	20,222	37,141	8,092.2	29.9%	1,151.5
Mongolia	60.5%	8,155	57,479	11,010	330	568	131.7	27.7%	22.3
Montenegro	84.2%	81	711	381	0	5	6.0	6.1%	0.7
Morocco	40.2%	485,432	1,734,810	161,240	7,202	28,996	1,527.5	52.3%	320.4
Mozambique*	14.4%	15,572,517	19,488,848	770,784	275,625	1,150,777	481.0	71.9%	109.0
Myanmar	10.5%	5,212,186	5,436,675	789,318	63,932	106,124	1,211.9	121.3%	72.9
Namibia*	50.4%	133,070	256,635	9,986	3,943	2,160	96.4	40.1%	31.8
Nepal*	30.9%	2,359,447	2,267,443	188,457	20,190	96,543	499.6	46.0%	87.4
New Zealand	89.1%	2,745	342	1,541	2	6	31.0	1.0%	9.2
Nicaragua	21.1%	1,549,572	1,239,257	99,402	3,282	53,219	266.4	65.6%	53.1
Niger	9.6%	7,055,553	7,796,842	723,979	706,362	725,777	388.1	67.6%	46.6
Nigeria*	11.2%	41,794,699	28,952,831	6,249,085	3,318,915	1,070,270	7,653.7	68.7%	918.4
North Macedonia	67.0%	7,914	13,175	2,805	6	121	57.7	24.1%	10.3
Oman	59.4%	2,549	0	20,495	510	0	554.1	29.2%	66.5
Pakistan	20.5%	33,776,667	25,720,465	3,419,164	1,077,764	574,235	6,279.6	80.1%	753.6
Panama	21.5%	466,251	254,552	43,624	1,273	8,199	937.1	69.0%	69.9
Papua New Guinea*	29.5%	311,190	780,735	82,481	21,858	26,003	504.6	66.5%	80.4
Paraguay	22.3%	95,070	263,961	95,354	3,914	6,956	628.6	66.4%	63.7
Peru	55.6%	100,826	179,559	271,419	5,332	4,206	1,187.0	27.2%	189.0
Philippines	9.1%	1,433,757	7,620,933	1,409,165	151,899	87,397	7,737.3	95.2%	1,091.3
Qatar	78.9%	6,173	148	7,006	19	0	350.5	11.0%	42.1
Republic of Moldova	89.0%	1,195	831	541	12	12	3.7	1.1%	0.7
Romania	82.1%	16,304	0	11,628	67	0	355.3	8.1%	57.4
Rwanda*	15.5%	2,643,342	3,791,657	211,077	20,884	25,442	289.5	63.9%	39.1
Saudi Arabia	67.6%	677,537	0	83,055	555	0	3,895.9	21.3%	304.1
Senegal	31.4%	2,294,031	2,055,129	158,883	28,972	75,719	515.8	67.5%	100.8
Sierra Leone*	2.0%	5,159,935	5,310,032	147,006	73,609	191,756	124.3	55.6%	14.9
Slovakia	77.9%	1,293	0	5,012	53	0	217.9	12.1%	42.4
Solomon Islands*	32.8%	61,293	68,766	15,859	1,260	1,787	27.3	70.8%	5.7
South Africa	18.0%	1,224,487	1,703,308	231,076	46,423	7,481	5,760.2	100.3%	1,498.0
Sri Lanka	85.2%	7,576	29,703	13,396	104	355	86.9	4.8%	8.6

Sudan*	17.3%	2,662,873	3,732,559	0	206,831	155,737	2,111.6	73.6%	156.1
Tajikistan*	88.8%	1,338	12,083	1,766	338	128	4.3	1.4%	0.5
Thailand	76.6%	41,972	364,279	150,233	810	7,555	1,196.8	13.0%	184.6
Timor-Leste*	39.6%	40,044	77,033	13,511	2,315	1,400	29.2	43.9%	6.3
Togo	18.3%	2,493,355	2,423,105	81,089	51,976	73,313	172.6	72.0%	25.5
Trinidad and Tobago	79.4%	2,344	8,660	2,206	53	44	35.6	10.6%	5.9
Tunisia	34.5%	68,829	233,861	32,981	1,783	685	534.1	61.6%	107.4
Turkey	81.5%	12,407	13,475	154,380	1,471	242	1,464.6	8.7%	271.5
Uganda	18.1%	24,683,890	27,105,895	1,301,173	135,455	1,124,353	892.4	46.6%	115.7
United Arab Emirates	74.1%	48,776	8,614	28,352	39	121	1,437.9	15.4%	9.0
United Republic of Tanzania*	50.7%	4,137,992	7,427,796	991,398	124,491	263,702	1,115.1	41.0%	128.1
Uruguay	56.4%	29,617	26,471	14,727	60	794	273.9	26.5%	51.1
Uzbekistan	67.6%	85,553	105,298	111,099	4,616	437	516.3	21.6%	59.5
Vanuatu*	28.3%	28,015	28,302	2,954	515	722	20.3	81.5%	3.5
Viet Nam	81.9%	173,163	960,708	171,864	8,883	17,112	738.3	8.2%	88.6
Zambia	1.5%	8,641,186	9,225,172	403,492	90,063	326,387	732.0	70.5%	122.8
Zimbabwe*	37.8%	689,060	1,696,356	181,855	43,844	69,744	460.4	40.7%	33.2

* Denotes countries with imputed Learning Poverty values

Table A2: Results by World Bank Income Grouping, 2031–2050

Income Group	% of 10-year-olds who can read	Additional children reaching last year of primary	Additional children reaching any form of secondary	Additional youth employed	Additional child mortality averted	Additional child marriages averted	Additional economic output (billions, USD)	% increase in GDP per capita in 2050	Additional tax revenue (billion, USD)
Low income	10.3%	190,094,810	184,891,775	11,224,512	4,797,244	9,101,229	11,142	58.5%	1,052
Lower middle income	34.6%	163,598,523	207,000,599	28,201,913	6,834,225	6,451,180	89,282	57.5%	9,057
Upper middle income	63.9%	13,257,321	30,464,392	9,278,631	282,815	576,600	81,504	30.6%	9,782
High income	75.5%	1,426,822	412,010	391,554	4,035	11,620	14,273	16.1%	1,497

Table A3: Results by World Bank Region Grouping, 2031–2050

Income Group	% of 10-year-olds who can read	Additional children reaching last year of primary	Additional children reaching any form of secondary	Additional youth employed	Additional child mortality averted	Additional child marriages averted	Additional economic output (billions, USD)	% increase in GDP per capita in 2050	Additional tax revenue (billion, USD)
East Asia & Pacific	65.3%	11,830,649	31,760,882	7,435,756	334,996	471,259	49,859	26.5%	5,050
Europe & Central Asia	78.9%	243,922	283,879	504,437	11,083	2,473	6,526	7.4%	968
Latin America & Caribbean	46.7%	10,122,926	11,610,672	4,375,374	149,640	367,375	31,624	46.0%	4,358
Middle East & North Africa	46.6%	3,726,063	11,299,227	1,402,412	141,090	250,404	22,028	19.9%	2,190
South Asia	40.3%	49,926,833	79,364,220	13,018,852	1,630,278	2,356,888	48,980	36.5%	3,729
Sub-Saharan Africa	15.5%	292,527,083	288,449,896	22,359,780	9,651,232	12,692,227	37,185	55.1%	5,093

B | Annex B: Methods

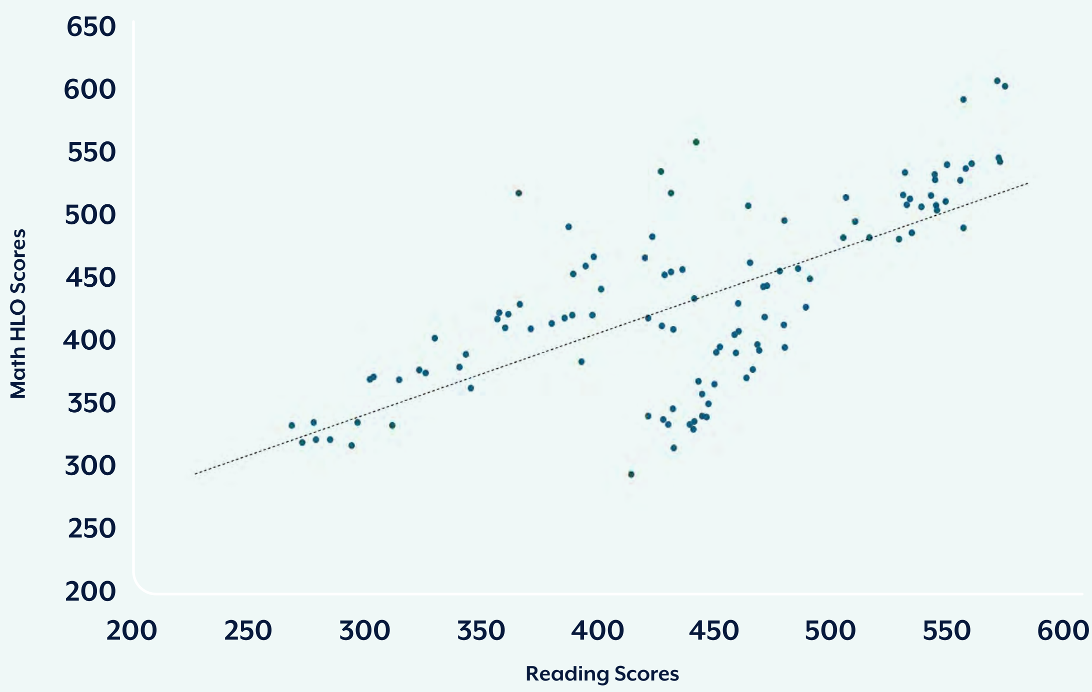
B.1 Defining universal foundational learning

An essential first step in this analysis was to clearly define the measure of foundational learning. Several options were considered, including the World Bank's 'learning poverty' metric, minimum proficiency thresholds from various assessments, or a derived cut-off score on the Harmonized Learning Outcomes (HLO) scale.

We prioritised selecting a measure that meaningfully captures foundational learning, practically met the needs of the modelling, and is intuitive and easily communicable. On this basis, the learning poverty metric proved especially suitable, as it directly captures a concept that resonates broadly: whether a child at age 10 can read proficiently. This framing is likely clearer and more relatable than referencing, for example, a specific numerical benchmark (eg scoring above 400 on the TIMSS assessment). Moreover, learning poverty is widely used in education policy and as a measure of progress within the sector.

While learning poverty focuses specifically on literacy, there is strong evidence that literacy at age 10 is a reliable proxy for broader foundational learning, including numeracy. Across international assessments, reading and mathematics scores are highly correlated. A cross-country fixed-effects regression of Harmonized Learning Outcomes (HLO), controlling for region, income group, year and assessment type, shows a statistically significant relationship between reading and numeracy (coefficient ≈ 1.14, $p < 0.001$, adjusted $R^2 = 0.88$). This supports the use of literacy-based measures as indicative of overall foundational skill acquisition. As shown in Figure B1, there is a clear positive correlation between reading and math scores, reinforcing the empirical basis for using literacy as a proxy for broader foundational learning outcomes.

Figure B1: Relationship between Reading and Math HLO Scores



On this basis we assume that foundational literacy is a reasonable proxy for foundational learning, and we define **universal foundational learning** as 90% of children being able to read at minimum proficiency by age 10, corresponding to the levels seen in many high-income countries.

B.2 Linking Learning Poverty to Harmonized Learning Outcomes

Several of the development outcomes documented in the literature are linked to HLO and other test scores rather than directly to learning poverty (eg economic growth in Angrist et al. 2021). To bridge these measures, we estimate the non-linear relationship between minimum proficiency and HLO using a probit transformation. The cumulative nature of minimum proficiency (capturing the share of students scoring below a threshold) resembles a cumulative distribution function (CDF) of the underlying learning score distribution.

Formally, let learning scores in country *i* at time *t* follow a normal distribution with mean μ and standard deviation σ. The probability of being below the minimum reading threshold *T* is:

$$P_{it} = \Phi(\frac{T-\mu}{\sigma}) \quad (1)$$

where Φ denotes the standard normal CDF.

Taking the inverse transformation and regressing against observed HLO yields:

$$\Phi^{-1}(P_{it}) = \alpha + \beta HLO_{it} + \gamma_r + \delta_g + \theta_s + \lambda_t + \varepsilon_{it} \quad (2)$$

with fixed effects for region (γ_r), income group (δ_g), assessment type (θ_s), and year (λ_t), and errors clustered at the country level.

The estimated coefficient β= −0.011 implies that a one-point increase in HLO is associated with a 0.011 reduction in the probit-transformed proportion of children below minimum proficiency. This provides a direct mapping between observed improvements in reading proficiency (learning poverty) and corresponding increases in HLO, which are then applied to downstream models of economic, social, and health outcomes.

In the global model, we simulate an immediate and sustained achievement of universal foundational learning – defined as reducing learning poverty to 10% (ie 90% proficiency). This scenario implies substantial upward shifts in HLO scores across countries, with the exact gain depending on the initial baseline. Because the normal CDF is non-linear, countries starting from lower proficiency levels require relatively smaller HLO gains to achieve 90% proficiency, while higher-performing countries require progressively larger gains. This property ensures that the model captures the increasing difficulty of achieving universal learning as systems approach the frontier.

Imputation of Missing Learning Poverty Values (LPV)

To extend coverage beyond countries with observed LPV data, the fixed-effects probit model described in Equation (2) was also used to impute LPV values for countries that reported HLO scores but no LPV observation. This procedure increased the number of countries included in the analysis to 114 after exclusions (24 additional countries).

Observed LPV values from the World Bank's LPV indicator (SE.LPV.PRIM) were expressed as proportions and transformed using the inverse-normal (probit) function. Each LPV observation was then matched to primary-level reading HLO data from the same country and, where necessary, within a two-year window (±2 years). When multiple matches existed, the closest year was selected, with ties resolved by using the most recent HLO value.

The regression linking LPV and HLO (Equation 2) was estimated with fixed effects for region, income group, assessment source, and year, and robust standard errors clustered by country. Using the estimated coefficients and fixed effects, predicted LPV values were generated for all country–year combinations that had valid HLO data but no LPV observation. For each new country, the corresponding regional, income-group, and assessment-source effects were drawn from the fitted model, with the assessment type identified from the country's most recent reading HLO record. Predicted probit values were then converted back to probability space via the standard normal CDF.

Imputed records were flagged and combined with observed LPV values to form an augmented dataset used in subsequent analyses. Countries lacking complete macroeconomic data (Cuba, Kiribati, South Sudan, Tonga, Ukraine, Yemen and Afghanistan) were excluded from projections.

B.3. Broader Economic and Fiscal Impacts

B.3.1. Economic output

Economic growth is one of the most widely documented outcomes associated with improved learning. Cross-country research consistently finds that human capital, particularly cognitive skills, plays a central role in driving long-run growth (Hanushek & Woessmann, 2008; Angrist et al., 2021). The Harmonized Learning Outcomes (HLO) metric developed by Angrist et al. (2021) provides a standardised global measure of achievement across assessments and years, enabling consistent estimation of the learning–growth relationship.

Angrist et al. (2021) estimate that a 1% increase in HLO is associated with a 7.2% increase in GDP per capita growth. This elasticity is derived from a panel covering 164 countries and nearly the entire global population, controlling for initial income levels and other macroeconomic factors. We adopt this parameter as the basis for translating improvements in foundational learning into growth outcomes.

To apply this relationship, we first translate universal foundational learning into HLO gains using the probit transformation described in equation (2). For each country, the movement from current proficiency levels to 90% proficiency implies an increase in mean HLO of:

$$\Delta HLO = \frac{\Phi^{-1}(P_{it+1}) - \Phi^{-1}(P_{it})}{\beta} \quad (3)$$

where P_{it} is the baseline share of children below minimum proficiency in country i at time t, P_{it+1} is the target share after achieving universal foundational learning (set to 0.10, ie 10% below minimum proficiency), and β is the estimated slope on HLO from the fixed-effects probit regression. In the implementation, β is obtained directly from the fitted model (approximately –0.011). Thus, each country's ΔHLO is derived from its own baseline learning poverty value and the universal foundational learning target of 90% proficiency.

The proportional increase in HLO is then:

$$\%\Delta HLO_i = \frac{\Delta HLO_i}{HLO_{i0}} \quad (4)$$

Dynamic phasing of growth impacts

To reflect the lag between improvements in foundational learning and their eventual impact on productivity, we model growth adjustments dynamically:

- **Lag period (0–5 years):** No additional effect, representing the time required for improved cohorts to enter the labour force.
- **Ramp-up (years 6–15):** Linear increase in growth elasticity as progressively larger shares of the workforce consist of better-educated cohorts.
- **Plateau (years 16–25):** Maximum effect sustained as universal foundational learning becomes fully embedded in the working-age population.

This phasing produces a smoother and more realistic trajectory of GDP per capita compared to an immediate shift in growth rates.

Aggregating global outcomes

For each country, GDP per capita is projected forward in 2023 USD under both business-as-usual (BAU) and universal foundational learning (FLN) scenarios using the growth paths above. Baseline GDP per capita trajectories are drawn from the IIASA Shared Socioeconomic Pathways (SSP) projections (Riahi et al., 2017). Population projections from the UN World Population Prospects medium variant (UN Population Division, 2024) are applied to scale GDP per capita to total GDP. Global aggregates are computed as population-weighted sums of GDP across all countries included in the analysis.

This framework yields estimates of the long-run income gains from achieving universal foundational learning. In practice, the effect size may be lower than the direct elasticity would suggest, since the Angrist et al. (2021) relationship was not designed to be extrapolated to very large shifts in HLO. To ensure plausibility, we impose a cap of 7% real annual GDP per capita growth as an upper bound on sustained expansion, consistent with historical experiences of the fastest-growing economies.

The proportional gain, $\%\Delta HLO_i$, is applied to baseline growth factors (1 + growth rate) rather than raw rates, consistent with our implementation. Specifically, for each country *i* we compute a target multiplier:

$$M_i = 1 + 0.072 \times \%\Delta HLO_i \quad (5)$$

This multiplier is phased in over time using a profile with (i) a lag period (2025–2030) where M_i=1, (ii) a linear ramp-up during 2031–2040, and (iii) a plateau at full effect in 2041–2050. The adjusted growth factor is:

$$g_{it}{}^{FLN} = min(g_{it}{}^{BAU} \times m_{it}, 1.07) \quad (6)$$

Where $g_{it}{}^{BAU}$ the baseline growth factor, m_{it} is the time-profile multiplier evolving from 1 to M_i, and the cap at 1.07 enforces a maximum 7% per-capita growth rate.

B.3.2. Tax revenue collection

To estimate fiscal impacts, we translate differences in GDP levels between the FLN and the BAU scenario into tax revenue using observed tax-to-GDP ratios. For each country, we use the most recently observed tax-to-GDP ratio from World Bank (2025); for countries where national data on tax-to-GDP are unavailable, we apply a fixed value of 12%, corresponding to the average tax-to-GDP ratio for lower-middle-income countries reported by the World Bank.

Country-level GDP per capita is projected in 2023 USD under both BAU and FLN scenarios (Riahi et al., 2017), anchored in 2023 and incorporating the lag, ramp-up, plateau, and cap dynamics described in Section 3. These per capita values are scaled by United Nations medium-variant population projections (UN Population Division, 2024) to form total projected GDP:

$$GDP_{it}{}^{scenario} = Pop_{it} \times GDPpc_{it}{}^{scenario} \quad (7)$$

Where scenario $\boldsymbol{\varepsilon}$ $\{BAU,FLN\}$

Tax revenues are then calculated by multiplying GDP levels by the country-specific tax ratio:

$$T_{it}{}^{scenario} = \tau_i \times GDP_{it}{}^{scenario} \quad (8)$$

From these, the absolute and relative differences are defined as:

$$\Delta T_{it} = T_{it}{}^{FLN} - T_{it}{}^{BAU} \quad (9)$$

$$\%\Delta T_{it} = \frac{T_{it}{}^{FLN}}{T_{it}{}^{BAU}} - 1 \quad (10)$$

Several assumptions underlie this approach. Tax-to-GDP ratios are held constant over time, with no additional buoyancy effects assumed. Population projections are identical under BAU and FLN, so all differences reflect productivity gains. Because GDP per capita trajectories incorporate dynamic adjustments (lag, ramp, plateau and cap), the tax revenue series inherits the same timing. This method yields country-specific and global estimates of the fiscal space created by universal foundational learning, expressed both in absolute terms and relative to business-as-usual.

B.4 Education and Employment Outcomes

Improving foundational learning reduces dropout rates and enhances both educational attainment and youth employment outcomes (Kaffenberger, Melville and Agarwal, 2025). The literature summarised in the What Works Hub for Global Education Synthesis Brief highlights varied estimates, typically ranging from a 20% to 60% reduction in dropout probability per standard deviation increase in test scores. In this analysis, we use the midpoint of this range (40%) for primary and a lower effect for secondary (25%) following the midpoint of impacts estimated for 12 year olds in Cueto, León and Felipe (2020). Regarding youth employment, Lee and Newhouse (2013) find that each standard deviation increase in learning achievement is associated with a reduction in youth unemployment of between 3.5 and 5.3 percentage points.

B.4.1 Primary school outcomes

The number of additional children reaching the last grade of primary school is estimated by combining baseline enrolment and survival data with country-specific improvements in HLO.

For each country, we compile:

- **Survival rate to the last grade of primary** (S_p), from World Bank (2025) converted to dropout probability:

$$P_p{}^{Dropout} = 1 - S_p \quad (11)$$

- **Net primary enrolment rate** (E_p), from World Bank (2025) with missing values imputed using regional averages.
- **Primary school entry population** (N_{entry}), approximated as one-fifth of the 5–9 year-old population in 2025 (UN medium-variant projections).

The effective number of children entering primary is defined as:

$$N_0 = N_{entry} \times (E_p + P_p{}^{Dropout}) \quad (12)$$

Improvements in HLO reduce the probability of dropout. We apply a dropout elasticity (θp) of 0.40 representing a 40% reduction in dropout probability per standard deviation increase in HLO (Cueto, León and Felipe, 2020).

For each country *i*, the standardised HLO change is:

$$HLO_i{}^{\Delta} = \frac{dHLO_i}{100} \quad (13)$$

Where *dHLO* is the modelled gain in HLO points under the universal learning scenario.

The additional number of children reaching the last grade of primary is:

$$X_p = HLO_i{}^{\Delta} \times \theta_p \times P_p{}^{Dropout} \times N_0 \quad (14)$$

Benefits would begin to accrue in 2028, when the first cohort treated in 2025 reaches the end of primary school. For consistency across measures, however, we implement benefits starting in 2031, with the full effect applied from 2031 through 2050.

B.4.2 Secondary school outcomes

Due to data limitations, for secondary we focus on the probability of reaching any form of secondary school conditional on reaching the last grade of primary. Given that a substantial number of individuals drop out between primary and secondary school in many countries, this is arguably the key transition of interest in assessing the impacts of foundational learning on secondary school outcomes. Ideally, one would also be able to identify impacts on reaching the end of secondary school, conditional on starting secondary, though data on completion success rates for secondary are patchy in cross-country databases.

We therefore estimate the number of additional children reaching any form of secondary schooling conditional on completing primary.

For each country:

- **Net secondary enrolment rate** (E_S), with missing values replaced by regional averages, from World Bank (2025).
- **Net primary enrolment rate** (E_P), as above.

The dropout probability at the transition to secondary is defined as:

$$P_s{}^{Dropout} = 1 - \frac{E_s}{E_p} \quad (15)$$

The number of children reaching the end of primary, conditional on entry, is:

$$N_p = N_0 \times E_p + X_p \quad (16)$$

Where N_0 is the effective primary entry cohort (from Section 1.1) and x_p is the additional number of children finishing primary due to improved learning.

Improvements in HLO reduce the dropout probability at the primary–secondary transition. We apply a dropout elasticity (θ_S) of 0.25 representing a 25% reduction in dropout probability per standard deviation increase in HLO (Cueto, León and Felipe, 2020).

The additional number of children reaching any form of secondary school is given by:

$$X_s = HLO_i{}^{\Delta} \times \theta_s \times P_s{}^{Dropout} \times N_p \quad (17)$$

Benefits would again begin to accrue prior to 2031, when the first cohort treated in 2025 completes primary school and becomes eligible to transition to secondary. For consistency across measures, however, we implement benefits starting in 2031, with the full effect applied from 2031 through 2050.

B.4.3 Youth employment

We estimate the reduction in youth unemployment associated with universal foundational learning, building on evidence that higher test scores reduce the likelihood of unemployment among young adults. Lee and Newhouse (2013), using cross-country household survey data, estimate that a one standard deviation increase in learning achievement reduces youth unemployment by 3.5–5.3 percentage points. In the absence of more recent global estimates, we adopt this parameter to translate country-specific HLO improvements into reductions in unemployment. This approach ensures consistency with prior empirical findings while providing a plausible range of impacts across settings.

For each country:

- **Youth working age population** ($Pop^{15\text{-}24}$) in 2025, from UN medium-variant projections (UN Population Division, 2024).
- **Youth employment-to-population ratio** (EtP^{youth}) in 2023, from World Bank (2025)
- **Youth unemployment rate** (U^{youth}) in 2023, from World Bank (2025).

$$LF^{youth} = Pop^{15-24} \times EtP^{youth} \quad (18)$$

The number of unemployed youth is then:

$$Unemp^{youth} = LF^{youth} \times U^{youth} \quad (19)$$

As in the school retention models, we use the standardised HLO change defined in Section B.2. The relationship between test scores and unemployment is taken from Lee and Newhouse (2013), who estimate a reduction in unemployment of 3.5–5.3 percentage points per one standard deviation increase in learning. While we modelled results for both the lower and upper bounds, we report the estimate from the midpoint of this range (4.4 percentage points) for ease of communication. This is applied as:

$$\Delta U_i = HLO_i{}^{\Delta} \times \eta \quad (20)$$

Where η = 0.044, the midpoint of the unemployment reduction

The relative decline in unemployment is:

$$Rel_i = \frac{\Delta U_i}{U_i{}^{youth}} \quad (21)$$

The absolute reduction in unemployed youth per single-year cohort (assuming ten cohorts within ages 15–24) is:

$$Unemp.Reduction_i = \frac{Unemp_i{}^{youth}}{10} \times Rel_i \quad (22)$$

For each country, the model produces annual estimates of the reduction in unemployed youth beginning in 2031, when the first treated cohorts reach age 15. Results are summed over the analytic period to report cumulative totals.

B.5. Broader Social Impacts

B.5.1. Child mortality

Foundational literacy has been shown to play an important role in reducing child mortality, largely through its impact on maternal education and the ability of mothers to access, interpret and act on health information. The most robust causal evidence comes from Kaffenberger and Pritchett (2021), who use an instrumental variables strategy across 128 Demographic and Health Surveys to isolate the effect of literacy and schooling on under-five mortality.

Their results indicate that literacy alone is associated with a 30% reduction in under-five mortality, holding schooling constant. This estimate provides the foundation for our mortality impact calculations.

Using this relationship, we apply the effect globally to examine the potential health benefits of universal foundational literacy. In this case, we do not need to map effects through HLO, since the Kaffenberger and Pritchett analysis uses the same literacy construct (although their data relate specifically to adult female literacy – more on this below).

Since the Learning Poverty database does not report gender-disaggregated data, we assume this rate applies equally to boys and girls. Universal literacy implies a country-specific percentage point increase in *child literacy*. However, the Kaffenberger and Pritchett results relate to adult female literacy. A 1:1 assumption between changes in age-10 literacy and adult literacy is an upper bound on the estimated impact since individuals who cannot read at age 10 might eventually learn to read later, even in the absence of intervention.

Evidence on the persistence of child illiteracy into adulthood in LMICs is limited. Longitudinal studies from the United Kingdom provide some guidance: in a 29-year follow-up of individuals born in 1970, 33% of those with very limited language skills at age 5 remained functionally illiterate at age 34 (Schoon et al., 2010). Similarly, a study of the 1958 British birth cohort found a correlation of 0.37 between literacy scores at ages 7 and 37 (Parsons and Bynner, 1998). These findings suggest that early illiteracy is predictive of adult illiteracy, but that substantial 'catch-up' occurs over time. In the absence of comparable evidence for LMICs, we apply conservative income-group specific assumptions: a 50% persistence rate in low- and lower-middle-income countries, 40% in upper-middle-income countries, and 30% in high-income countries. This reflects the expectation that higher-income settings offer greater opportunities for remediation, reducing the share of children who remain illiterate into adulthood.

For each country *i* the effective reduction in under-five mortality attributable to literacy is given by:

$$CMR_i = \Delta Literacy_i \times 0.30 \times c_i \quad (23)$$

Where CMR_i is the country-level reduction in child mortality, $\Delta Literacy_i$ is the increase in literacy (1 – LPV) between baseline and the universal FLN target (90% proficiency), 0.30 is the mortality reduction from Kaffenberger & Pritchett (2021), and c_i is the catch-up factor for country, *i*, based on income group.

This formulation ensures that the mortality benefits are proportionally smaller relative to literacy gains in higher-income countries, where more children are likely to 'catch up' to literacy in later schooling years even in the absence of intervention, and proportionally larger in low-income settings where early literacy deficits are more likely to persist into adulthood.

To apply the literacy–mortality effect to actual birth cohorts, we link treated children (those benefiting from universal foundational literacy at age 10) to their eventual role as mothers during the 2031–2050 period. This requires a mapping between childhood cohorts and maternal cohorts at reproductive ages.

We begin with the population of girls aged 5–9 in 2025 (UN Population Division, 2024; World Bank, 2025), which represents the first cohorts to benefit from improved foundational learning. These cohorts are tracked forward in time to align with maternal ages 15–34 in the years 2031–2050. The mapping is constructed so that, for example, a girl aged 5 in 2025 becomes a 15-year-old potential mother in 2035, and so on. This ensures that the timing of births reflects realistic demographic dynamics.

For each maternal age and year, we combine the number of treated females with age-specific fertility rates (ASFRs) by single year of age (15–34) from UN Population Division (2024). This yields an estimate of the number of live births attributable to treated mothers in each country–year of the projection horizon.

Formally, for country *i*, maternal age *a*, and year *t*:

$$Births_{iat}{}^{treated} = Female\ Pop_{iat}{}^{treated} \times ASFR_{iat} \quad (24)$$

Where $Female\ Pop_{ait}{}^{treated}$ is the projected number of women who benefited from improved foundational literacy at age 10 and are now age *a*, and $ASFR_{ait}$ is the annual probability of giving birth at age *a*. Summing across maternal ages gives the total number of births exposed to improved literacy in each year:

$$Births_{it}{}^{treated} = \sum_a Births_{iat}{}^{treated} \quad (25)$$

This cohort-based approach ensures that reductions in child mortality are only applied to births that are realistically attributable to mothers who experienced universal foundational learning in childhood as part of the simulation exercise.

Projecting U5MR and calculating averted deaths

We anchor each country's under-five mortality rate (U5MR) at the latest observation and extrapolate it forward using the country's average historical proportional change (World Bank, 2025). Let $U_{i,2023}$ denote under-five deaths per live birth in 2023 (converted from 'per 1,000 live births' to a probability). We compute the mean year-over-year proportional change $\hat{d}_i$ from the WDI time series of last two decades, and project:

$$U_{it} = U_{i,2023}(1 + \hat{d}_i)^{t-2023}, t = 2031,\ldots,2050 \quad (26)$$

We then apply the literacy-mortality effect to the treated births (mothers drawn from the improved-literacy cohorts) in each country–year. Let $Births_{it}^{treated}$ be the number of live births to mothers who benefited from universal foundational literacy (constructed via the cohort mapping and age-specific fertility rates described above). Let CMR_i be the country-specific mortality reduction factor derived from improved literacy and the income-group catch-up adjustment. Annual averted under-five deaths are:

$$CMA_{it} = Births_{it}^{treated} \times U_{it} \times CMR_i \quad (27)$$

Finally, we sum over t=2031,...,2050 to obtain the 2031–2050 cumulative averted deaths by country and in aggregate.

B.5.2. Child marriage

We estimate the reduction in child marriage prevalence associated with increased secondary school attainment under universal foundational learning.

For each country:

- **Prevalence of child marriage** (M_i), defined as the proportion of women aged 20–24 married before age 18, sourced from UNICEF (2023). Where unavailable, regional averages are used.
- **Additional secondary school entrants** (X_S), as calculated in Section B3.2.
- **Female proportion** ($Prop_f$), 50% of additional secondary entrants are assumed to be girls.

Evidence from Wodon et al., (2018) indicates that each additional year of secondary schooling reduces the probability of child marriage by 6.1 percentage points. This finding is based on 15 countries with the highest rates of child marriage, though the source report does not mention the exact countries. To convert the absolute risk reduction into a risk ratio, we identify the top 15 countries from the Girls Not Brides Child Marriage Atlas (Girls Not Brides, 2025), noting an average child marriage prevalence of ~50% in these countries. Therefore, the 6.1 percentage points reduction is translated to a risk reduction as follows:

$$rr_{mar} = \frac{0.061}{0.50} = 0.122 \quad (28)$$

This value represents a 12.2% reduction in child marriage risk per year of secondary schooling.

The number of additional years of secondary school gained by girls is expected to be in the range of 1–3 years. For purposes of this note, we estimate child marriage outcomes using the midpoint of this range (2 years). The number of child marriages averted for each country is therefore:

$$Mar_i = X_s \times Prop_f \times M_i \times Y \times rr_{mar} \quad (29)$$

Where Y= 2, the number of additional years of secondary school gained by girls

Impacts would begin to accrue around 2029, when the first cohort treated in 2025 completes primary school and becomes eligible to transition into secondary. For consistency across measures, however, we implement benefits starting in 2031, with the full effect applied from 2031 through 2050.

7 References

Angrist, N. et al. (2021) "Measuring human capital using global learning data," Nature, 592(7854), pp. 403–408. Available at: **https://doi.org/10.1038/s41586-021-03323-7**.

Angrist, N. et al. (2023) "Improving Learning in Low- and Lower-Middle-Income Countries," Journal of Benefit-Cost Analysis, pp. 1–26. Available at: **https://doi.org/10.1017/bca.2023.26**.

Azevedo, J.P. et al. (2021) Will Every Child Be Able to Read by 2030? Defining Learning Poverty and Mapping the Dimensions of the Challenge. Working Paper. Washington, DC: World Bank. Available at: **https://doi.org/10.1596/1813-9450-9588**.

Cueto, S., León, J. and Felipe, C. (2020) "Predictors of school dropout across Ethiopia, India, Peru and Vietnam," Documentos de Investigación [Preprint]. Available at: **https://ideas.repec.org//p/gad/doctra/dt109.html** (Accessed: October 3, 2025).

Gakidou, E. et al. (2010) "Increased educational attainment and its effect on child mortality in 175 countries between 1970 and 2009: a systematic analysis," The Lancet, 376(9745), pp. 959–974. Available at: **https://doi.org/10.1016/S0140-6736(10)61257-3**.

Girls Not Brides (2025) Child marriage atlas - Girls Not Brides. Available at: **https://www.girlsnotbrides.org/learning-resources/child-marriage-atlas/atlas/** (Accessed: June 13, 2025).

Glewwe, P. (1999) "Why Does Mother's Schooling Raise Child Health in Developing Countries? Evidence from Morocco," The Journal of Human Resources, 34(1), pp. 124–159. Available at: **https://doi.org/10.2307/146305**.

Glewwe, P. and Muralidharan, K. (2016) "Improving Education Outcomes in Developing Countries," in Handbook of the Economics of Education. Elsevier, pp. 653–743. Available at: **https://doi.org/10.1016/B978-0-444-63459-7.00010-5**.

Hanushek, E.A. and Woessmann, L. (2008) "The Role of Cognitive Skills in Economic Development," Journal of Economic Literature, 46(3), pp. 607–668. Available at: **https://doi.org/10.1257/jel.46.3.607**.

Hanushek, E.A. and Woessmann, L. (2012) "Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation," Journal of Economic Growth, 17(4), pp. 267–321. Available at: **https://doi.org/10.1007/s10887-012-9081-x**.

Heath, R. and Mobarak, M.A. (2015) "Manufacturing growth and the lives of Bangladeshi women," Journal of Development Economics, 115, pp. 1–15. Available at: **https://doi.org/10.1016/j.jdeveco.2015.01.006**.

ILO (2024) Global Employment Trends for Youth 2024. Decent work, brighter futures. Geneva, Switzerland: ILO. Available at: **https://www.ilo.org/sites/default/files/2024-11/GET_2024_EN_web4.pdf**.

Kaffenberger, M., Melville, S. and Agarwal, M. (2025) The benefits of foundational learning to individuals and society: A review of the evidence. What Works Hub for Global Education. Available at: . **https://doi.org/10.35489/BSGWhatWorksHubforGlobalEducation-RI_2025/003**.

Kaffenberger, M. and Pritchett, L. (2021) "Effective investment in women's futures: Schooling with learning," International Journal of Educational Development, 86, p. 102464. Available at: **https://doi.org/10.1016/j.ijedudev.2021.102464**.

Kaffenberger, M., Sobol, D. and Spindelman, D. (2023) "The role of learning in school persistence and dropout: A longitudinal mixed methods study in four countries," International Journal of Educational Research, 121, p. 102232. Available at: **https://doi.org/10.1016/j.ijer.2023.102232**.

Lee, J. and Newhouse, D. (2013) Cognitive Skills and Youth Labor Market Outcomes. World Bank.

No, F., Sam, C. and Hirakawa, Y. (2012) "Revisiting primary school dropout in rural Cambodia," Asia Pacific Education Review, 13(4), pp. 573–581. Available at: **https://doi.org/10.1007/s12564-012-9220-2**.

Parsons, J. et al. (2015) "Economic Impacts of Child Marriage: A Review of the Literature," The Review of Faith & International Affairs, 13(3), pp. 12–22. Available at: **https://doi.org/10.1080/15570274.2015.1075757**.

Riahi, K. et al. (2017) "The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview," Global Environmental Change, 42, pp. 153–168. Available at: **https://doi.org/10.1016/j.gloenvcha.2016.05.009**.

Shrestha, V. (2019) "Can Basic Maternal Literacy Skills Improve Infant Health Outcomes? Evidence from the Education Act in Nepal," Journal of Human Capital, 13(3), pp. 434–478. Available at: **https://doi.org/10.1086/704320**.

Stern, J.M.B. et al. (2024) "Persistence and Emergence of Literacy Skills: Long-Term Impacts of an Effective Early Grade Reading Intervention in South Africa," Journal of Research on Educational Effectiveness [Preprint]. Available at: **https://www.tandfonline.com/doi/abs/10.1080/19345747.2024.2417288** (Accessed: October 3, 2025).

UN Population Division (2024) "World Population Prospects." Available at: **https://population.un.org/dataportal/home**.

UNESCO (2025) "Out of School Rate." Available at: **https://education-estimates.org/out-of-school/**.

UNICEF (2023) "UNICEF Child Marriage." Available at: **https://data.unicef.org/topic/gender/child-marriage/**.

Wodon, Q. et al. (2018) Missed Opportunities: The High Cost of Not Educating Girls. Washington DC: World Bank.

World Bank (2023) The State of Global Learning Poverty 2022 Update.
Washington DC: World Bank. Available at: **https://thedocs.worldbank.org/en/doc/34035a49acb5700ce8b118aeda81a5cb-0510022023/original/TheStateOfLearningPoverty-Feb2023Update-03-08-23.pdf**.

World Bank (2025) "World Development Indicators." Available at: **https://databank.worldbank.org/source/world-development-indicators**.

World Bank and UNESCO Institute of Statistics (2022) "Learning Poverty Global Database." Available at: **https://data360.worldbank.org/en/dataset/WB_LPGD**.

Zuilkowski, S.S., Jukes, M.C.H. and Dubeck, M.M. (2016) "'I failed, no matter how hard I tried': A mixed-methods study of the role of achievement in primary school dropout in rural Kenya," International Journal of Educational Development, 50, pp. 100–107. Available at: **https://doi.org/10.1016/j.ijedudev.2016.07.002**.

What Works Hub for Global Education

www.wwhge.org
wwhge@bsg.ox.ac.uk