



What Works Hub
for Global Education

The benefits of foundational learning to individuals and society: A review of the evidence

Synthesis brief

Michelle Kaffenberger, Sarah Melville
and Madhuri Agarwal

April 2025



The benefits of foundational learning to individuals and society: A review of the evidence

Synthesis brief

Michelle Kaffenberger

University of Oxford

michelle.kaffenberger@bsg.ox.ac.uk

Sarah Melville

University of Oxford

sarah.melville@bsg.ox.ac.uk

Madhuri Agarwal

University of Oxford

madhuri.agarwal@bsg.ox.ac.uk

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.

Please cite this as:

Kaffenberger, M., Melville, S. & Agarwal, M. 2025. The benefits of foundational learning to individuals and society: a review of the evidence. What Works Hub for Global Education. Synthesis brief. 2025/003. https://doi.org/10.35489/BSG-WhatWorksHubforGlobalEducation-RI_2025/003

This work is available under the Creative Commons Attribution 4.0 International Public License, and use and dissemination is encouraged.

The findings, interpretations, and conclusions expressed in this document are those of the author(s) and do not necessarily represent those of the What Works Hub for Global Education, its funders, or the authors' respective organisations. Copyright of evidence and resources posted on What Works Hub for Global Education website remains with the author(s).

The brief was developed in partnership with the Coalition for Foundational Learning.



The benefits of foundational learning to individuals and society: A review of the evidence

Synthesis brief

Contents

- 1 | Introduction 04
- 2 | Methods and scope 06
- 3 | Learning and individual level outcomes 09
- 4 | Learning, economic growth, and other societal level outcomes 20
- 5 | Discussion 24
- 6 | References 26
- 7 | Appendix 1: Literature review matrices 34



1 | Introduction

Education is key to many desirable outcomes for both individuals and society. It plays a well-established role in economic growth, social mobility, improved health outcomes and reductions in poverty in low- and middle-income countries. For instance, women's schooling has been credited with reducing child mortality by more than 50% in recent decades (Gakidou et al. 2010). In terms of individual earnings, average returns to schooling are estimated at 7–10% per year (Psacharopoulos and Patrinos 2004; Duflo 2001; Peet, Fink, and Fawzi 2015).¹ Analysis of the returns to government expenditure, referred to as the 'Marginal Value of Public Funds', finds that investments in the education of children, particularly low-income children, achieve some of the highest returns (Hendren and Sprung-Keyser 2020).

However, most of the research on the benefits of education to individuals and society have used measures of schooling attainment as proxies for education (Lutz and Kc 2011; Mankiw, Romer, and Weil 1992; Barro and Lee 2015). If schooling always produced learning, then years of schooling could be a reasonable proxy for education in such analyses. However, in many countries learning is very low (World Bank 2018). Across 10 low- and middle-income countries, for instance, only half of women who had completed primary school had achieved basic foundational literacy (Kaffenberger and Pritchett 2021).

Using years of schooling as a proxy for education makes it impossible to determine the extent to which education creates impact through schooling attainment versus learning achievements. Furthermore, relying on schooling as a proxy for education will underestimate the potential impact of a high-quality education in contexts where learning on average is low. It is possible that **education could have even larger impacts on later outcomes than suggested by current estimates if children consistently achieved greater learning.**

Better understanding the role of learning in later outcomes is therefore critical for informing policy priorities and educational investments. This brief reviews the limited but growing evidence on learning achievements, particularly foundational learning achievements, and later individual and societal outcomes.

We find evidence of a **positive association between learning and economic growth, individual earnings, child health outcomes (particularly child mortality) and school retention and attainment.**

Moderate evidence exists of a correlation between learning and fertility decisions and individual health outcomes. Evidence on the association between learning and employment probabilities, gender-related outcomes beyond fertility such as women's empowerment,

This brief reviews the limited but growing evidence on learning achievements, particularly foundational learning achievements, and later individual and societal outcomes.

¹ Education has been shown to generate broader societal benefits as well, including reduced crime rates, improved health outcomes, and enhanced social mobility (Heckman, Stixrud, and Urzua 2006).



and higher education attainment and school enrolment remains limited, though the studies that do exist suggest positive correlations. Similarly, evidence on societal-level outcomes such as economic mobility and declines in mortality is limited but also suggests positive correlations.

Causal evidence on learning and later outcomes is limited. Much of the evidence synthesised in this brief relies on correlational analysis, with some studies using quasi-experimental approaches and one study using analysis of a randomised controlled trial. Furthermore, results from some studies are sensitive to estimation methods, and some results hold only for subsamples, particularly results related to wage returns. Findings overall paint a positive picture of the association between learning and individual and societal outcomes, but more rigorous, causal research will provide stronger estimates of the monetary and non-monetary returns to learning.



2 | Methods and scope

The main objective of this review is to take stock of the evidence and highlight the role of learning in later individual and societal outcomes. The review initially aimed to investigate the link specifically between foundational learning and later outcomes. However, due to limited research focusing on foundational learning, the review was expanded to include other measures of learning, such as cognitive skills, secondary school test scores and measures of adult learning. Box 1 describes how we define foundational learning and broader learning measures, and it includes a list of measures used in the literature and synthesised in this brief.

This brief synthesises evidence on the relationship between learning and individual (micro-level) and societal (macro-level) outcomes. At the individual level, we reviewed evidence on outcomes including wages, employment probabilities, individual health outcomes, child mortality, gender-related outcomes and schooling persistence outcomes. At the societal level, we reviewed evidence on the relationship between learning and economic growth, economic mobility and mortality rates. Table 1 provides an overview of the outcomes covered, with the number of studies identified in parentheses for each outcome.²

Table 1

Outcomes of interest for understanding the impact of learning

	Individual (Micro)	Society (Macro)
Monetary	<ul style="list-style-type: none"> • Wages (16)* • Employment (4) 	<ul style="list-style-type: none"> • GDP per capita growth rates (5) • GDP per capita (levels) (4) • Economic mobility (1)
Non-monetary	<ul style="list-style-type: none"> • Health (10): Self-reported health, mental health, substance abuse, mortality, prenatal care, child mortality • Gender-related outcomes (3): Fertility rates, women's empowerment, women's financial behaviours • Schooling (14): Probability of dropout, school attainment, school enrolment, higher education attainment 	<ul style="list-style-type: none"> • Mortality rates (1)

*Numbers in parentheses indicate number of studies.

² Additional outcomes were considered when conducting the literature search; Table 1 lists the outcomes for which evidence was found. The full list of outcomes considered when reviewing the literature is as follows: Individual (Micro) level outcomes – Wages, labour force participation, health outcomes such as child mortality and vaccination rates, gender-related outcomes such as fertility rates and women's empowerment, and schooling related outcomes such as schooling attainment, completion and tertiary attendance. Society (Macro) level outcomes – economic growth, productivity and development; social mobility, civic engagement and social cohesion.



Box 1

Measures of learning in this brief

Foundational learning includes skills and competencies that form the basis for further learning, consisting primarily of literacy and numeracy (Belafi, Hwa, and Kaffenberger 2020). Learning more broadly can be understood as the mastery and application of a range of skills, from foundational skills to higher order competencies and tasks, across various subjects and domains such as critical thinking and problem-solving.

The following measures of learning or foundational learning are used in the literature synthesised in this brief:

- Literacy indicators – demonstrating the ability to read and/or write
- Literacy tests
- Numeracy tests
- Cognitive skills tests
- Reasoning ability tests
- Vocabulary tests
- Problem-solving ability tests



We employed a semi-structured search approach to identify and synthesise relevant research. The initial phase involved conducting searches of academic databases using key words related to learning and our outcomes of interest. This was followed by citation tracing, wherein the reference lists of key papers were systematically examined. Our initial inclusion criteria prioritised studies measuring foundational learning and focused on low- and middle-income countries. Following initial searches, this was extended to studies focusing on additional measures of learning in low- and middle-income countries. Finally, the search was broadened to include select evidence from developed countries. We identified 54 studies that were included in this review. Tables A.1 and A.2 in Appendix 1 contain the lists of micro and macro studies (respectively) included in this review as well as key characteristics of the studies, such as country coverage and analytical method.

The brief is organised as follows: Section 3 discusses the evidence on learning and individual-level outcomes including economic outcomes, health outcomes, gender-related outcomes and schooling-related outcomes. Section 4 discusses the evidence on learning and societal-level outcomes including economic growth, productivity and development. Section 5 discusses the key findings and highlights the challenges and gaps in the existing literature.



3 | Learning and individual level outcomes

3.1 Evidence on learning and economic outcomes

Learning and individual wages

Table 2 summarises this evidence and is followed by a discussion of key studies. These studies are correlational in nature except for Angrist and Lavy (1997) which presents causal evidence.

Hanushek and Woessmann (2008) reviewed evidence on estimated returns to improved cognitive skills. Across six studies covering five developing countries, they found a one standard deviation increase in test scores measuring a combination of reasoning ability, mathematics and literacy skills is correlated with a 5% to 48% increase in earnings. However, these results were found to be sensitive to the estimation methodology, and many of the studies are somewhat dated.

In Kenya and Tanzania, Boissiere, Knight, and Sabot (1985) find that learning achievements have a stronger correlation with wages than secondary school completion. The authors find statistically significant wage returns to increases in reading and mathematics test scores: a one unit increase in reading and mathematics test scores is correlated with a 2% increase in wages in Kenya and a 1.3% increase in Tanzania, controlling for secondary school completion, a measure of reasoning ability, and years of experience (Boissiere, Knight, and Sabot 1985). The premium on secondary school completion is two-thirds lower and is no longer statistically significant when test scores and a measure of reasoning ability are added to the regression, indicating learning may have stronger effect than schooling completion.

Glewwe (1996) uses data from the Ghana Living Standards Survey to estimate the wage returns to human capital, measured by reading and mathematics test scores. They use both a maximum likelihood estimation (MLE) and an instrumental variable two-step procedure to account for selection bias and estimate wage returns separately for government and private sector employees. For government employees, mathematics test scores are significantly correlated with increases in earnings (of between 2.4% and 3.5%). For private sector employees, reading scores are significantly correlated with increases in earnings (of between 3% and 3.4%).³

³ Ranges include results from different estimation strategies (MLE and instrumental two-step procedure) and the inclusion of different control variables. All estimations control for a measure of innate ability (Raven test result), experience, gender and region. For the government sector employees estimations, years of schooling and several variables for holding a diploma are also included (none of these were statistically significant for the private sector employees estimation).



Table 2

Evidence on the wage returns to learning in low- and middle-income countries

Country	Study	Estimated effect	Regression controls
China	Yu et al. (2017)	1 SD increase in test scores → 12.1% increase in earnings	Age, gender, marital status, education level, BMI, years of work experience, frequency of changing jobs, hukou (Chinese household registration system)
China	Sun (2019)	1 SD increase in test scores → 7–12% increase in earnings	Age, gender, years of schooling, education level, occupation, industry, province, capital city indicator, public firm indicator
China	Glewwe, Song, and Zou (2022)	1 SD increase in test scores → 10% increase in earnings	Parental education, household wealth, years of schooling, gender, age, village fixed effects
Ghana	Glewwe (1996)	1 SD increase in test scores → 2.4–3.5% increase in earnings	Innate ability, gender, years of experience, region. For government employees only: years of schooling, holding a diploma.
Indonesia	Crawford (2024)	1 SD increase in test scores → 4–8% increase in earnings	Parental education, childhood household wealth, age, grade, sex, current completed schooling, current test scores
Mexico	Campos-Vazquez (2018)	1 SD increase in test scores → 2% increase in earnings	Gender, age, years of schooling, region, marital status, wealth index, indicator of whether parent spoke an indigenous language
Morocco	Angrist and Lavy (1997)	Moving from having some ability to having functional competence in French language → 50% increase in earnings	Age, labour market experience
Pakistan	Danon et al. (2024)	1 SD increase in test scores → USD 8.3 increase in median earnings	Age, district fixed effects, years of schooling
Pakistan	Alderman et al. (1996)	1 SD increase in test scores → 12–28% increase in earnings	Innate ability, total years of experience, years of wage experience, years of schooling, region, height, BMI
South Africa	Nikolov, Jimi, and Chang (2020)	1 SD increase in test scores → 10–14% increase in earnings	Years of schooling, experience, gender, race
South Africa	Moll (1998)	1 SD increase in test scores → 34–48% increase in earnings	Area (rural/urban), gender, experience, years of schooling, tertiary education
8 low- and middle-income countries	Chua (2017)	1 SD increase in test scores → 4.8% increase in earnings across countries	Gender, experience, years of schooling



Moll (1998) finds large estimates of the wage returns to a one standard deviation increase in literacy test results in South Africa (34% to 48%), controlling for urban/rural location, gender, experience, years of schooling and tertiary education. Alderman et al. (1996) find that a one standard deviation increase in literacy and numeracy test results is significantly correlated with a between 12% and 28% increase in monthly wages in Pakistan, controlling for a measure of ability, total and wage experience, years of schooling, region, height and BMI.

Angrist and Lavy (1997) use a difference-in-difference methodology to estimate the causal effect of a change in language instruction policy in Morocco on the wage returns to French language skills. Their two-stage least squares estimates indicate that moving from having some ability to having functional competence in French language raises monthly earnings by more than 50% (Angrist and Lavy 1997).

More recent literature points to variations in the returns to learning that may arise from different country, education system and labour market contexts.

Chua (2017) finds that literacy skills are an important determinant of earnings in a sample of twelve less-developed countries,⁴ but there is considerable heterogeneity between countries. A one standard deviation increase in literacy skills is correlated with a 14.6% increase in earnings on average across all countries in the study, with the largest returns seen in Kenya (30%) and the smallest in Ukraine (6%). The cross-country average estimate decreases substantially to 4.8% and loses its statistical significance when controlling for years of schooling, however, and the effect of years of schooling is statistically significant for both the cross-country average and individual country estimates. This suggests that in this instance, the effect of education on earnings may be driven by schooling attainment more so than literacy alone.

Ozawa et al. (2022) conducted a meta-analysis of four studies included in their systematic review and find that a one standard deviation increase in cognitive test scores is correlated with a 4.5% increase in wages. Studies included in their systematic review reach different conclusions on the statistical and economic significance of learning for wage returns, with estimates ranging from roughly 2% to 7% across different country contexts.

Sun (2019) finds that, in China, the estimated returns to exam ability (ie the ability that raises exam scores)⁵ as a measure of learning are significantly larger compared to the returns to an additional year of schooling and the returns to an education degree. Furthermore, exam ability explains more wage variation than education qualification



A one standard deviation increase in literacy and numeracy test results is significantly correlated with a between 12% and 28% increase in monthly wages in Pakistan.

⁴ The countries included in the study are those for which there is data from the STEP Skills Measurement Program surveys: Armenia, Bolivia, China, Colombia, Georgia, Ghana, Kenya, Laos, Sri Lanka, Macedonia, Ukraine and Vietnam. They are described as less-developed countries relative to the high-income countries that are included in the second dataset used in this study, the Programme for International Assessment of Adult Competencies (PIAAC).

⁵ The authors use three proxies to measure this: high school performance, high school quality and a dummy variable indicating whether or not an individual's National College Entrance exam score is missing in the data.



or years spent in school. Also in China, Yu et al. (2017) find that while cognitive ability is found to have a positive and significant correlation with wages, the correlation of non-cognitive abilities with wages is larger.

Nikolov, Jimi, and Chang (2020) find that a one standard deviation increase in an aggregate ability score (including measures of literacy and numeracy) is significantly correlated with a 10% and 14% increase in monthly earnings for an urban and rural sample of South Africans, respectively. Danon et al. (2024) link Urdu, maths and English scores of primary-school-age children to earnings in Pakistan and find that these cognitive skills are strongly, positively and significantly correlated with monthly earnings; conditional on years of schooling, a one standard deviation increase in cognitive skills is associated with a USD 8.3 increase in median monthly earnings. In Mexico, Campos-Vazquez (2018) finds that including years of schooling in the estimation model significantly reduces the returns to a one standard deviation increase in cognitive skills from 14% to 5%, and including a measure of parents' wealth further decreases the estimate to 2% and eliminates its statistical significance.

Glewwe, Huang, and Park (2017) and Glewwe, Song, and Zou (2022) estimate the wage returns to Chinese literacy and mathematics skills for primary school children in China but find contrasting results. While Glewwe, Huang, and Park (2017) find that these skills measured at ages 9–12 have no predictive power on monthly wages at ages 17–21, Glewwe, Song, and Zou (2022) find a one standard deviation increase in general cognitive skills measured at age 9–12 to be significantly correlated with a 10% increase in wages at ages 24–27 when controlling for years of schooling.⁶ The authors conduct several tests to understand possible reasons for the divergence in results; they find that the difference is explained by the time it takes for individuals to find jobs best suited for their abilities, as increases in the cognitive and literacy scores are significantly correlated with higher returns only for the subset of individuals who reported changing an employer (Glewwe, Song, and Zou 2022). Again, this finding indicates that country-specific labour market dynamics are important to consider in relation to the relationship between foundational learning and wages.⁷

Finally, Crawford (2024) finds that a one standard deviation increase in early grade literacy and numeracy test scores is significantly correlated with a 4–8% increase in wages, using longitudinal data from Indonesia. Building on this finding and Glewwe, Song, and Zou's (2022) estimate above, Crawford (2025) estimates the return on investment from USAID's spending on foundational education programmes. Crawford (2025) calculates the net present value of lifetime benefits



Lifetime benefits from these learning gains are estimated to be USD 1,000 per individual, compared with an average USAID spend of USD 34 per child, representing a benefit-cost ratio of nearly 30–1.

⁶ Estimations from both studies include controls for parental education, household wealth, years of schooling, gender, age and village fixed effects.

⁷ Relatedly, weak economies, high formal unemployment and informal labour markets in low- and middle-income countries can change the wage returns to early skills in these contexts, and weak links between learning and economic outcomes could be affected by these broader economic and labour market conditions.



from these learning gains to be USD 1,000 per individual, against an average USAID spend USD 34 per child, representing a benefit-cost ratio of nearly 30–1.⁸

There is also strong evidence supporting a positive correlation between learning and later earnings in developed countries.

Consistent estimates of the wage returns to learning are found across different time periods, models and samples in developed countries. Hanushek and Zhang (2009) find that, across 12 OECD countries, a one standard deviation increase in the International Adult Literacy Survey literacy score is correlated with an increase in annual earnings of between 5 to 15%.⁹ These estimates align with individual studies on the returns to cognitive skills in the UK and US (Currie and Thomas 2001; Murnane et al. 2000; Mulligan 1999; Lazear 2003; Neal and Johnson 1996). The measures of learning used in these studies are test scores taken at secondary or adult level that include measures of foundational skills such as literacy.

Learning and employment

Evidence on the relationship between learning and employment in low- and middle-income countries is limited but suggests a positive and significant correlation, including reduced youth unemployment.

Lee and Newhouse (2012) use data from TIMSS, PISA and a meta-dataset containing regionally focused assessments¹⁰ to understand the relationship between cognitive skills and youth unemployment. When restricting estimates to a sample of low- and middle-income countries, they find a one standard deviation increase in test scores is significantly correlated with a 4.7 to 5.7 percentage point decrease in the youth unemployment ratio. This is a similar result to those found when using the global sample and one which is robust to the inclusion of additional controls, different unemployment measures, and a broader sample of youth (Lee and Newhouse 2012).^{11,12} The authors do not further decompose the results for low-income countries, but this would be a useful area for additional analysis.

Further evidence on the relationship between learning and individual employment probabilities is primarily from the UK. It shows that a one standard deviation increase in test scores is significantly correlated with a 3% to 5.5% increase in the probability of an individual being employed when controlling for a range of variables including



A one standard deviation increase in test scores is significantly correlated with a 4.7 to 5.7 percentage point decrease in the youth unemployment ratio.

⁸ These calculations assume a 40-year working life, annual salary growth of 2%, and an 8% discount rate.

⁹ The authors control for gender, experience, and a rural dummy variable.

¹⁰ Alongside data from PISA and TIMSS, the meta-dataset includes data from regionally focused examinations such as the International Assessment of Education Progress (IAEP), the Program on the Analysis of Education Systems (PASEC), the International Assessment of Educational Progress (IEA), the Latin American Laboratory for the Evaluation of the Quality of Education (LLECE), and the Southern and Eastern Africa Consortium for Monitoring Education Quality (SACMEQ).

¹¹ The authors include controls for age, log of country GDP per capita, youth unemployment rates by gender, youth labour force participation rates by gender, the share of GDP in natural resources, the survey year, gender and a set of regional indicators.

¹² Despite these robustness checks, the authors highlight the difficulty of establishing causality for this relationship, and acknowledge the possibility of reverse causality in this instance, where improved labour market opportunities raise the returns to investment in skills and thus schooling and test scores.



educational attainment and socio-economic status (Currie and Thomas 2001; Carneiro, Crawford, and Goodman 2007; McIntosh and Vignoles 2001). This indicates a substantial relationship between measures of cognitive skills and an individual's probability of employment in the UK.

3.2 Evidence on learning and health outcomes

Learning and child mortality

In low- and middle-income countries, learning levels among adults are strongly correlated with improved child health, particularly reduced child mortality.

Multiple studies on learning and child health look at the effect of learning on child mortality (Kaffenberger and Pritchett 2021; Smith-Greenaway 2013; Shrestha 2019). Some studies further investigate whether maternal literacy specifically is a mediator between maternal education level and child health (Glewwe 1999; Khandke, Pollitt, and Gorman 1999).

Using data for more than 50 low- and middle-income countries, Kaffenberger and Pritchett (2021) find that women's acquisition of basic education (completing primary school and acquiring basic literacy) is significantly correlated with a decrease in child mortality of 67% compared to those who have not acquired basic education. Similarly, Smith-Greenaway (2013) uses cross-sectional household survey data in Nigeria and finds that, in a sample of women who did not attend secondary school, a mother's reading skill in her own language is highly and significantly correlated with a reduction in child mortality. Compared to children whose mothers cannot read at all, those whose mothers have full reading skills have a 30% lower risk of child mortality.

Shrestha (2019) uses a natural experiment to estimate the causal effect of a reform in Nepal, which increased the maternal literacy rate, on the infant mortality rate. Using a difference-in-difference approach, estimates indicate that a percentage point increase in the ability to write significantly reduces infant and under-five child mortality by 0.2 and 0.3 percentage points, respectively. To interpret these results, the author considers the improvements in maternal literacy and under-five mortality in Nepal between 1971 and 1991; their results suggest that **approximately 40% of the reduction in under-five child mortality can be explained by improvements in the literacy rate among women over this period.**

Glewwe (1999) uses data from Morocco to investigate the causal mechanism through which increased schooling is positively correlated with improved child health and nutrition. He finds that a mother's improved health knowledge is crucial for improving child health



Women's basic education (primary schooling + literacy) is significantly correlated with a decrease in child mortality of 67%.



and nutrition. While this knowledge is often obtained outside of the classroom in Morocco, the author states that it is obtained using foundational literacy and numeracy skills learned in school (Glewwe 1999).

Similarly, Khandke, Pollitt, and Gorman (1999) investigate maternal literacy as a mediator of the relationship between maternal education and various child outcomes from birth to age 7 in Guatemala (including incidence of illness, growth and performance on cognitive tests). When controlling for socio-economic status, maternal literacy significantly mediated the relationship between maternal education and respiratory illness in a mother's child at age 4, and it significantly mediated maternal education and cognitive tests of a mother's child at ages 5 and 6.

Learning and individual health outcomes

There is some evidence of a significant positive relationship between learning and individual health outcomes, though most of this evidence is from developed countries.

In ten West African countries,¹³ Taylor et al. (2016) find a significant, positive correlation between adult literacy and prenatal care, controlling for a range of variables and with region and country fixed effects.¹⁴ Their analysis uses data from the 2006 to 2010 Demographic and Health Surveys (DHS), which include data on reproductive and general health. Women who were literate had 71% higher odds of having had any prenatal care and 27% higher odds of having had adequate care compared to women who were not literate. Both results are statistically significant.

Using longitudinal data from the National Child Development Study conducted in the UK, Carneiro, Crawford, and Goodman (2007) find significant correlations between combined test results for mathematics, reading, copying and general ability (pattern recognition) at age 11 and various health outcomes. They find that a one standard deviation increase in test scores is significantly associated with a 3 percentage point (23%) decrease in the probability of reporting depression at age 42. Similarly, a one standard deviation increase in test scores is significantly associated with a 27% decrease in the probability of reporting poor or fair health rather than good or excellent health. Test scores were not significantly associated with the probabilities of smoking or having mental health problems.¹⁵



Women who were literate had 71% higher odds of having had any prenatal care and 27% higher odds of having had adequate care compared to women who were not literate.

¹³ Countries included the study are Benin, Burkina Faso, Ghana, Guinea, Liberia, Mali, Nigeria, Niger, Senegal and Sierra Leone.

¹⁴ The authors control for age, the number of children a woman has given birth to, marital status, rural/urban residence, religion, multiple births, pregnancy wantedness, and involvement in decision-making at home. Socio-economic status was not controlled for as wealth was treated as a separate independent variable, also with a strong, positive and significant association to the prenatal care measures.

¹⁵ Having mental health problems is considered separately from depression by the authors, with the former being defined as showing signs of psychological distress i.e. having a General Health Questionnaire score greater than 15, and depression being defined as having a malaise index score greater than 7.



Several additional studies find strong positive correlations between measures of learning and health outcomes. Borgonovi and Pokropek (2016) find that among OECD countries, a one standard deviation increase in literacy scores in the PIAAC assessment is associated with an increase of 0.13 in a standardised self-reported health scale. Hatch et al. (2007) found that higher childhood cognitive ability at age 8 was significantly correlated with reporting fewer symptoms of anxiety and depression in women. It was also, however, correlated with an increased risk of alcohol abuse in men and women at age 53. Finally, Bijwaard, Van Kippersluis, and Veenman (2015), using a structural equation model, find a correlation between cognitive ability at the end of primary school and lower mortality risk between ages 55 and 75 in the Netherlands.

3.3 Evidence on learning and gender-related outcomes

There is a limited body of evidence supporting associations between learning and various gender-related outcomes, including lower fertility rates and increased women's empowerment.

Kaffenberger and Pritchett (2021) use data for more than 50 low- and middle-income countries and find that achieving basic education (completing primary school and being able to read) is significantly correlated with a reduction of 1.24 births: a 37% decrease in average number of children. Alongside fertility, the authors also investigate the relationship between learning, an index of women's empowerment indicators, and an index of women's financial behaviours, which measures the use of financial products, sophistication of savings behaviours, and money management behaviours. They find that achieving basic education is significantly correlated with an increase in the women's empowerment index by 0.68 standard deviations and an increase in the financial behaviours index by 0.9 standard deviations (Kaffenberger and Pritchett 2021). These results are three times larger than the estimates of gains from years of schooling alone, indicating that literacy plays an important role in education's effect on later outcomes (Kaffenberger and Pritchett 2021).

In the US, Lou and Thomas (2015) use longitudinal survey data to understand the relationship between test scores at ages 6–14 and nonmarital teenage childbearing. A one standard deviation increase in subtest scores (passage comprehension and applied problem-solving) was significantly associated with a reduction of about 50% in the risk of experiencing a nonmarital teenage birth. This result was found only in a subgroup with relatively few behavioural problems; no evidence of this relationship was found in a sample with more pronounced behavioural problems. This suggests that early academic achievement in cognitive skills may play a protective role against nonmarital teenage childbearing, especially for children with few behavioural problems.



Similarly, Carneiro, Crawford, and Goodman (2007) look at the relationship between an average of test results for mathematics, reading, copying and general ability at age 11 and the probability of having a first child as a teenager in the UK. The authors find a significant correlation between the two, with a one standard deviation increase in test results being associated with a 4.4 percentage point decrease in the probability of having had a first child as a teenager (37%). These studies suggest that learning at early ages can have significant long-term impacts on reproductive behaviour.

Overall, these findings highlight the potential role of early learning in shaping long-term gender outcomes, particularly fertility. More research is needed to explore the relationship between early learning and other gender-related outcomes such as women's empowerment.

3.4 Evidence on learning and schooling-related outcomes

Learning and the probability of dropping out of school

Learning is significantly correlated with large decreases in the probability of dropping out of school across a range of low- and middle-income countries.

Across studies, estimates of the correlation between learning and the probability of dropping out range between a 21% to 63% decrease. Using longitudinal panel data from Ethiopia, India, Peru and Vietnam, Kaffenberger, Sobol, and Spindelman (2023) find that a one standard deviation increase in mathematics test scores is significantly associated with 50% lower odds of dropping out between ages 8 and 12 and again associated with a 50% lower odds of dropping out between ages 12 and 15. In these same countries and using the same data source, Cueto, Felipe, and León (2020) find slightly smaller estimates for an older cohort of children. In this study, a one standard deviation increase in a vocabulary test taken at age 12 is significantly associated with a 21% to 32% decrease in the risk of dropping out before the end of school across the four countries (Cueto, Felipe, and León 2020). Both sets of estimates are large in magnitude.

In Kenya, Zuilkowski, Jukes, and Dubeck (2016) find that a one standard deviation increase in literacy and numeracy test scores is significantly associated with a 40% and 17% decrease in the probability of dropping out, respectively. No, Sam, and Hirakawa (2012) find larger estimates using data collected from 11 schools in Cambodia. A one standard deviation increase in standardised test scores was significantly associated with a 51% and 61% lower dropout probability for first and fifth graders respectively, with dropout measured one year after test score data were collected. In China, Yi et al. (2012) find that a 10-percentage point improvement in mathematics test scores is significantly associated with a 1.3 percentage point decrease in



A one standard deviation increase in a vocabulary test taken at age 12 is significantly associated with a 21% to 32% decrease in the risk of dropping out before the end of school.



the likelihood of dropping out. Finally, Glewwe, Huang, and Park (2017) find a one standard deviation increase in a Chinese test score taken between age 9 and 12 is significantly associated with a 5 percentage point increase in the probability of being in school nine years later.

Learning and school attainment outcomes

There is strong evidence of a positive, significant association between learning and school attainment across low- and middle-income countries, mainly through the effect of learning on grade progression or completion.

Stern et al. (2024) establish the relationship between learning and school attainment causally, using a randomised controlled trial of an early grade literacy intervention in South Africa to examine the impact of literacy on grade progression. The authors find that students in the treatment group were 15% more likely to reach grade 7 on schedule, thus not repeating a grade, compared to students in the control group (Stern et al. 2024).

Glewwe, Huang, and Park (2017) find a one standard deviation increase in Chinese and mathematics tests taken between age 9 and 12 is significantly correlated with increases in eventual years of schooling by 0.24 and 0.2 years respectively. Kaila, Sahn, and Sunder (2024) find slightly larger estimates in Senegal and Madagascar, with a one standard deviation increase in a grade 2 composite test score being significantly correlated with an increase by 1.7 and 0.7 years in the highest grade completed in Senegal and Madagascar, respectively.

Similarly, using Young Lives data from Ethiopia, India, Pakistan, Peru and Vietnam, Das, Singh, and Yi Chang (2022) find that students with a one standard deviation higher test score at age 12 were significantly more likely to have, on average, one to two more years of schooling by age 22. They find large variation by socioeconomic status, however, with test scores explaining roughly 15% to 55% of the socioeconomic status gap in years of completed schooling at age 22. Using this same data, Lopez et al. (2024) investigate the association between four specific foundational cognitive skills domains (inhibitory control, working memory, long-term memory and implicit learning) and school attainment.¹⁶ In Ethiopia, a one standard deviation increase in working memory is significantly correlated with a 7.5% increase in the probability of completing lower secondary school.

Harbison and Hanushek (1992) find a one standard deviation increase in Portuguese test results to be significantly correlated with an increase in the probability of promotion to the next grade by between 3.75% and 6.25% for the average student in Brazil. Performance on a mathematics test did not have a strong influence on the probability of promotion.

¹⁶ These domains have been shown to form part of overall executive function, which equips children with the cognitive skills necessary to perform well and adapt in classroom environments (Lopez et al. 2024).



In Ethiopia, a one standard deviation increase in working memory is significantly correlated with a 7.5% increase in the probability of completing lower secondary school.



In terms of school completion, Glick and Sahn (2010) find that in Senegal, a one standard deviation improvement in a grade 2 pretest score is significantly correlated with a 22 percentage point increase in the probability of completing grade 6. Similarly, Nakajima, Kijima, and Otsuka (2018) find that being able to read or write at age 12 is significantly correlated with an increase in the probability of completing upper primary and upper secondary school by 1.2 and 1.5 percentage points respectively, compared to children who cannot read or write.

There is a small body of evidence focusing on the positive effect of learning on higher education attainment.

Sánchez and Singh (2018) also use Young Lives data to look at learning and higher education attainment in India, Peru and Vietnam. They find that a one standard deviation increase in vocabulary and mathematics scores at age 12 is significantly correlated with a 9.8% (vocabulary) and 6% (mathematics) increase in being enrolled in higher education in India, a roughly 4% to 6.5% increase for both tests in Peru, and a 4% to 7% increase in Vietnam. Using the same data from Peru, Lopez et al. (2024) find larger estimates, where a one standard deviation increase in foundational cognitive skills is significantly correlated with a 12.3–15.7% increase in the probability of ever enrolling in university. In this instance, the difference in estimates may arise from the different outcomes used to measure foundational learning.

Overall, there is strong evidence suggesting that improved learning is associated with increased school attainment and progression. More evidence is needed on the effect of learning on higher education attainment. The evidence is primarily correlational in nature, but it includes some causal evidence on the effect of learning on grade progression.



Overall, there is strong evidence suggesting that improved learning is associated with increased school attainment and progression.



4 Learning, economic growth, and other societal level outcomes

Learning and economic growth and productivity

Economic growth is more strongly correlated with learning than with years of schooling.

Researchers often use the concept of human capital to estimate the association between education and economic growth¹⁷ Human capital refers to the collective knowledge and skills embodied in a population. Years of schooling data are commonly used as a proxy for human capital; however, schooling without learning can weaken the correlation between human capital and economic growth (Pritchett 2013; UNESCO 2017). This disconnect makes it crucial to assess whether expanding schooling or improving education quality matters more for economic growth.

The idea of prioritising school quality for growth is not new. Solmon (1985) focuses on measures of school quality, finding a strong correlation with economic growth. However, his analysis relies on input-based measures of school quality, such as expenditures per pupil, which are not always well correlated with learning achievement. Barro (2001), on the other hand, uses direct measures of education quality, including internationally comparable tests in science, mathematics and reading, to estimate its relationship with economic growth. He finds that a one standard deviation increase in science scores is associated with an increase in per capita GDP growth rate by 1 percentage point per year, compared to only 0.2 percentage points per year for a one standard deviation rise in school attainment.

Over the past two decades, research increasingly shows that learning correlates more strongly with annual per capita GDP growth than schooling. In a seminal paper, Hanushek and Kimko (2000) use performance on international mathematics assessments to measure learning's effect on growth using an endogenous growth model for the period 1960 to 1990. Their results show that a one standard deviation increase in test scores raises real per capita GDP growth by 1.4 percentage points annually. In comparison, a one standard deviation rise in years of schooling led to only a 0.25 percentage point increase in per capita growth rates.¹⁸



Research increasingly shows that learning correlates more strongly with annual per capita GDP growth than schooling.

¹⁷ Economic growth can be measured as a change in annual GDP per capita growth rates or change in GDP per capita (levels). We discuss evidence for both these measures of economic growth.

¹⁸ The authors acknowledge how large this effect is – the growth effect of a one standard deviation increase in test scores is greater than the effect of more than nine years of average schooling, and similarly, this estimate in absolute terms is roughly the same as estimates of the average rates of technological progress between 1960 to 1990 (Hanushek and Kimko 2000). As such, while the results indicate that labour-force quality differences are important for growth, the authors acknowledge that their estimates likely overstate that causal impact, pointing to possible omitted variables in the growth equations as a potential explanation (Hanushek and Kimko 2000).



Hanushek and Woessmann (2012) expand on this study using an updated dataset covering 36 international tests from 12 testing cycles conducted between 1965 and 2003. To measure learning in their growth model they use international standardised assessments including TIMSS, PISA, and PIRLS which evaluate proficiency in mathematics, science, and reading. They find that one-standard-deviation higher test scores are associated with 2 percentage point higher annual GDP per capita growth rates, whereas years of schooling alone have a negligible effect. These findings hold across various model specifications, including instrumental variable approaches,¹⁹ longitudinal designs and controls for cultural and institutional differences, such as migration status. Their findings reinforce Hanushek and Kimko (2000), confirming a stronger association between learning and economic growth than schooling alone and economic growth.

Hanushek and Woessmann's extensive research consistently demonstrates a strong and robust correlation between learning (cognitive skills) and economic growth (Hanushek and Woessmann 2007, 2008, 2020, 2023). Other researchers have tested the robustness of this evidence by using diverse data sets, extended time periods and various model specifications. For example, Altinok and Aydemir (2017) analyse an updated dataset of cognitive skills measured through international and regional student achievement tests from 1960–2012.²⁰ Using multiple regression models, their estimates show that a one-standard-deviation improvement in cognitive skills correlates with a 1.5 percentage point increase in annual GDP per capita growth rates.

Angrist et al. (2021) use growth regressions to explore how learning outcomes relate to economic growth. They find that 1% higher learning outcomes translates to a 7.2% higher annual GDP growth rates, while schooling-based measures produce much smaller growth effects, ranging from 1.6% to 3.3%. A key contribution of their study is the introduction of the Harmonized Learning Outcomes (HLO) database, which spans 164 countries and covers 98% of the global population between 2000 and 2017, thus enabling a comprehensive analysis.

Lastly, Richards (2023), use a difference-in-differences regression to examine how learning poverty – the share of children failing to achieve basic literacy – relates to changes in per capita GDP from 2015 to 2019. The study finds that lower learning poverty rates (indicating a higher proportion of children achieving basic literacy) are more strongly associated with GDP growth than schooling



A one standard deviation increase in test scores raises real per capita GDP growth by 1.4 percentage points annually. In comparison, a one standard deviation rise in years of schooling led to only a 0.25 percentage point increase in per capita growth rates.

¹⁹ The study uses measures of the institutional structure of the school systems, for example the share of enrolment in private schools and presence of external exit exam systems, as instruments for the cognitive-skill measure

²⁰ The International student achievement tests include TIMSS, PIRLS and PISA while the regional tests are from Africa and Latin America, such as LLECE, SACMEQ or PASEC.



attainment (defined as the proportion of a cohort reaching grade 5). The regression estimates imply that a country with a learning poverty rate that is 10 percentage points lower than another is projected to have a \$200 higher per capita GDP over the 2015–2019 period.

Overall, findings from these studies reinforce that learning achievement is strongly related to economic growth. Findings further show that the association between GDP growth and learning is stronger than the correlation between GDP and schooling attainment.

Education quality accounts for significant differences in GDP per capita levels across countries.

The studies above focused on the contribution of learning to annual GDP growth rates. Another set of studies aims to quantify the contribution of human capital to GDP per capita levels.²¹

Angrist et al. (2021) use this framework to estimate the contribution of human capital, measured through schooling attainment and learning outcomes, to cross-country differences in GDP per capita. They find that human capital accounts for 20% to 50% of differences in GDP per capita across countries. Notably, they find that integrating learning outcomes into their model nearly doubles human capital's contribution to GDP compared years of schooling alone.

Schoellman (2012) applies an innovative approach to examine how education quality explains cross-country variations in GDP per worker. The study uses the returns to schooling for foreign-educated immigrants in the US as a proxy for the quality of education in their home countries. He then uses both this measure of education quality and a measure of years of schooling to estimate the contributions of each to output per worker. He finds that accounting for education quality doubles human capital's role in explaining cross-country GDP per worker differences, increasing its share to 20%. The study concludes that if the poorest countries' education quality and years of schooling are replaced with US levels, their GDP per worker could rise from 3% to 20% of the US level. Hendricks and Schoellman (2018) refine this approach by incorporating pre-migration wages using data from the New Immigrant Survey to correct for migrant selection bias. Their updated analysis suggests that human capital – when adjusted for quality of education and experience – plays an even greater role in cross-country income differences, with an estimated contribution of nearly 60%.



1% higher learning outcomes translates to a 7.2% higher annual GDP growth rates, while schooling-based measures produce much smaller growth effects, ranging from 1.6% to 3.3%.

²¹ In terms of methodologies, the first set of studies use growth regressions to estimate the relationship between learning and annual GDP growth rate. The second set uses growth accounting framework, which decomposes GDP into contributions from human capital, physical capital, and total factor productivity. This method quantifies how much each factor contributes to economic growth.



Altinok and Aydemir (2017) look at the relative importance of different skill levels for economic development and whether these patterns vary between less developed and advanced economies. They find that for high-income countries, economic growth is closely correlated with the proportion of top-performing students.²² In Sub-Saharan Africa and the Arab States, however, economic growth is more strongly associated with the share of students achieving minimum proficiency levels, highlighting the need to address basic literacy and numeracy.

Overall, these findings confirm that quality-adjusted human capital metrics are instrumental in explaining GDP per capita differences across countries.

Evidence on the associations between learning achievements and other societal level outcomes is limited.

Finally, we explore evidence on education quality and other societal level outcomes beyond economic growth, though evidence on this is very limited. Jamison, Jamison, and Hanushek (2007) analyse the correlations between education quality and income growth and mortality decline using panel data from 51 countries over 10-year intervals from 1960–2000.²³ The study finds that higher education quality significantly enhances economic growth and reduces infant mortality rates, primarily by fostering technical progress. These effects are particularly pronounced in open economies, where a one standard deviation increase in test scores is associated with a 0.6% increase in the annual rate of decline in infant mortality.

Chetty et al. (2014) examine intergenerational economic mobility in the United States, focusing on regional disparities and their underlying causes. The study finds that economic mobility varies significantly across regions, with education quality as one of the key predictors. Most importantly, education quality, measured by primary school test scores²⁴ instead of input measures like class size, are significantly correlated with upward mobility. The correlation between income-adjusted test scores and upward mobility is nearly 0.6.

²² The study defines the minimum level threshold as 400 test-score points in the adjusted international scale, while the advanced level threshold is defined as 600 points. Following these benchmarks, they find that the international median of share of students at minimum threshold is 73% and for those at the advanced threshold is 11%.

²³ Their methodology accounts for country-specific heterogeneity, with parameter estimation through maximum likelihood methods.

²⁴ The study uses average math and English test scores for grades 3–8 from the Global Report Card. This data converts statewide test scores into a national scale by comparing them to National Assessment of Educational Progress (NAEP) scores.



5 | Discussion

This review has shown that it is not just schooling, but the learning achieved through schooling, that is associated with later outcomes including at both the individual and societal level. Learning is associated with increased individual earnings and broader economic growth. Indeed, studies suggest nearly all of the association between education and growth is through cognitive skills rather than schooling attainment. Associations have also been found between learning achievements and reductions in child mortality, increased women's empowerment, reduced school dropout and more. Prioritising learning is therefore essential to deliver on education's promise for individuals and society (World Bank 2018).

To realise these potential benefits, governments will need to invest in cost-effective, scalable policies to ensure schooling leads to learning. Fortunately, in recent decades innovative programmes for improving foundational learning have been identified with proven success (Akyeampong et al. 2023; Glewwe and Muralidharan 2016; Kremer, Brannen, and Glennerster 2013). For example, strong evidence supports strategies such as targeting instruction to students' learning levels (eg 'Teaching at the Right Level' and other differentiated instruction approaches) and structured pedagogy (ie high quality, integrated lesson plans, student materials, teacher training and support, and monitoring) as cost-effective ways to improve outcomes (Angrist et al. 2025).

However, knowing what works is not enough on its own. A key challenge is to ensure successful programmes are adapted and implemented in different contexts at scale. There exist large gaps between policy and practice (Angrist and Dercon 2024). To achieve the goal of universal foundational literacy and numeracy we need not only evidence for what works but also a strong focus on measuring and supporting effective implementation. Implementation research in education can bridge the gap between evidence, policy and practice, enabling large-scale impact.

This review also revealed gaps in the current literature. More research is needed on the relationship between learning and outcomes at the individual level, such as gender-related outcomes and employment probabilities, and outcomes at the societal level, such as reducing crime, fostering social cohesion and civic engagement, addressing the climate crisis and improving democracy. Such findings can help inform government spending and educational investment decisions. Furthermore, interpretation and synthesis of the evidence would be more useful if learning measures



Studies suggest nearly all of the association between education and growth is through cognitive skills rather than schooling attainment.



focused on proficiencies and competencies rather than standard deviations, given the wide variation in a standard deviation of learning both within and across country contexts.

The evidence in this brief suggests the returns to education are much larger when children are learning than when they are not. It also shows that the outcomes associated with learning are multifaceted, spanning wages and GDP growth, as well as health improvements and increases in schooling attainment. Learning-oriented policies can, therefore, contribute to both educational goals and to the achievement of countries' broader development goals.



6 | References

- Akyeampong, K, T Andrabi, A Banerjee, R Banerji, S Dynarski, R Glennerster, S Grantham-McGregor, et al. 2023. 'Cost-Effective Approaches to Improve Global Learning - What Does Recent Evidence Tell Us Are "Smart Buys" for Improving Learning in Low- and Middle-Income Countries?' Recommendations of the Global Education Evidence Advisory Panel (GEEAP). London, Washington D.C., New York: FCDO, the World Bank, UNICEF, and USAID. <https://thedocs.worldbank.org/en/doc/231d98251cf326922518be0cbe306fdc-0200022023/related/GEEAP-Report-Smart-Buys-2023-final.pdf>.
- Alderman, Harold, Jere R. Behrman, David R. Ross, and Richard Sabot. 1996. 'The Returns to Endogenous Human Capital in Pakistan's Rural Wage Labour Market'. *Oxford Bulletin of Economics and Statistics* 58 (1): 29–55. <https://doi.org/10.1111/j.1468-0084.1996.mp58001003.x>.
- Altinok, Nadir, and Abdurrahman Aydemir. 2017. 'Does One Size Fit All? The Impact of Cognitive Skills on Economic Growth'. *Journal of Macroeconomics* 53 (September):176–90. <https://doi.org/10.1016/j.jmacro.2017.06.007>.
- Angrist, Joshua D., and Victor Lavy. 1997. 'The Effect of a Change in Language of Instruction on the Returns to Schooling in Morocco'. *Journal of Labor Economics* 15 (1, Part 2): S48–76. <https://doi.org/10.1086/209856>.
- Angrist, Noam, and Stefan Dercon. 2024. 'Mind the Gap between Education Policy and Practice'. *Nature Human Behaviour* 8 (12): 2261–63. <https://doi.org/10.1038/s41562-024-02013-4>.
- Angrist, Noam, Simeon Djankov, Pinelopi K. Goldberg, and Harry A. Patrinos. 2021. 'Measuring Human Capital Using Global Learning Data'. *Nature* 592 (7854): 403–8. <https://doi.org/10.1038/s41586-021-03323-7>.
- Angrist, Noam, David K. Evans, Deon Filmer, Rachel Glennerster, Halsey Rogers, and Shwetlena Sabarwal. 2025. 'How to Improve Education Outcomes Most Efficiently? A Review of the Evidence Using a Unified Metric'. *Journal of Development Economics* 172 (January):103382. <https://doi.org/10.1016/j.jdeveco.2024.103382>.
- Barro, Robert J. 2001. 'Human Capital and Growth'. *The American Economic Review* 91 (2): 12–17.
- Barro, Robert J., and Jong-Wha Lee. 2015a. *Education Matters: Global Schooling Gains from the 19th to the 21st Century*. Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199379231.001.0001>.
- . 2015b. *Education Matters: Global Schooling Gains from the 19th to the 21st Century*. Education Matters: Global Schooling Gains from the 19th to the 21st Century. New York, NY, US: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199379231.001.0001>.



Belafi, Carmen, Yue-Yi Hwa, and Michelle Kaffenberger. 2020. 'Building on Solid Foundations: Prioritising Universal, Early, Conceptual and Procedural Mastery of Foundational Skills'. Research on Improving Systems of Education (RISE). https://doi.org/10.35489/BSG-RISE-RI_2020/021.

Bijwaard, Govert E., Hans Van Kippersluis, and Justus Veenman. 2015. 'Education and Health: The Role of Cognitive Ability'. *Journal of Health Economics* 42 (July):29–43. <https://doi.org/10.1016/j.jhealeco.2015.03.003>.

Boissiere, M., J.B. Knight, and R.H. Sabot. 1985. 'Earnings, Schooling, Ability, and Cognitive Skills'. *The American Economic Review* 75 (5): 1016–30.

Borgonovi, Francesca, and Artur Pokropek. 2016. 'Education and Self-Reported Health: Evidence from 23 Countries on the Role of Years of Schooling, Cognitive Skills and Social Capital'. Edited by Joshua L Rosenbloom. *PLOS ONE* 11 (2): e0149716. <https://doi.org/10.1371/journal.pone.0149716>.

Campos-Vazquez, Raymundo M. 2018. 'Returns to Cognitive and Non-Cognitive Skills: Evidence for Mexico'. *Applied Economics Letters* 25 (16): 1153–56. <https://doi.org/10.1080/13504851.2017.1403551>.

Carneiro, Pedro, Claire Crawford, and Alissa Goodman. 2007. 'The Impact of Early Cognitive and Non-Cognitive Skills on Later Outcomes'. Centre for the Economics of Education.

Chetty, Raj, Nathaniel Hendren, Patrick Kline, and Emmanuel Saez. 2014. 'Where Is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States *'. *The Quarterly Journal of Economics* 129 (4): 1553–1623. <https://doi.org/10.1093/qje/qju022>.

Chua, Kenn. 2017. 'Skill Achievement and Returns in Developing Countries: Evidence from Adult Skills Surveys'. *European Journal of Education* 52 (4): 498–510. <https://doi.org/10.1111/ejed.12236>.

Crawford, Lee. 2024. 'The Economic Returns to Foundational Literacy and Numeracy: Evidence from Indonesia'. In . Oxford, United Kingdom. <https://custom.cvent.com/4E741122FD8B4A1B97E483EC8BB51CC4/files/event/334d210869f54ae4b976ced08c757224/c9dc256cb17a497db6d83e8f353e6c05.pdf>.

———. 2025. 'Center For Global Development'. Why the US Should Keep Funding Global Education (blog). 2025. <https://www.cgdev.org/blog/why-us-should-keep-funding-global-education>.

Cueto, Santiago, Claudia Felipe, and Juan León. 2020. Predictors of School Dropout across Ethiopia, India, Peru and Vietnam. First edition. Documentos de Investigación / Grupo de Análisis Para El Desarrollo (GRADE) Educación y Aprendizajes 109. Lima: Grupo de Análisis para el Desarrollo (GRADE).



- Currie, Janet, and Duncan Thomas. 2001. 'Early Test Scores, School Quality and SES: Longrun Effects on Wage and Employment Outcomes'. *Worker Wellbeing in a Changing Labor Market* 20:103–32.
- Danon, Alice, Jishnu Das, Andreas De Barros, and Deon Filmer. 2024. 'Cognitive and Socioemotional Skills in Low-Income Countries: Measurement and Associations with Schooling and Earnings'. *Journal of Development Economics* 168 (May):103132. <https://doi.org/10.1016/j.jdeveco.2023.103132>.
- Das, Jishnu, Abhijeet Singh, and Andres Yi Chang. 2022. 'Test Scores and Educational Opportunities: Panel Evidence from Five Low- and Middle-Income Countries'. *Journal of Public Economics* 206 (February):104570. <https://doi.org/10.1016/j.jpubeco.2021.104570>.
- Duflo, Esther. 2001. 'Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment'. *The American Economic Review* 91 (4): 795–813.
- Gakidou, Emmanuela, Krycia Cowling, Rafael Lozano, and Christopher J. L. Murray. 2010. 'Increased Educational Attainment and Its Effect on Child Mortality in 175 Countries between 1970 and 2009: A Systematic Analysis'. *Lancet (London, England)* 376 (9745): 959–74. [https://doi.org/10.1016/S0140-6736\(10\)61257-3](https://doi.org/10.1016/S0140-6736(10)61257-3).
- Glewwe, P., and K. Muralidharan. 2016. 'Improving Education Outcomes in Developing Countries'. In *Handbook of the Economics of Education*, 5:653–743. Elsevier. <https://doi.org/10.1016/B978-0-444-63459-7.00010-5>.
- Glewwe, Paul. 1996. 'The Relevance of Standard Estimates of Rates of Return to Schooling for Education Policy: A Critical Assessment'. *Journal of Development Economics* 51:267–90.
- . 1999. 'Why Does Mother's Schooling Raise Child Health in Developing Countries? Evidence from Morocco'. *The Journal of Human Resources* 34 (1): 124. <https://doi.org/10.2307/146305>.
- Glewwe, Paul, Qiuqiong Huang, and Albert Park. 2017. 'Cognitive Skills, Noncognitive Skills, and School-to-Work Transitions in Rural China'. *Journal of Economic Behavior & Organization* 134 (February):141–64. <https://doi.org/10.1016/j.jebo.2016.12.009>.
- Glewwe, Paul, Yang Song, and Xianqiang Zou. 2022. 'Labor Market Outcomes, Cognitive Skills, and Noncognitive Skills in Rural China'. *Journal of Economic Behavior & Organization* 193 (January):294–311. <https://doi.org/10.1016/j.jebo.2021.11.021>.
- Glick, Peter, and David E. Sahn. 2010. 'Early Academic Performance, Grade Repetition, and School Attainment in Senegal: A Panel Data Analysis'. *The World Bank Economic Review* 24 (1): 93–120. <https://doi.org/10.1093/wber/lhp023>.



- Goldin, Claudia, and Lawrence F. Katz. 2018. 'The Race between Education and Technology'. In *Inequality in the 21st Century*, 49–54. Routledge. <https://www.taylorfrancis.com/chapters/edit/10.4324/9780429499821-10/race-education-technology-claudia-goldin-lawrence-katz>.
- Hanushek, E., and L. Woessmann. 2007. 'The Role of Education Quality in Economic Growth (World Bank Policy Research No. 4122)'. WP.: World Bank.
- Hanushek, Eric A., and Dennis D. Kimko. 2000a. 'Schooling, Labor-Force Quality, and the Growth of Nations'. *American Economic Review* 90 (5): 1184–1208.
- Hanushek, Eric A, and Dennis D Kimko. 2000b. 'Schooling, Labor-Force Quality, and the Growth of Nations'. *American Economic Review* 90 (5): 1184–1208. <https://doi.org/10.1257/aer.90.5.1184>.
- Hanushek, Eric A, and Ludger Woessmann. 2008a. 'The Role of Cognitive Skills in Economic Development'. *Journal of Economic Literature* 46 (3): 607–68. <https://doi.org/10.1257/jel.46.3.607>.
- Hanushek, Eric A., and Ludger Woessmann. 2008b. 'The Role of Cognitive Skills in Economic Development'. *Journal of Economic Literature* 46 (3): 607–68.
- . 2012. 'Do Better Schools Lead to More Growth? Cognitive Skills, Economic Outcomes, and Causation'. *Journal of Economic Growth* 17 (4): 267–321. <https://doi.org/10.1007/s10887-012-9081-x>.
- . 2020. 'Education, Knowledge Capital, and Economic Growth'. In *The Economics of Education*, 171–82. Elsevier. <https://doi.org/10.1016/B978-0-12-815391-8.00014-8>.
- Hanushek, Eric A, and Ludger Woessmann. 2023. *The Knowledge Capital of Nations: Education and the Economics of Growth*. MIT press.
- Hanushek, Eric A., and Lei Zhang. 2009. 'Quality-Consistent Estimates of International Schooling and Skill Gradients'. *Journal of Human Capital* 3 (2): 107–43. <https://doi.org/10.1086/644780>.
- Harbison, Ralph W., and Eric A. Hanushek. 1992. *Educational Performance of the Poor: Lessons from Rural Northeast Brazil*. New York: Oxford University Press.
- Hatch, Stephani L., Peter B. Jones, Diana Kuh, Rebecca Hardy, Michael E.J. Wadsworth, and Marcus Richards. 2007. 'Childhood Cognitive Ability and Adult Mental Health in the British 1946 Birth Cohort'. *Social Science & Medicine* 64 (11): 2285–96. <https://doi.org/10.1016/j.socscimed.2007.02.027>.
- Heckman, James J, Jora Stixrud, and Sergio Urzua. 2006. 'The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior'. *Journal of Labour Economics* 24 (3).



Hendren, Nathaniel, and Ben Sprung-Keyser. 2020. 'A Unified Welfare Analysis of Government Policies*'. *The Quarterly Journal of Economics* 135 (3): 1209–1318. <https://doi.org/10.1093/qje/qjaa006>.

Hendricks, Lutz, and Todd Schoellman. 2018. 'Human Capital and Development Accounting: New Evidence from Wage Gains at Migration*'. *The Quarterly Journal of Economics* 133 (2): 665–700. <https://doi.org/10.1093/qje/qjx047>.

Jamison, Eliot A., Dean T. Jamison, and Eric A. Hanushek. 2007. 'The Effects of Education Quality on Income Growth and Mortality Decline'. *Economics of Education Review* 26 (6): 771–88.

Kaffenberger, Michelle, and Lant Pritchett. 2021. 'Effective Investment in Women's Futures: Schooling with Learning'. *International Journal of Educational Development* 86 (October):102464. <https://doi.org/10.1016/j.ijedudev.2021.102464>.

Kaffenberger, Michelle, Danielle Sobol, and Debi Spindelman. 2023. 'The Role of Learning in School Persistence and Dropout: A Longitudinal Mixed Methods Study in Four Countries'. *International Journal of Educational Research* 121:102232. <https://doi.org/10.1016/j.ijer.2023.102232>.

Kaila, Heidi, David E Sahn, and Naveen Sunder. 2024. 'Starting Strong: Investigating the Importance of Early Academic Performance for Adult Human Capital'. *Journal of African Economies* 33 (4): 343–67. <https://doi.org/10.1093/jae/ejad018>.

Khandke, Veena, Ernesto Pollitt, and Kathleen S Gorman. 1999. 'The Role of Maternal Literacy in Child Health and Cognitive Development in Rural Guatemala'. Educational Resources Information Center.

Kremer, Michael, Conner Brannen, and Rachel Glennerster. 2013. 'The Challenge of Education and Learning in the Developing World'. *Science* 340 (6130): 297–300. <https://doi.org/10.1126/science.1235350>.

Lazear, Edward P. 2003. 'Teacher Incentives'. *Swedish Economic Policy Review* 10:179–214.

Lee, Jean N, and David Newhouse. 2012. 'Cognitive Skills and Youth Labor Market Outcomes'. World Bank Human Development Network.

Lopez, Jennifer, Jere Behrman, Santiago Cueto, Marta Favara, and Alan Sánchez. 2024. 'Late-Childhood Foundational Cognitive Skills Predict Educational Outcomes through Adolescence and into Young Adulthood: Evidence from Ethiopia and Peru'. *Economics of Education Review* 100 (June):102543. <https://doi.org/10.1016/j.econedurev.2024.102543>.

Lou, Cary, and Adam Thomas. 2015. 'The Relationship Between Academic Achievement And Nonmarital Teenage Childbearing: Evidence from the Panel Study of Income Dynamics'. *Perspectives on Sexual and Reproductive Health* 47 (2): 91–98. <https://doi.org/10.1363/47e2115>.



Lutz, Wolfgang, and Samir Kc. 2011a. 'Global Human Capital: Integrating Education and Population'. *Science* 333 (6042): 587–92.

<https://doi.org/10.1126/science.1206964>.

———. 2011b. 'Global Human Capital: Integrating Education and Population'. *Science (New York, N.Y.)* 333 (6042): 587–92. <https://doi.org/10.1126/science.1206964>.

Mankiw, N. Gregory, David Romer, and David N. Weil. 1992a. 'A Contribution to the Empirics of Economic Growth'. *The Quarterly Journal of Economics* 107 (2): 407–37.

Mankiw, N Gregory, David Romer, and David N Weil. 1992b. 'A Contribution to the Empirics of Economic Growth'. *Quarterly Journal of Economics* 107:407–37.

McIntosh, S., and A. Vignoles. 2001. 'Measuring and Assessing the Impact of Basic Skills on Labour Market Outcomes'. *Centre for the Economics of Education* 53 (3): 453–81. <https://doi.org/10.1093/oep/53.3.453>.

Moll, Peter G. 1998. 'Primary Schooling, Cognitive Skills and Wages in South Africa'. *Economica* 65 (258): 263–84. <https://doi.org/10.1111/1468-0335.00127>.

Mulligan, Casey B. 1999. 'Galton versus the Human Capital Approach to Inheritance'. *Journal of Political Economy* 107 (S6): S184–224. <https://doi.org/10.1086/250108>.

Murnane, Richard J., John B. Willett, Yves Duhaldeborde, and John H. Tyler. 2000. 'How Important Are the Cognitive Skills of Teenagers in Predicting Subsequent Earnings?' *Journal of Policy Analysis and Management* 19 (4): 547–68. [https://doi.org/10.1002/1520-6688\(200023\)19:4<547::AID-PAM2>3.0.CO;2-#](https://doi.org/10.1002/1520-6688(200023)19:4<547::AID-PAM2>3.0.CO;2-#).

Nakajima, Maki, Yoko Kijima, and Keiji Otsuka. 2018. 'Is the Learning Crisis Responsible for School Dropout? A Longitudinal Study of Andhra Pradesh, India'. *International Journal of Educational Development* 62 (September):245–53. <https://doi.org/10.1016/j.ijedudev.2018.05.006>.

Neal, Derek A., and William R. Johnson. 1996. 'The Role of Pre-market Factors in Black-White Wage Differences'. *Journal of Political Economy* 104 (5): 869–95.

Nikolov, Plamen, Nusrat Jimi, and Jerray Chang. 2020. 'The Importance of Cognitive Domains and the Returns to Schooling in South Africa: Evidence from Two Labor Surveys'. *Labour Economics* 65 (August):101849. <https://doi.org/10.1016/j.labeco.2020.101849>.

No, Fata, Chanphirun Sam, and Yukiko Hirakawa. 2012. 'Revisiting Primary School Dropout in Rural Cambodia'. *Asia Pacific Education Review* 13 (4): 573–81. <https://doi.org/10.1007/s12564-012-9220-2>.

'Oye, Pritchett and Sandefur (2016)'. n.d.



Ozawa, Sachiko, Sarah K. Laing, Colleen R. Higgins, Tatenda T. Yemeke, Christine C. Park, Rebecca Carlson, Young Eun Ko, L. Beryl Guterman, and Saad B. Omer. 2022. 'Educational and Economic Returns to Cognitive Ability in Low- and Middle-Income Countries: A Systematic Review'. *World Development* 149 (January):105668. <https://doi.org/10.1016/j.worlddev.2021.105668>.

Peet, Evan D., Günther Fink, and Wafaie Fawzi. 2015. 'Returns to Education in Developing Countries: Evidence from the Living Standards and Measurement Study Surveys'. *Economics of Education Review* 49 (C): 69–90.

Pritchett, Lant. 2013. *The Rebirth of Education: Schooling Ain't Learning*. CGD Books.

Psacharopoulos, George, and Harry Anthony Patrinos. 2004. 'Returns to Investment in Education: A Further Update'. *Education Economics* 12 (2): 111–34. <https://doi.org/10.1080/0964529042000239140>.

Richards, John. 2023. "'Schooling without Learning Is a Terrible Waste of Precious Resources and of Human Potential" – The South Asian Paradox'. *International Journal of Educational Development* 103 (November):102904. <https://doi.org/10.1016/j.ijedudev.2023.102904>.

Sánchez, Alan, and Abhijeet Singh. 2018. 'Accessing Higher Education in Developing Countries: Panel Data Analysis from India, Peru, and Vietnam'. *World Development* 109 (September):261–78. <https://doi.org/10.1016/j.worlddev.2018.04.015>.

Schoellman, Todd. 2012. 'Education Quality and Development Accounting'. *The Review of Economic Studies* 79 (1): 388–417.

Shrestha, Vinish. 2019. 'Can Basic Maternal Literacy Skills Improve Infant Health Outcomes? Evidence from the Education Act in Nepal'. *Journal of Human Capital* 13 (3): 434–78. <https://doi.org/10.1086/704320>.

Smith–Greenaway, Emily. 2013. 'Maternal Reading Skills and Child Mortality in Nigeria: A Reassessment of Why Education Matters'. *Demography* 50 (5): 1551–61. <https://doi.org/10.1007/s13524-013-0209-1>.

Solmon, Lewis C. 1985. 'Quality of Education and Economic Growth'. *Economics of Education Review* 4 (4): 273–90.

Stern, Jonathan M. B., Matthew C. H. Jukes, Jacobus Cilliers, Brahm Fleisch, Stephen Taylor, and Nompumelelo Mohohlwane. 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*, November, 1–22. <https://doi.org/10.1080/19345747.2024.2417288>.

Sun, Qian. 2019. 'Estimating the Earnings Returns to Exam-Measured Unobserved Ability in China's Urban Labor Market: Evidence for 2002–2013'. *China Economic Review* 53 (February):180–90. <https://doi.org/10.1016/j.chieco.2018.08.012>.



Taylor, Yhenneko J., Sarah B. Laditka, James N. Laditka, Larissa R. Brunner Huber, and Elizabeth F. Racine. 2016. 'Associations of Household Wealth and Individual Literacy with Prenatal Care in Ten West African Countries'. *Maternal and Child Health Journal* 20 (11): 2402–10. <https://doi.org/10.1007/s10995-016-2068-z>.

UNESCO. 2017. 'More Than One-Half of Children and Adolescents Are Not Learning Worldwide. UIS Fact Sheet No. 46'. 2017. <http://uis.unesco.org/sites/default/files/documents/fs46-more-than-half-children-not-learning-en-2017.pdf>.

World Bank. 2018. 'World Development Report 2018: Learning to Realize Education's Promise'. Washington, DC: World Bank. <https://openknowledge.worldbank.org/bitstream/handle/10986/28340/9781464810961.pdf>.

Yi, Hongmei, Linxiu Zhang, Renfu Luo, Yaojiang Shi, Di Mo, Xinxin Chen, Carl Brinton, and Scott Rozelle. 2012. 'Dropping out: Why Are Students Leaving Junior High in China's Poor Rural Areas?' *International Journal of Educational Development* 32 (4): 555–63. <https://doi.org/10.1016/j.ijedudev.2011.09.002>.

Yu, Fan, Chu Wang, Jun Shen, Yuxuan Shi, and Tang Li. 2017. 'Effect of Cognitive Abilities and Non-Cognitive Abilities on Labor Wages: Empirical Evidence from the Chinese Employer-Employee Survey'. *China Economic Journal* 10 (1): 76–89. <https://doi.org/10.1080/17538963.2016.1274005>.

Zuilkowski, Stephanie Simmons, Matthew C.H. Jukes, and Margaret M. Dubeck. 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 (September):100–107. <https://doi.org/10.1016/j.ijedudev.2016.07.002>.



Appendix 1 | Literature review matrices

Table A1

Literature review matrix: Micro evidence with main findings, learning measures and method of analysis

Study number	Reference	Outcome	Effect Size	Learning Measure	Method of Analysis	Country/Region
1	Alderman et al. (1996)	Earnings	1 SD increase in test scores → 12-28% increase in earnings	Literacy and numeracy test results	Regression analysis and instrumental variable estimation	Pakistan
2	Angrist and Lavy (1997)	Earnings	Moving from having some ability to having functional competence in French language → 50% increase in earnings	French language skills	Difference-in-difference	Morocco
3	Bijwaard, Van Kippersluis and Veenman (2015)	Adult mortality	1 SD increase in cognitive ability → 18% decrease in mortality hazard for those with primary school and 28% decrease for those with secondary school	Cognitive skills and vocabulary test scores	Structural equation model	UK
4	Boissiere, Knight and Sabot (1985)	Earnings	1 unit increase in test scores → 2% increase in earnings in Kenya and 1.3% increase in earnings in Tanzania	Literacy and numeracy test scores	Regression analysis	Kenya, Tanzania
5	Borgonovi and Pokropek (2016)	Self-reported health	1 SD increase in literacy scores → 0.13 increase in a standardised self-reported health scale.	Literacy assessments	Regression analysis	OECD countries
6	Campos-Vazquez (2018)	Earnings	1 SD increase in test scores → 2% increase in earnings with controls	Cognitive skills test scores	Regression analysis	Mexico
7.1	Carneiro, Crawford and Goodman (2007)	Teenage pregnancy	1 SD increase in test scores → 37% decrease in the probability of having had a first child as a teenager	Cognitive skills test scores	Regression analysis	UK
7.2	Carneiro, Crawford and Goodman (2007)	Self-reported health; Mental health	1 SD increase in test scores → 23% decrease in the probability of reporting experiencing depression and a 27% decrease in the probability of reporting poor or fair health rather than good or excellent health	Cognitive skills test scores	Regression analysis	UK
7.3	Carneiro, Crawford and Goodman (2007)	Employment probability	1 SD increase in cognitive skills → 5.7% increase in probability of employment	Cognitive skills test scores	Regression analysis	UK
8	Chua (2017)	Earnings	1 SD increase in literacy skills → 14.6% average increase in earnings across countries	Literacy skills	Regression analysis	Low- and middle-income countries
9	Crawford (2024)	Earnings	1 SD increase in foundational skills → 4-8% increase in earnings	Literacy and numeracy test scores	Regression analysis	Indonesia
10	Cueto, Felipe and Leon (2020)	School dropout probability	1 SD increase in test scores → 21-32% decrease in risk of dropping out before end of school	Cognitive skills test scores	Regression analysis	Ethiopia, India, Peru, Vietnam
11	Currie and Thomas (2001)	Employment probability	1 SD increase in test scores → 3% increase in employment probability	Reading and mathematics test scores	Regression analysis	UK
12	Danon et al. (2024)	Earnings	1 SD increase in test scores → USD 8.3 increase in median earnings	Cognitive skills test scores	Regression analysis	Pakistan
13	Das, Singh and Yi Chang (2022)	School attainment	1 SD increase in test scores → 1-2 more years of schooling by age 22	Test scores	Regression analysis	Ethiopia, India, Pakistan, Peru and Vietnam



Study number	Reference	Outcome	Effect Size	Learning Measure	Method of Analysis	Country/Region
14	Glewwe (1996)	Earnings	1 unit increase in maths/reading test scores → 2.4–3.5% increase in earnings	Mathematics and English test scores	Maximum-Likelihood Estimation; Two-stage procedure	Ghana
15	Glewwe (1999)	Child health (height for age Z-score)	1 point increase in health knowledge → 2.02 point increase in height for age Z-score	Mother's Arabic and mathematics skills	Regression analysis; Instrumental variable estimation	Morocco
16.1	Glewwe, Huang and Park (2017)	Dropout	1 SD increase in test scores → 5 p.p. increase in the probability of being in school 9 years later	Chinese, mathematics and literacy achievement tests	Regression analysis	China
16.2	Glewwe, Huang and Park (2017)	School attainment	1 SD increase in test scores → 0.2–0.24 increase in eventual years of schooling	Chinese, mathematics and literacy achievement tests	Regression analysis	China
17	Glewwe, Song and Zou (2022)	Earnings	1 SD increase in test scores → 10% increase in earnings	Cognitive skills and literacy test scores	Regression analysis	China
18	Glick and Sahn (2010)	School attainment	1 SD increase in test scores → 22 p.p. increase in the probability of completing sixth grade	Test scores	Regression analysis	Senegal
19	Hanushek and Woessmann (2008)	Earnings	1 SD increase in test scores → 5–48% increase in earnings	N/A	Literature review	Global
20	Hanushek and Zhang (2009)	Earnings	1 SD increase in test scores → 5–15% increase in earnings	Literacy test scores	Regression analysis	OECD countries
21	Harbison and Hanushek (1992)	Promotion probability; School dropout probability	1 SD increase in test scores → 3.75–6.25% increase in the probability of being promoted to the next grade	Portuguese and mathematics test scores	Regression analysis	Brazil
22	Hatch et al. (2007)	Mental health; Substance abuse	1 point increase in childhood cognitive ability → 0.29 point decrease in mental health score and a 4% increase in the risk of screening positive for alcohol abuse	Literacy test scores	Regression analysis	UK
23.1	Kaffenberger and Pritchett (2021)	Child mortality	Acquiring basic education compared to not → 67% decrease in child mortality	Mother's literacy test results (ability to read)	Regression analysis and instrumental variable estimation	50 low- and middle-income countries
23.2	Kaffenberger and Pritchett (2021)	Fertility	Acquiring basic education compared to not → 1.24 decrease in births and 37% decrease in average number of children	Literacy test scores (ability to read)	Regression analysis and instrumental variable estimation	50 low- and middle-income countries
23.3	Kaffenberger and Pritchett (2021)	Index of women's empowerment; Index of women's financial behaviours	Acquiring basic education compared to not → 0.68 SD increase in women's empowerment index and 0.9 SD increase in financial behaviours index	Literacy test scores (ability to read)	Regression analysis and instrumental variable estimation	50 low- and middle-income countries
24	Kaffenberger, Sobol and Spindelman (2023)	School dropout probability	1 SD increase in test scores → 50% lower odds of dropping out between ages 12–15	Mathematics test scores	Regression analysis	Ethiopia, India, Peru and Vietnam
25	Kaila, Sahn and Sunder (2024)	School attainment	1 SD increase in test scores → 1.7 year increase in highest grade completed in Senegal and 0.7 years in Madagascar.	Mathematics and French test scores	Regression analysis	Senegal and Madagascar
26	Khandke, Pollitt and Gorman (1999)	Child health	1 point increase in the maternal literacy score → 3.7 percentage point decrease in respiratory illness	Mother's literacy	Regression analysis	Guatemala
27	Lee and Newhouse (2012)	Youth unemployment ratio	1 SD increase in test scores → 3–5 p.p. decrease in youth unemployment ratio	International test scores	Regression analysis	Global
28.1	Lopez et al. (2024)	Lower secondary school completion	1 SD increase in test scores → 7.5% increase in probability of completing lower secondary school	Foundational cognitive skills	Regression analysis	Ethiopia
28.2	Lopez et al. (2024)	University enrolment	1 SD increase in test scores → 12.3–15.7% increase in probability of ever enrolling in university	Foundational cognitive skills	Regression analysis	Peru



Study number	Reference	Outcome	Effect Size	Learning Measure	Method of Analysis	Country/Region
29	Lou and Thomas (2015)	Nonmarital teenage childbearing	1 SD increase in test scores → 50% decrease in risk of experiencing a nonmarital teenage birth	Test scores	Regression analysis	US
30	McIntosh and Vignoles (2001)	Employment probability	Having level 1 numeracy skills relative to below this level → 4–5.5% increase in probability of employment	Literacy test scores	Regression analysis	UK
31	Moll (1998)	Earnings	1 SD increase in test scores → 34–48% increase in earnings	Literacy test results	Regression analysis	South Africa
32	Nakajima, Kijima and Otsuka (2018)	School attainment	Being able to read or write compared to not → 1.2 p.p. increase in the probability of completing upper primary school and 1.5 increase for upper secondary school	Reading and writing skills	Regression analysis	India
33	Nikolov, Jimi and Chang (2020)	Earnings	1 SD increase in aggregate ability score → 10–14% increase in earnings	Aggregate ability score, including measures of literacy and numeracy	Regression analysis and instrumental variable estimation	South Africa
34	No, Sam and Hirakawa (2012)	School dropout probability	1 SD increase in test scores → 51% lower dropout probability for first graders and 61% lower dropout probability for fifth graders	Test scores	Regression analysis	Cambodia
35	Ozawa et al. (2022)	Earnings	1 SD increase in test scores → 4.5% increase in earnings	Literacy, numeracy and cognitive skills test scores	Systematic review and meta-analysis	Low- and middle-income countries
36	Sánchez and Singh (2018)	Higher education enrolment	1 SD increase in test scores → 6–9.8% increase in being enrolled in higher education in India, 4–6.5% increase in Peru, and a 4–7% increase in Vietnam	Cognitive and mathematics test scores	Regression analysis	India, Peru, Vietnam
37	Shrestha (2019)	Infant and under-five child mortality rate	1 p.p. increase in the ability to write → 0.2 p.p. reduction in infant mortality and 0.3 p.p. reduction in under-five child mortality	Mother's ability to read and write	Difference-in-difference	Nepal
38	Smith-Greenaway (2013)	Child mortality	Mothers with full reading skills compared to mothers who cannot read at all → 30% lower risk of child mortality	Mother's reading skills	Regression analysis	Nigeria
39	Stern et al. (2024)	School attainment	Students in the treatment group compared to the control group → 15% more likely to reach grade 7 on schedule	Literacy assessments	Randomised controlled trial	South Africa
40	Sun (2019)	Earnings	1 SD increase in exam ability → 7–12% increase in earnings over time	Exam ability	Generalised method of moments	China
41	Taylor et al. (2016)	Prenatal care	Being literate compared to not being literate → 71% higher odds of having had any prenatal care and 27% higher odds of having had adequate care	Literacy	Regression analysis	West Africa (Benin, Burkina Faso, Ghana, Guinea, Liberia, Mali, Nigeria, Niger, Senegal and Sierra Leone)
42	Yi et al. (2012)	School dropout probability	10 p.p. increase in maths test scores → 1.3 p.p. decrease in likelihood of dropping out	Mathematics test scores	Regression analysis	China
43	Yu et al. (2017)	Earnings	1 SD increase in English proficiency score → 12.1% increase in earnings	English, reading, mathematics and problem-solving skills	Regression analysis	China
44	Zuilkowski, Jukes and Dubeck (2016)	School dropout probability	1 SD increase in test scores → 40% (literacy) and 17% (numeracy) decrease in probability of dropping out.	Literacy and numeracy assessments	Regression analysis	Kenya



Table A2

Literature review matrix: Macro evidence with main findings, learning measures and method of analysis

Study number	Reference	Outcome	Effect Size	Learning Measure	Method of Analysis	Country/Region
1	Altinok and Aydemir (2017)	Average annual growth rate in real per capita GDP, 1960–2010	1 SD increase in test scores → 1.5 pp annual per capita GDP growth rate	International & regional assessments in science, mathematics and reading	Endogenous growth model	80 countries
2.1	Angrist et al. (2021)	Average annual growth rate in real per capita GDP, 2000–2010	1% improvement in test scores → 7.2% annual per capita GDP growth rate	Harmonised Learning Outcomes	Endogenous growth model	164 countries
2.2	Angrist et al. (2021)	GDP per capita	Human capital's role in GDP per worker approx. 20–50%	Harmonised Learning Outcomes	Growth accounting framework	164 countries
3	Barro (2001)	Real GDP per capita growth rate	1 SD increase in test scores → 1 pp annual per capita GDP growth rate	International test scores in mathematics and science	Growth regression	100 countries
4	Chetty et al. (2014)	Upward mobility (measured as the expected income percentile rank of children from low-income families), 2011–12	Income-adjusted test scores and dropout rates are highly correlated with upward mobility (= 0.6)	Income-adjusted test scores (mean grade 3–8 mathematics and English test scores)	Ordinary least squares regression	US
5	Hanushek and Kimko (2000)	Average annual growth rate in real per capita GDP, 1960–90	1 SD increase in test scores → 1.4 pp annual per capita GDP growth rate	International Test scores in science, mathematics, and reading exams	Endogenous growth model	39 countries
6	Hanushek and Woessmann (2012)	Average annual growth rate in real per capita GDP, 1960–2000	1 SD increase in test scores → 2 pp annual per capita GDP growth rate	International Test scores in science, mathematics, and reading exams	Endogenous growth model	50 countries
7	Hendricks and Schoellman (2018)	GDP per worker	Human capital (quality education) role in GDP per worker approx. 60%	Wage gains at migration	Growth accounting framework	US income data, global education data
8	Jamison, Jamison, and Hanushek (2007)	Log of the infant mortality rate (deaths in the year following birth per 1000 live births), 1960–2000	1 SD increase in test scores → 0.6% faster decline in infant mortality rate	International test scores in science, mathematics, and reading exams	Endogenous growth model	62 countries
9	Richards (2023)	Change in per capita GDP, 2015–19	10% lower learning poverty → \$200 higher per capita GDP	Learning poverty rates, World Bank	Difference-in-differences in GDP growth rates	75 countries
10	Schoellman (2012)	GDP per worker	Human capital (quality education) role in GDP per worker approx. 20%	Returns to schooling of immigrants	Growth accounting framework	US income data, global education data





What Works Hub
for Global Education

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