Original Manuscript

RESEARCH IN
Comparative &
International Education

Research in Comparative &
International Education
2024, Vol. 0(0) 1–31

DOI: 10.1177/17454999241255182
journals.sagepub.com/home/rci
Sage

Accelerating progress towards eradicating child labour (SDG8.7) with quality education (SDG4): School quality is linked to reduced child cocoa labour in Côte d'Ivoire

Brooke Wortsman*, **Jasodhara Bhattacharya*** and **Joshua Lim**
University of Toronto, Canada

Fabrice Tanoh
University Péléforo Gon Coulibaly de Korhogo, Côte d'Ivoire

Shamina Shaheen
University of Toronto, Canada

Amy Ogan
Carnegie Mellon University, USA

Kaja Jasińska
University of Toronto, Canada; Haskins Laboratories, USA

Abstract

Child labour disrupts education, but there is scant research on the reciprocal relationship: *education disrupting child labour*. We examined the link between school quality and child cocoa agricultural work in a sample of 2168 fifth-grade children from forty-one primary schools in rural Côte d'Ivoire. Children attending a higher quality school were less likely to work on a cocoa plantation. Specifically, quality infrastructure and teaching materials were associated with reduced cocoa agricultural activities, but not with domestic and economic activities. Against the backdrop of a global focus on improving education quality, we suggest that investments in quality education may serve the dual purpose of reducing child labour alongside improving children's learning outcomes.

*Co-first authors

Corresponding author:
Kaja Jasińska, Applied Psychology and Human Development, University of Toronto, 252 Bloor Street West, Toronto, ON M5S 1V6, Canada.
Email: kaja.jasinska@utoronto.ca

Keywords
Child labour, Côte d'Ivoire, school quality, SDG4, SDG8

Introduction

In September 2015 (UNDESA, 2015), a bold new agenda was unveiled at the Sustainable Development Summit held at the UN headquarters in New York City. Titled 'Transforming Our World: The 2030 Agenda for Sustainable Development', and adopted by 193 Member States of the United Nations, these 17 transformative Sustainable Development Goals (SDGs) call to end poverty, improve the lives of people, and protect the planet. Amongst these is SDG 8 (decent work and economic growth), with its indicator Target 8.7:

> "Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms".

In specifically measuring the progress of nations towards ending child labour by 2025, the world renewed its commitment to eradicate this global crisis which exposes an estimated 160 million children around the world (International Labour Office and United Nations Children's Fund, 2021) to physical/mental/moral hazard, sacrifices their future welfare for immediate benefit (e.g. Posso 2017). The increase in child labour worldwide as a result of the COVID-19 pandemic further reinforces the relevance of this commitment to protect and restore children's childhood and future (e.g. ILO, 2018, ICI, 2020).

The measurement of child labour is internationally bounded by three United Nations conventions around two context-sensitive elements: age and the nature, duration and conditions of productive activities performed by the child.[1] The ILO (2018) defines working children as any child below the age of 18 engaged in an activity falling within the general production boundary as defined by the System of National Accounts (SNA), including production of goods and services for own use, work performed for pay or profit, unpaid trainee work, and volunteer non-compulsory work. While context sensitive, this encompasses (i) any economically active child under the age of 12; (ii) children 12–14, engaged in productive activities outside permissible light work; (iii) children aged 17 and younger engaged in 'hazardous' activities (those affecting the child's safety, physical and mental development) or the 'worst forms of child labour' (e.g. commercial sexual exploitation, armed conflict). It should be noted that not all work done by children is considered child labour.

Unlike children's participation in activities that develop life-skills and knowledge, child labour harms children and interferes with their right to education through *direct channels* such as education loss through decreased school attendance and *indirect channels* such as negative effects on attitudes to learning and health (Emerson et al., 2017; Heady 2003; Ibrahim et al., 2019; Putnick and Bornstein, 2015). For example, children's reading competence (as assessed by parents) decreases with child labour hours in Tanzania (Akabayashi and Psacharopoulos 1999). Heady (2003) found a negative relationship between child labour and educational attainment, using direct measures of reading and mathematics ability, in Ghana. Lee et al. (2021) found child labour lowers reading and mathematics scores for both genders and regardless of age (children under 12 and over 13 years) in francophone West and Central Africa. Child labour is a significant

predictor of age-grade distortion in Peru and hinders learning performance by taking time away from study, play and sleep, injuries that damage physical and mental health, interfering with children's school attendance and opportunity to learn (Patrinos and Psacharopoulos, 1995). Further, it has negative effects on attitudes toward studying (e.g. Dumas, 2013; Emerson et al., 2017). By impeding education, child labour is linked to a vicious downward spiral of persistent poverty: poor households send their children to work, lowering children's years of schooling, and reducing intergenerational school attainment; they become low productivity workers whose future earnings are low, contributing further to intergenerational poverty (e.g. Barro, 1991; Emerson and Souza, 2003; Njong, 2010; Patrinos and Psacharopoulos, 1995; Psacharopoulos and Patrinos, 2004, 2004b; Sen, 1999).

While child labour impedes education, the reverse may also hold true – education may pull children out of child labour. Education is one among the constellation of policy and legislative tools that governments have deployed to disrupt the equilibrium *horribilis* of child labour, low education over generations, and persistent poverty. These tools target expanding school *access* through a variety of channels such as increasing the number of schools (Vuri, 2008), lowering financial barriers with vouchers to reduce school fees, or reducing socio-cultural barriers to access with girl-friendly schools (Leinberger-Jabari et al., 2005; Paruzzolo, 2009; see note for other policy tools). These policies seek to reverse the positive feedback loop between child labour and poverty through a theory of change that improved schooling attainment in the current generation will increase intergenerational income and educational attainment, allowing sustained growth to take-off. However, these efforts have varied in effectiveness. Furthermore, the post-pandemic surge in child labour rates (ILO, 2020), the first in nearly two decades (UNDESA, 2020) illustrates how tenuous gains in child labour reduction have been.

The persistence of this problematic phenomenon suggests the need for novel approaches. With less than a year to achieve Target 8.7, we forward that nations need to accelerate legislative and practical actions to eradicate child labour worldwide and reach Target 8.7. The International Labour Organization (ILO) projects 121 million children will still be enmeshed in child labour by 2025 (ILO, 2017). Our research aims to inform this conversation by understanding how *school quality* (a component of education quality; SDG 4) could be applied as a lever against child labour (SDG 8.7).

If school quality indeed deters child labour, this would represent a value-added outcome to the growing global investments in education quality. While there is much research on how child labour interrupts school attendance and constrains learning, evidence on schools disrupting child labour is sparse. A recent report from the International Cocoa Initiative (2019) suggests school quality, as measured by a range of indicators (school infrastructure, school environment, teaching materials, and human resources), may reduce child labour. The strongest associations between education quality and child labour pertained to toilet facilities and school canteen programs. Abou (2021) and Guarcello and Rosati (2007) suggest such a link, but acknowledges that research on the connection between education policy and child labour reduction is sparse.

Given that our understanding of the reciprocal relationship between child labour and education is nascent, our school-based study specifically investigates this emerging new lever of school quality in the context of rural cocoa-growing communities of Côte d'Ivoire. Côte d'Ivoire is one of the fastest growing African economies, with an unsustainable confluence of high rates of youth and adult illiteracy and high rates of child labour in its key economic sector (nearly a million Ivorian children work in cocoa agriculture). It is a young nation (42% of the population 14 years and younger; UNDESA, 2019) in the lowest quintile of the Human Development Index (rank 162 out of 189 countries and territories; Conceicao, 2020). We focus specifically on children who experience

the dual demands of school and labour; a population that represents the majority of children active in the agricultural cocoa industry in Côte d'Ivoire. 38% of children in agricultural households are involved in cocoa production, and 80% of children in agricultural households attend school (Sadhu et al., 2020). Understanding the relationship between school quality and child labour in this context will shed light on how to support the development of this population.

Cocoa labour in Côte d'Ivoire

Côte d'Ivoire is the third largest economy of West Africa and has been the world's largest supplier of cocoa since 1977/1978 (AfDB, 2018). Cocoa forms the backbone of the Ivorian economy (Kanga et al., 2019; UNDESA, 2021). Known as 'brown gold', this commodity is of extraordinary importance to the national economy (United Nations Children's Fund, 1997; AfDB, 2018) and economic development (IFC, 2020). In 2020, cocoa represented approximately 35% of Côte d'Ivoire's total commodity exports (UNDESA, 2023) and accounted for 74% of total income for the average cocoa-growing household (Fairtrade International, 2018).

Most Ivorian cocoa production is done by approximately one million small household cocoa farmers concentrated in the South and South-West of the country (AfDB, 2018). Children often work on these small family cocoa farms as part of their household's normal economic activity (United Nations Children's Fund, 1997; Nkamleu and Ndoye, 2003). 78% of children in these agricultural households are economically active (Sadhu et al., 2020). Of the children in cocoa farming regions of Côte d'Ivoire, 80% are enrolled in school – the typical child working in cocoa agriculture manages labour activities alongside attending school. A subset of these children (38% or approximately 791,000 children between the ages of 5 and 17; Sadhu et al., 2020) are considered child labourers. These children are exposed to a variety of hazards at a critical time in their physical and mental development (Sadhu et al., 2020) performing activities that fall under the seven categories of child cocoa labour. Some examples of these activities include lifting heavy weights, clearing land, making charcoal, using sharp tools to harvest and break pods, interacting with agricultural chemicals such as fertilizers and pesticides, and working long hours in the sun, or working during school hours (Sadhu et al., 2020). Based on the total population of children in Côte d'Ivoire (UIS, 2019), this means approximately 1 in 10 children are engaged in child labour in the cocoa sector.

In addition to high rates of child labour, and despite a policy of compulsory education lasting 10 years from ages 6 to 15, Côte d'Ivoire maintains one of the highest levels of youth and adult illiteracy (Jasińska et al., 2023; Jasińska and Guei, 2022): an estimated 82% of 10 year olds in Côte d'Ivoire cannot read and understand simple text by the end of primary school (Azevedo et al., 2021). As of 2019, 42% of 15–24 year olds in Côte d'Ivoire and 53% of adults aged 15+ are estimated to be illiterate, compared to SSA at 30% and 41%, respectively (UNESCO Institute for Statistics, 2019). This is a problematic combination for sustainable economic development: participation in child labour hinders learning and educational attainment with substantive negative impacts ranging from lower reading and mathematics scores (Lee et al., 2021) to age-grade distortion (Patrinos and Psacharopoulos, 1997) and school dropout (Guarcello and Rosati, 2007; Wortsman et al., 2024).

School quality matters for student learning

School quality is one aspect of the multi-dimensional concept of education quality (e.g. Cheong Cheng and Min Tam, 1997; Conn, 2017). Aspects of school quality, as laid out in the targets of SDG-4, include the school's infrastructure, the school environment, quality of teaching materials,

and human resources (i.e. teachers). Indeed SDG 4A recognizes the importance of adequate physical *infrastructure* (SDG 4A), with indicators such as access to water, sanitation and hygiene (WASH) and electricity (UNESCO, 2016). There is a broad body of research on adequate physical infrastructure facilitating improvements in student outcomes, and reducing dropout rates (e.g. Barrett et al., 2019; Cash, 1993, 1994; Chirgwin et al., 2021; Fuller, 1990; Guarcello and Rosati, 2007; Heyneman and Loxley, 1983; Urwick and Junaidu, 1991; Varghese, 1995; Wortsman et al., 2024). Elements of infrastructure which promote safe, secure, and supportive schools include WASH facilities, building maintenance, and library, furniture, and classrooms that have kept pace with expanding class sizes.

Studies investigating the *school environment* (characterized by the presence of certain basic services such as the availability of a canteen, the presence of a drinking water point, and class size) and students' performance in Côte d'Ivoire illustrate that the characteristics that make up the school environment are important for educational attainment (e.g. Abou, 2016; Aturupane, et al., 2013; Bacolod & Ranjan, 2008; Conn, 2017; Spears, 2012; Spears and Lamba, 2016). The availability and adequacy of facilities including the building, classroom furniture, recreational equipment apparatus, and relevant *teaching materials* has been linked to higher academic achievement (e.g. Conn, 2017; Moscoviz and Bélanger, 2019). Alongside a school's infrastructure, learning environment, and teaching materials another input is the *human resources* of a capable and qualified teaching force in required numbers for lower pupil-to-teacher ratios. These quality indicators (e.g. teacher training and education) also meaningfully predict student learning outcomes (Slot et al., 2015).

Mechanisms linking school-quality and child work activities

A multitude of interdependent mechanisms link schooling and child work, including children's school engagement, parental-level decisions regarding work and education, to teacher-level factors. In rural cocoa-producing communities in rural Côte d'Ivoire, many households experience poverty and live on $1–2 per day (Fonds monétaire international, 2009; Institut National de la Statistique du Côte d'Ivoire, 2015). Families are left with the decision of whether to send their child to school or contribute to the family income (Jasińska and Guei, 2022; Rosati and Rossi, 2003). Child labour is often used as a strategy to gain economic resources to meet schooling cost (Ango et al., 2022; Human Rights Watch, 2005; Jensen and Nielsen, 1997; Kruger, 2007; Mohammed, 2023). Paradoxically, families in poverty may meet the cost burden of schooling by using child labour, despite the fact that child labour pulls children out of school and places child at greater risk of dropout (e.g. Ango et al., 2022; Jensen and Nielsen, 1997; Kruger, 2007; Mohammed, 2023; Wortsman et al., 2024).

'In many countries around the world, school fees and related education costs create formidable barriers to children's right to education' (Human Rights Watch, 2005). Following the global Education For All movement in 1990, many countries including Côte d'Ivoire have abolished formal tuition fees to primary and secondary education, however, indirect costs (i.e. books, uniforms, supplies, and transportation) still act as a substantial barrier to those in poverty. In fact, the Human Rights Watch (2005) found that 'in many countries where formal fees have been lifted without an effective reallocation of resources, local schools have imposed additional 'informal' fees to make up for the lost income' (p. 6). Worse, some research in Africa (Evans and Mendez Acosta, 2021; Glewwe et al., 2009; Lauwerier & Akkari, 2015) found that trends towards increasing access has lowered quality as government expenditure was spread more thinly and the increased demands for teachers could not be met.

Consider Côte d'Ivoire: government school fees are 6,000 FCFA (~10 USD); the cost of school uniforms and supplies (school textbooks are not provided by the school) range from 30,000 FCFA over 50,000 FCFA (~50–90 USD) according to the child's grade; and there are fees applied by COGES (School Management Committee consisting of parents of students, teachers and the principal, akin to a parent-teacher association) ranging from 5,000 over 20,000 FCFA (~9–35 USD), which is typically allocated for funding construction of new school buildings, latrines, etc., or other needs, depending on the school. Therefore, schooling costs for each child can range from 70 to 135 USD. Given the average annual cocoa farmer income of 3,000 USD (World Bank, 2019) and the average number of school-age children in these households being between 5 and 8, this sum can represent over 35% of the average household income. This cost burden has been suggested by prior research (e.g. Abou, 2014). Despite parents making the decision (and investment) to send their child to school, many children remain functionally illiterate even after completing six grades of primary education (UNESCO Institute for Statistics, 2019).

Here, we posit that this cycle may be interrupted if schools are of higher quality. If schools are of higher quality, then parents may see a greater benefit in sending their child to school (i.e. having relevant education leading to functional literacy, numeracy and overall positive learning outcomes). Consequently, there may be a shift in the fine balance between economic value from child work and the longer-term multi-dimensional social, economic, and community-building value of an educated child with a higher earning potential.

Current study

Our school-based exploratory research study explored whether improved school quality, a component of education quality (SDG 4), may be a potential lever to reduce child labour (SDG 8.7). While evidence of such a potential mechanism is starting to accumulate (e.g. Abou, 2021; ICI, 2019), it is not yet clear if school quality reduces all forms of child work activities, if all aspects of school quality matter, or what underlying mechanisms link school quality and child labour and work activities.

We contribute to the emerging evidence by quantitatively examining the relation between school quality and children's participation in work activities across different domains: domestic (i.e. chores or helping with child care), economic (i.e. non-agricultural), and cocoa agricultural activities. We further examine distinct components of school quality, as defined within the UN's SDG-4 targets: school infrastructure and environment (target 4.a), teaching materials (targets 4.6 and 4.c), and human resources (target 4.c). Specifically, we address the following research questions: (1) How does school quality relate to children's work activities? (2) Does school quality similarly influence different forms of children's work activities (domestic, economic, and agricultural activities)? (3) What aspects of school quality have the strongest relationship to children's work activities? We test the hypothesis that higher school quality is associated with lower rates of work activity, and that higher school quality may specifically predict lower child agricultural cocoa labour activity.

To directly examine the link between school quality and children's participation in work activities, our study focuses on the effect of school quality on rates of work activity for children who both work and attend school. If higher school quality is associated with reduced cocoa farming-related activities performed by the children, we expect to observe this direct link among children who attend school. Thus, we do not consider the entire child work force which includes out-of-school children. We hope the insights from our research will inform practitioners' and policy-makers' ideation and implementation of novel interventions to reduce and ultimately eradicate child labour, while maximizing their investments in quality education, and arguing for increased funding for education systems.

Method

Participants

2168 students and 38 teachers in 41 public schools across rural cocoa-producing communities of South-Eastern, Central, and South-Western Côte d'Ivoire[2] (specifically, Adzope, Sikensi, Thiebissou, and Soubre) participated in this study between 2019 and 2021. Students and teachers were participating in a larger research program aimed at understanding children's development and learning outcomes (Jasińska et al., 2021).

Children. 2168 fifth-grade students (N_{Female} = 1024) ages 8–16 years (M_{age} = 11.02, SD = 1.420) participated in the study. Children with disabilities (developmental disorders, hearing, and vision impairments) were not eligible for the study. Our sample also excludes children who are out-of-school; this exploratory study specifically examines the relationship between school quality and children's work activities in a demographic which represents the experience of the majority of children in (80% of children in Cote d'Ivoire balance the dual demands of school and work activities; Sadhu et al., 2020).

Teachers. Thirty-eight fifth-grade teachers participated in this study (M_{age} = 43.19; SD = 8.39; range = 30–58; N_{Female} = 10, N_{Male} = 26; 2 teachers did not report their gender on the questionnaire). 41 teachers from participating public schools were invited to participate, and three however did not complete a questionnaire. Of the 38 teachers surveyed, all taught in French (35 teachers used French as the exclusive language of instruction (LOI); three teachers taught at schools which incorporated a local language as LOI in Grades 1–3).

Procedure

The data was collected on-site in Côte d'Ivoire by our research team. This study was authorized by the Ivorian Ministry of Education and received ethics approval from the University of Toronto research ethics board. During school hours, children participated in one-on-one interviews conducted by a trained researcher who, at a minimum, had an undergraduate degree in a relevant field (sociology, education, and development). Testing took place on school property outside the classroom. Children received small gifts (e.g. books) for their voluntary participation in the study. The teachers' questionnaires were distributed by an experimenter from the research team at the beginning of a school day; teachers completed the questionnaires during school hours, at their respective schools, later the documents were collected at the end of the research team's visit to the school (i.e. at the end of the day or within a 1–2 days). Consent and data collection procedures were conducted by researchers who spoke Ivorian French and the local languages of the community. Consent was verbally obtained from village chiefs, elders, and community members following culturally appropriate procedures (see Jasińska and Guei, 2018 for details about informed consent procedures for low-literacy rural communities in Côte d'Ivoire). Data were collected and managed using REDCap and were hosted at the University of Toronto (Harris et al., 2009, 2019). Though the larger research program was preregistered, the current study was not.

Measures

Demographic and socioeconomic characteristics. Children completed questionnaires eliciting information about child-level characteristics (e.g. age), SES, child work activities in three categories

(economic, domestic, and agricultural; detailed below in *child work activities;* Tulane University, 2015), and academic skills (RTI International, 2015). These questionnaires – Tulane University's Survey Research on Child Labour in West African Cocoa Growing Areas (Tulane University, 2015) and USAID Early Grade Reading Assessment (EGRA) Child Questionnaire (RTI International, 2015) – have previously been used in Côte d'Ivoire (Ball et al., 2022; Brice et al., 2024; Jasińska et al., 2022, 2022a; Whitehead et al., 2024; Wortsman et al., 2024; Zinszer et al., 2023a, 2023b) and sub-Saharan Africa more broadly (Gove and Wetterberg, 2011; RTI International, 2015; Sprenger-Charolles, 2008).

Children's household SES was measured using a questionnaire developed as part of the EGRA which included a household inventory of specific items in the home (e.g. toys, books, radio, phone, electricity, and indoor plumbing) (Gove and Wetterberg, 2011). The household SES measure yields a score between 0 and 15 where a higher score indicates higher SES. This previously validated and widely used measure of SES is common for low- and middle-income countries (LMICs) such as those in sub-Saharan Africa (SSA; Gove and Wetterberg, 2011). In LMICs like Côte d'Ivoire, measuring SES using a household inventory is more appropriate than using additional factors such as income which can fluctuate highly (Filmer and Pritchett, 2001; Howe et al., 2012; Diamond et al., 2016). Using a sum of household inventory items, similar to a poverty scorecard, gives a total child-reported score and is a common measure for the World Bank (Diamond et al., 2016; World Bank, 2019). Children also reported whether or not their mother was literate, a proxy for education level, which is often used as an additional measure of SES (e.g. Chen et al., 2018; Khan et al., 2024). Maternal literacy was highly positively correlated with household inventory ($t(2395) = 9.03$, $p < .001$; $M_{\text{literate}} = 6.69$, $SD_{\text{literate}} = 2.57$, $M_{\text{illiterate}} = 5.73$, $SD_{\text{illiterate}} = 2.66$). In this study, we use the household inventory as our measure of SES.

School quality. Individual teachers completed a 30-item teacher questionnaire previously used as part of the Tulane University's Survey of Child Labour in West African Cocoa Growing Areas (Tulane University, 2015) and the Early Grade Reading Assessment (EGRA) used in West Africa (RTI International, 2015). The questionnaire elicited information about teachers' professional demographics (e.g. number of years of experience, professional degrees, and educational rank in teaching), and several parameters related to their perception of classroom and school quality (e.g. presence of toilets and school canteens, child-appropriate pedagogical materials; see Supplemental Materials for full list of measures).

Child Work Activities. The ILO (2018) states that 'statistics on working children should distinguish between the categories of children in economic production, children engaged in unpaid household services, and children in other work activities' (p. 31). Tulane University's Survey Research on Child Labour in West African Cocoa Growing Areas (Tulane University, 2015) divides work activities into three major categories: economic, domestic, and agricultural. Economic activities cover all market production (paid work) and certain types of non-market production (unpaid work), including the production of goods for own use (Hagemann et al., 2006). Economic activity in relation to age and time spent working is a primary condition of child labour. Domestic activities involve personal services, including unpaid household work, which are commonly called 'household chores' (ILO, 2018). Household work is considered to be a hidden form of child labour because it is unpaid and often goes unreported (e.g. Gibbons et al., 2005; Webbink et al., 2012). Child activity surveys have shown that domestic activities may take a considerable amount of children's time and may reach thresholds that define it as 'hazardous', making it child labour. Agricultural activities include any work related to cacoa farming. Agricultural work is prevalent in our research context and amongst child labourers.

This measure considered children's responses, in a 'yes/no' format, to 42 items from Tulane University's Survey Research on Child Labour in West African Cocoa Growing Areas (2015). Items referred to children's participation in specific *domestic*, *economic*, *cocoa agricultural* activities within the previous 12 month period. For analytical purposes, and in line with previous research, we divided types of work into domestic, economic, and cocoa agricultural categories to better capture the nuances of child work activities.

Eight items pertained to *domestic activities* including laundry, cleaning, fetching water and firewood for household use, preparing food, and caring for other children or elderly family members, household repairs, and shopping. Children received a 'domestic activities' score ranging between zero to 8 based on how many of the aforementioned domestic activities they undertook within the last year.

Nine items pertained to *economic activities* including commercial, artisanal, or agricultural work for payment or other remuneration (e.g. in-kind), unpaid commercial, artisanal, or agricultural work, paid domestic work, assisting parents in a family business, work in a family garden or plot, construction or repair work, fishing and/or hunting, and produce goods/property for use at home. Children received an 'economic activities' score ranging between zero and 9 based on how many of the aforementioned economic activities they undertook within the last year.

Twenty-four items pertained to *cocoa agriculture activities* including land preparation (e.g. clearing fields, felling and chopping trees, burning, digging tree stumps, and cutting stakes), planting (e.g. planting seedlings, aligning and planting stakes, and preparing/digging/planting nurseries), farm maintenance activities (weeding, using agrochemicals, transporting water, maintaining and pruning cocoa trees), harvesting (e.g. plucking pods, gathering and heading pods, breaking cocoa pods), and post-harvest activities (e.g. fermenting and transporting cocoa beans, drying the cocoa beans). Children received an 'agricultural cocoa activities' score ranging between zero and 24 based on how many of the aforementioned activities they undertook within the last year.

Participants were 11 year olds on average, and reported working multiple activities, including in the physically demanding and laborious work of cocoa agricultural activities. Based on the boundaries for child labour including the System of National Accounts (SNA) production boundary ceiling set by the ILO (2018), the low threshold for acceptable coca agriculture work (less than 1 hour per week: Sadhu et al., 2020), the types of coca agriculture activities in which children self-reported their participation, the young average age of our participants, it is likely these children would be identified as child labourers (Table 1).

Data analysis

Separate generalized linear mixed models with random intercept of school were used to examine whether age, gender, household SES, and school quality significantly predicted child domestic, economic, and agricultural work using the open-source statistical software R (Bates et al., 2015; Kuznetsova et al., 2017; Lüdecke, 2021; Pearson, 2020; Pinheiro et al., 2020; R core Team, 2021). Research analyses of work activities and/or child labour in research literature based in Côte d'Ivoire, and more broadly in SSA and beyond, are typically separated into the three domains we outline in the above 'Child Work Activities' section (e.g. ILO & UNICEF, 2021; Kembou et al., 2022; Moyi, 2011). School quality was computed as an index representing distinct quality indicators (school infrastructure, school environment, teaching materials, and human resources) constructed following the protocol applied by the International Cocoa Initiative (ICI, 2019), see Supplemental Materials for full details.

Table 1. Demographic, School Quality, and Work Descriptive Statistics.

Variable		*N*	Mean	SD	Min	Max	Median
Demographic	Age	2168	11.02	1.42	8	16	11
	Household inventory index	2168	6.41	2.59	0	15	6
School quality	Teachers' age	26	43.19	8.4	30	58	43
	Teachers' years of experience	36	14.42	9.14	3	38	13.5
	Average class size	35	44.6	15.27	10	76	42
	School quality index (19-item average)	38	.06	.28	−.47	.68	.09
Child work	Domestic activities	2158	4.67	1.27	0	7	5
	Economic activities	2160	3.86	1.95	0	9	4
	Agricultural cocoa activities (full sample)	2129	4.96	6.46	0	24	0
	Agricultural cocoa activities (sample of children who work on a plantation)	967	10.91	5.18	1	24	11

Generalized linear mixed models were fitted by maximum likelihood estimation for domestic and economic work data. Zero-inflated Poisson regression model was fitted with both a count model (Poisson) and zero-inflation model (binomial) for agricultural labour data, given the over-representation of zero scores, that is, children who did not work on a cocoa plantation and therefore did not complete any cocoa agricultural tasks; this analytic approach has previously been used to model child work (e.g. Dendir, 2007). The zero-inflated Poisson regression model showed an improved model fit as compared to a linear mixed model for agricultural activities ($\chi^2(5) = 4837.6$, $p < .001$). To examine how different aspects of education quality impacted children's work activities, we conducted follow-up regression models with distinct quality indicators, as stated above. To account for group similarities within schools, all models included a random intercept for school, following the analytic models for nested data (e.g. Lee and Zuze, 2011; Tessema et al., 2021; Wortsman et al., 2024).

Please see Supplemental Materials for a detailed description of the coding of school quality and child work indices, and specific R packages used.

Results

Descriptive results

Additional descriptive results are presented in Supplemental Materials.

Child domestic, economic, and agricultural work activities. The proportion of children who reported each type of domestic, economic, and agricultural work activity is shown in Figure 1(A). The majority of children reported completing domestic and economic activities (e.g., >90% reported household chores such as cleaning and doing laundry, 86% reported fetching water). We explored the correlations within and between the three different work activity categories using Goodman–Kruskal τ. Our results indicate a moderate positive correlation between domestic and economic activities ($r(2156) = 0.422$, $p < .001$), between domestic and agricultural activities ($r(2123) = 0.227$, $p < .001$), and between economic and agricultural activities ($r(2125) = 0.344$, $p < .001$). These strong positive correlations between all forms of work activities (domestic, economic, and agricultural) indicate that children who reported doing more tasks in one category were also likely to report doing more tasks in another. However, there were no strong associations within the category of domestic activities

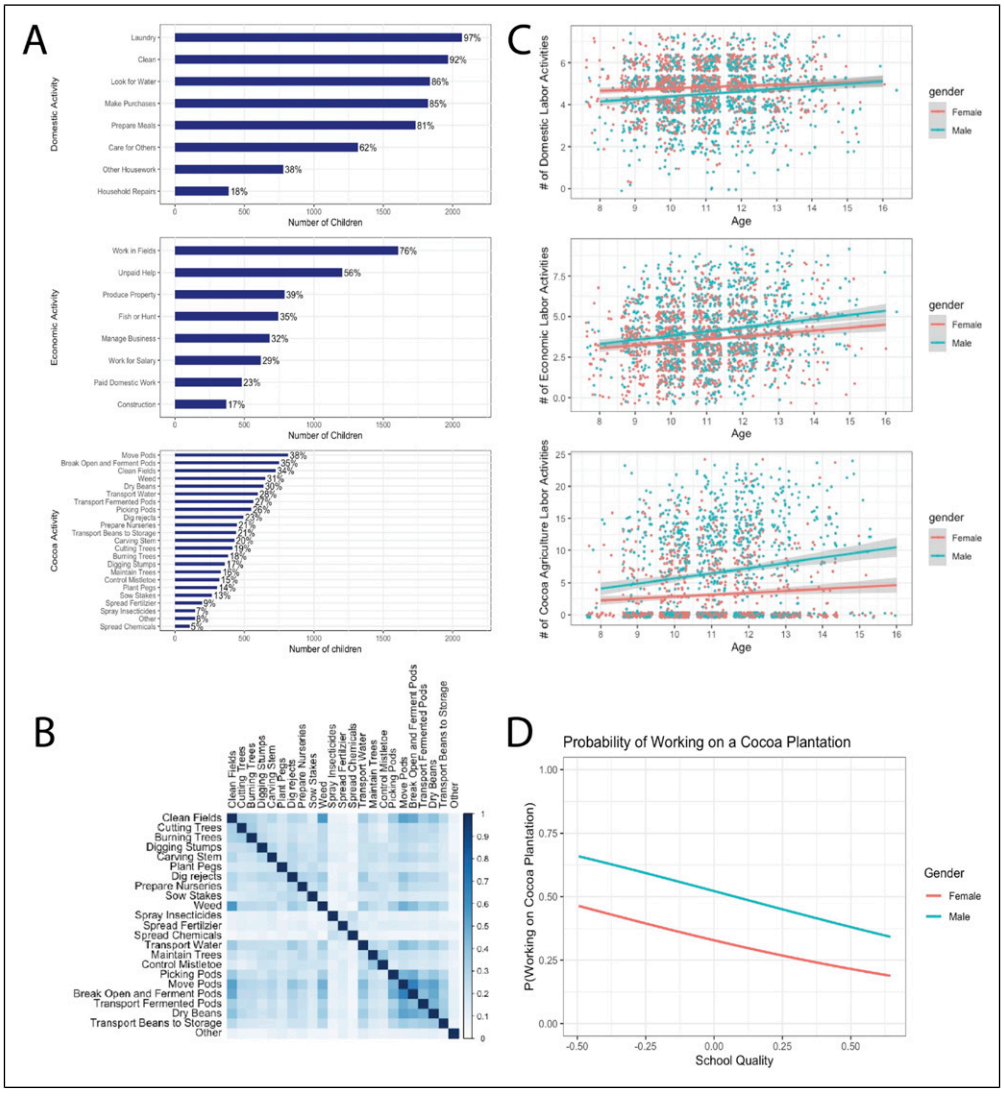

Figure 1. (A) Proportion of total children who reported performing work activities within each work category. (B) Goodman–Kruskal τ associations between each cocoa agriculture activity. (C) Relation between age, gender, and child work across domestic, economic, and cocoa agriculture activities. (D) Probability of working on a cocoa plantation as a function of school quality.

and within the category of economic activities (see 'Associations within Cocoa Agricultural Activities' below). As a follow up, we found that 17.45% of children reported being obligated to work (77.40% reported not being obligated, 5.15% either did not know or did not have a response).

Associations within agricultural activities. The most commonly reported cocoa agricultural activities were related to the cocoa harvest (moving pods, fermenting pods) and farm maintenance (cleaning fields, weeding). 35% of children reported breaking open and fermenting pods and

19% reported cutting trees; both tasks require the use of a sharp tool, and are considered hazardous forms of labour for children. While the least commonly reported activities were spreading fertilizer, insecticides and other chemicals, up to 9% of children self-reported being engaged in these hazardous tasks. A number of cocoa agricultural activities were moderately to strongly associated, see Goodman–Kruskal τ results in Figure 1(B). For example, children who reported doing one harvest-related activity, such as picking, moving, and fermenting pods, transporting fermented pods, drying beans, and transporting beans to storage, were more likely to report doing other harvest-related activities (τ = 0.26–0.66).

Demographics and child work activities

Older age was associated with more domestic, economic, and agricultural activities. Boys reported more economic and agricultural activities, whereas girls reported more domestic activities, see Figure 1(C). Higher household SES was associated with increased domestic and economic activities, but not agricultural activities.

School quality and child work activities

Higher school quality was associated with a decreased likelihood of working on a cocoa plantation (zero-inflation logit model), see Figure 1(D). School quality however was not associated with the number of agricultural activities reported by children who worked on cocoa plantations (Poisson count model); see Table 2. School quality was not associated with domestic or economic work. However, school quality and the number of domestic and agricultural activities were negatively correlated, see Supplemental Table 3. See further Supplemental Materials for descriptive results regarding measures of school quality.

A follow-up zero-inflated Poisson regression model for agricultural activities examined specific components of school quality, namely, school infrastructure, school environment, teachers, and teaching materials, on the number of cocoa agricultural activities reported and the probability of working on a cocoa plantation, see Table 3. Better school infrastructure and teaching materials were associated with a decreased likelihood of working on a cocoa plantation (zero-inflation logit model);

Table 2. Parameter Estimates of Age, Gender, Household SES, and School Quality Predicting Work Outcomes: Domestic and Economic Work and Agricultural Labour (Count Model for Number of Cocoa Labour Activities and Logit Model for Probability of Working on a Cocoa Plantation).

			Agricultural		
	Domestic	Economic	Count model	Zero-inflation logit model	
Predictor	β(SE)	β(SE)	β(SE)	β(SE)	Exp(β)
Age	0.096 (0.019)***	0.231 (0.029)***	0.055 (0.007)***	−0.117 (0.034)***	0.889
Gender (Male)	−0.324 (0.054)***	0.474 (0.081)***	0.321 (0.022)***	−0.804 (0.095)***	0.447
Household SES	0.033 (0.011)**	0.078 (0.016)***	0.007 (0.003)$^{+}$	−0.023 (0.019)	0.977
School quality	−0.204 (0.136)	−0.014 (0.95)	0.109 (0.076)	1.292 (0.407)**	3.163
R^2	0.05	0.11		0.175	
N	2158	2160		2129	

Note: $^{+}p < .1$,*$p < .05$, **$p < .01$, ***$p < .001$.

however, no effects were observed for school environment (e.g. public health, school security, etc) and teachers (e.g. teacher qualifications, years of experience, etc.).

Discussion

This study examined the associations between school quality and children's domestic, economic, and cocoa agriculture work activities in rural Côte d'Ivoire. Our results indicate that children who attended schools with a better infrastructure and better teaching materials had a lower probability of working on a cocoa plantation relative to their peers who attended lower quality schools; these results support our hypothesized link between school quality and child labour.

Côte d'Ivoire currently invests approximately 3.3% of its GDP on education (World Bank, 2018). Our findings suggest that focussing these investments on school quality, against the backdrop of a larger continental focus on the importance of quality education for Africa's future (African Economic Outlook report, 2020) and the shift in global discourse from education access to quality (e.g. Britto et al., 2011; Mundy and Manion, 2021; Piper et al., 2006; United Nations Children Fund, 2019), may produce gains beyond school access and academic achievement: improving school quality may also address the systemic issue of child labour. Our findings may also inform conversations on increasing investments in education, to be at par with the world average education expenditure of 4.5% (World Bank, 2018). With a reduction in child work, Côte d'Ivoire might more fully realize the gains from the education reforms implemented. Together, our findings begin to reveal a complex system in which child- and family-level characteristics (i.e. gender, age, household SES) and children's access to quality education impact child work.

Child work activities

Approximately 1 in 3 children (38%) self-reported working in cocoa agriculture, consistent with previous reports of child cocoa agricultural activities in Côte d'Ivoire (Sadhu et al., 2020). Furthermore, children who reported working on a cocoa plantation were likely to be engaged in multiple cocoa agricultural tasks. Nearly one-fifth of children reported that they were obligated to

Table 3. Parameter Estimates of Specific School Quality Indicators Predicting Agricultural Cocoa Labour Outcomes: Count Model for Number of Cocoa Labour Activities and Logit Model for Probability of Working on a Cocoa Plantation.

	Count model	Zero-inflation logit model	
Predictor	β(SE)	β(SE)	Exp(β)
Age	0.056 (.007)***	−.115 (.034)***	0.891
Gender (Male)	0.321 (.022)***	−0.804 (.095)***	0.447
Household SES	.007 (.004)	−.022 (.019)	0.978
School infrastructure	0.026 (.052)	0.553 (.241)*	1.738
School environment	0.031 (.063)	0.142 (.296)	1.152
Teachers	−.046 (.066)	−.421 (.305)	0.657
Teaching materials	0.043 (.041)	0.381 (.194)*	1.464
R^2		0.186	
N		2129	

Note: $^{+}p < .1$,*$p < .05$, **$p < .01$, ***$p < .001$.

work, signalling that children may want to attend school but are faced with the difficult position of supplementing family income. Older children worked more relative to their younger peers across all three domains of activities (domestic, economic, and cocoa agriculture), and girls reported more domestic tasks while boys reported more economic and cocoa agriculture tasks, corroborating existing literature. For example, Del Carpio and Macours' (2010) findings in Nicaragua: intra-household allocations of child labour prior to a social protection program is heterogeneous, with older children (boys in their context) more involved in child labour activities than their younger siblings. Across multiple contexts, girls are more likely than boys to work inside the home doing domestic work such as household chores, childcare, and elder care (e.g. Allais, 2009; Bonke, 2010; Del Carpio and Macours, 2010; Fares and Raju, 2007; Pells, 2011).

School quality

Our findings are situated within existing literature on school quality in Côte d'Ivoire and in SSA more generally. In line with our findings, primary schools, particularly in rural areas, face challenges in implementing high-quality primary education due to worn building infrastructure, a shortage of motivated and educated teachers, large class sizes, and insufficient and inappropriate teaching materials and classroom resources (Friedman et al., 2016; Heneveld, 1994; Lauwerier and Akkari, 2015), and insufficient teaching and learning materials in local languages (e.g. Ball et al., 2022; Muthwii, 2004; Piper et al., 2018).

About a third of schools lacked drinking water, almost half did not have latrines, and about a third lacked electricity. These results corroborate the statistics of the Ivorian Ministry of National Education: in La Mé region (Adzope), 38.9% of schools do not have electricity, 43.5% do not have functional latrines, and 54.9% of schools do not have drinking water. Given the lack of latrines and water in many schools, it is perhaps not surprising that over half of teachers reported public health problems in their schools. Class sizes were as high as 76 children, a number substantially higher than the Ivorian target class size of 40 students as per the Ivorian Ministry of Planning and Development's Strategic Education Plan for 2015–2025 (2021), and higher than the observed average student:teacher ratio of 43:1 in Côte d'Ivoire (Ivorian Ministry of Education, 2021). This average Ivorian student:teacher ratio is very high compared to, for example, rates amongst OECD countries which average 21:1 (OECD, 2019). Most, but not all, teachers in our study reported completing a Pedagogical Aptitude Certificate (the Ivorian requirement for teaching), suggesting that many under-qualified teachers are working in rural schools.[3]

Theorized mechanisms by which school quality impacts child work activities

Children's participation in work activities, their education, and household economics connect through multiple and complex pathways, and the link between working and school quality may be explained by several mechanisms, see Figure 2. Our findings show that children who attend higher quality schools (with smaller class sizes, more qualified teachers, child-appropriate materials, a sufficient canteen program, and access to water and electricity and latrines) were significantly less likely to work on a cocoa plantation (and also reported less involvement in the number domestic and agricultural activities; Supplemental Table 3). The quality of school infrastructure and teaching materials related significantly to the probability of a child working on a cocoa plantation. In other words, the higher the school quality, the fewer the number of children who reported cocoa agriculture activities. As we did not observe any associations between school quality and domestic or economic activities in our main models, our results seem to uniquely relate school quality to cocoa

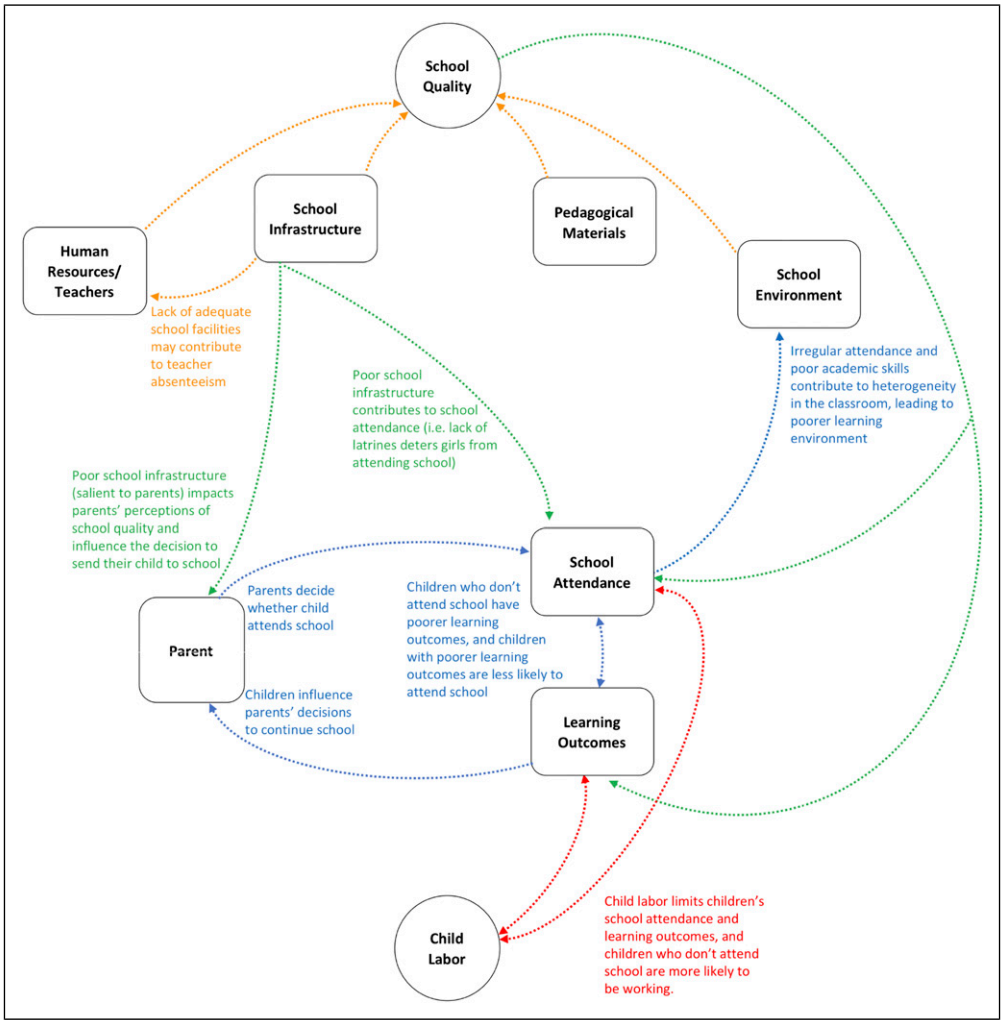

Figure 2. Potential mechanisms by which school quality impacts child work activities. We consider the multitude of pathways by which school quality and child work activities are interconnected. The circles represent the constructs examined in the research and rectangles represent factors that may play a role in the relation between the two. Though many mechanisms may be at play in this relation, our following discussion focuses on three overarching ideas: family factors such as decisions on child work and parental decisions about schooling, teacher factors as they relate to the quality of the school, and child factors such as interest in schooling and motivation to choose education over work.

agricultural activities. These results linking child work and school quality should be considered in the context of children's participation in agricultural cocoa labour in Côte d'Ivoire being primarily a household-level decision.

Family-related mechanisms. One potential powerful mechanism linking school quality and child labour may be parents' (or caretakers, or other family members) opportunity-cost decision to send children to school, rather than to cocoa plantation, when school quality improves. In poor

households faced with severely limited options, parents may weigh the future benefit of sending children to school against the immediate economic survival of the household (e.g. Basu and Van, 1998; Grootaert and Kanbur 1995; Guarcello and Rosati 2007; Nkamleu and Kielland, 2006; Ranjan 1999; Rosati and Rossi, 2003). The parents may prefer their children to go to school, but when faced with higher costs of schooling or low quality of schools, may prefer that their children either combine school and work or only work (e.g. Edmonds and Pavnick, 2005; Webbink et al., 2013). These decision mechanisms may underpin our findings.

The choice to send a child to school or have the child work on a family cocoa plantation is even more significant in the context of the cocoa crop cycle with respect to the start of the academic school year. There are two cocoa harvests each year, a main harvest typically in October, and a second smaller harvest in April (Mull and Kirkhorn, 2005). Cocoa farming households typically earn their entire year's income after beans are harvested and sold. The start of the school year in September and October coincides with the main cocoa harvest – a time period when cocoa farming families typically have their lowest cash reserves and the highest need for children's work in an activity that generates much of their household income until the next harvest. The pressure for children to work on the cocoa plantation is greatest at precisely the moment when parents are faced with the decision to send their child to school. Indeed, our results show that children mostly engage in harvest and post-harvest activities, which start at the beginning of the school year. Therefore, schooling and work decisions may be intimately linked to the cocoa crop cycle and the financial constraints that households may face at the start of the school year. This may also be the reason that the economic and household work, which are not a main source of farmer livelihood in cocoa farming households, is not significantly linked to school quality.

In this context, for school quality to deter child work, the opportunity-cost of a child attending school rather than working on a plantation must shift to favour schooling. From the perspective of the parent, some features of quality schooling may be more salient than others. For example, if a child's literacy and numeracy skills improve noticeably after attending school, parents can infer that schooling is effective and may be more inclined to support their child's continued attendance *if* they are engaged in their child's learning and actively monitoring their child's progress. For many farming families, it is common for parents to live on their plantation during the work week and return home on weekends while their child remains in the village, therefore, parents may have limited engagement in their child's schooling. Similarly, updates to the curriculum and/or teacher training that increase education quality are unlikely to be perceived by disengaged parents. On the other hand, highly visible indicators of school quality such as the construction of new school buildings, latrines, or access to water and electricity may be more salient to parents, having a more direct influence on parents' perception of school quality. Indeed, better school infrastructure and teaching materials were associated with a decreased likelihood of working on a cocoa plantation. This would align with the existing evidence in research literature about quality infrastructure and parental perceptions (e.g. Abou, 2021). In addition, basic infrastructure such as access to water may directly benefit households (e.g. Hutton et al., 2004) by making the household chore of fetching water less time-consuming and thus lowering the demand for children's work (e.g. Guarcello et al., 2015; Shafiq, 2007).

Interestingly, we found small positive associations between household SES and domestic and economic activities, but only a marginal association with agricultural labour. This positive relationship between household SES, schooling, and potentially hidden forms of child work such as domestic activities (e.g. Boutin, 2012; Rosati and Rossi, 2003) may indicate the complexity of the micro-relationships underlying this phenomenon. One mechanism by which household SES

specifically impacts child work may be that children who engage in domestic and economic activities (non-agricultural income-generating work) indirectly contribute to household SES. For example, in replacing parental household work, they allow their parents to pursue more income-generating activities, which in turn may contribute to higher household SES. It may also be, as suggested by De Hoop et al. (2019) in the context of a cash transfer program in the Philippines aimed at increasing school attendance through a soft nudge, that working children help their households to fully cover the cost of education. Emerging programs and research in Africa has shown similar effects of cash transfers (Evans and Mendez Acosta, 2021) in improving school enrolment. These recent findings illustrate that the trade-off between a parent's decisions between immediate reward from children's participation in child labour and long-term success from schooling, is moderated by the costs associated with access to school. Therefore, in addition to quality schooling, factors such as SES must be considered in efforts to improve schooling outcomes.

Teacher-related mechanisms. School quality may also influence child work through teachers, specifically teacher absenteeism as a result of inadequate school facilities and infrastructure or classroom structure (e.g. Chaudhury et al., 2006; Lee et al., 2015). If the school lacks a latrine, water, and/or electricity, a teacher may be less inclined to come to work and stay for the entire duration of the school day. Similarly, if teachers face overwhelmingly large class sizes, or if there are insufficient learning and teaching materials available and limited school supplies, then teachers may feel ill prepared to teach to a classroom which frequently has children of different ages and skill levels. This would diminish teachers' motivation and contribute to lower education quality in the classroom and increased teacher absenteeism. An absent teacher may result in cancelled classes, and children may return to their homes or to work in the fields with their parents. In turn, this schooling disruption may shift household perceptions of the opportunity-cost of sending children to school in favour of keeping them working at home for the household's immediate benefit. The impact of poor school facilities and unavailability of teachers as a reason for student attrition has been previously suggested (e.g. Momo et al., 2019).

Child-related mechanisms. The child may also be agentic in the relationship between school quality and child work through either the *direct* channel of their own decision to choose among going to school, combining school and work, or working, or the *indirect* channel of influencing the household's decision. When school quality is high, the child's interest in education may be correspondingly higher, and this may limit the propensity that (s)he engages in child work. For example, if a school is able to offer a functioning canteen program, attending school may be more attractive to both parents and children. A child who is engaged in their schooling may be able to convince their parents to allow him or her to continue to go to school on a regular basis and to better engage with schooling. It should be noted that school quality is an endogenous indicator, meaning it includes the possibility of a reverse relationship, with child work leading to low school quality. The link between child labour and poor educational outcomes is well established in the research literature from LMICs. For example, in a sample of nine Latin American countries, Gunnarsson et al. (2006) found that child labour was a significant predictor of poor learning outcomes. In particular, children who work one standard deviation above the mean show a 16% decrease in their mathematics test scores and an 11% decrease in their language test scores. Therefore, child work might reduce school quality by introducing higher heterogeneity in the classroom, and in turn, a lower quality education context for all students. In addition, children's absenteeism from school as a result of child labour (Colclough et al., 2000; Ersado, 2005; Guarcello and Rosati (2007) may in turn contribute to higher heterogeneity in the classroom teaching-learning environment. Students who

are more frequently absent may struggle to catch up with missed materials, impacting teaching effectiveness and strategies (Buckler, 2015).

Implications for policy and practice

Our findings that higher school quality is associated with lower rates of child work has implications for both education and child labour policy formulation and implementation. Though there is no singular mechanism for examining school quality, issues related to educational attainment such as participation in work activities (examined here) as well as parent, school, and community factors are interconnected, nested within broader societal contexts, and differ by school (e.g. Evans and Mendez Acosta, 2021; Wortsman et al., 2024). We posit that the following contextual factors should be considered in both the improvement of school quality and the reduction of child labour.

First, school quality can be a nuanced policy tool to reduce child work which nudges the largely household decision about children working on family farms. This novel approach can augment existing mandates such as child labour bans or compulsory attendance, which may be blunter instruments against the breadth of reasons why individual families may be noncompliant (e.g. Basu and Tzannatos, 2003; Brown, 2001; Krueger, 1996). Bans, assuming adequate resources to enforce them, can have dire consequences for poor households (and their children) who resort to child work out of desperation to make household ends meet. Similarly, trade policies and consumer boycotts, while spotlighting child work, are unlikely to alter the household decision of a typical child cocoa labourer helping their parents on the family farm. We forward that child labour policies can be strengthened by including and measuring school quality, with consideration given to quality infrastructure that provides access to basic services alongside materials and human resources.

Second, our findings highlight the importance of strengthening, expanding, and evaluating high-quality infrastructure. The Ivorian government's National and Education Sector Plans under the Global Partnership for Education (2017) aims to improve the quality of education and calls for quality school infrastructure and improved school safety, hygiene, and health in rural areas by constructing more latrines, hand washing systems, and drinking water points at schools. The government also plans to reduce class sizes and improve student-teacher ratios by constructing 3,000 additional classrooms per year and rehabilitating 5% of existing classrooms. We forward that aligning new high-quality school infrastructure, and updates to infrastructure, around *community-identified* basic services of importance (e.g. reliable water and latrines, reliable functioning canteens) may shift household perceptions about the value of schools and schooling in their communities, and nudge household decisions around the opportunity-cost of sending children to school.

Third, in alignment with the myriad mechanisms through which school quality likely acts on parents and children (see Figure 2) to influence the household decision around child cocoa labour, multiple entry points are needed to nudge households along the continuum of children-only-working to children-only-going-to-school (e.g. Kembou et al., 2022). The pivot to remote learning, as a result of the COVID-19 pandemic, has illustrated that learning at scale can occur outside a restricted number of hours of the day at a physical school plant. We forward that the Ivorian plan to implement and expand high-quality infrastructure can be an opportunity to strengthen life-wide learning through a high-quality out-of-school education ecosystem, with adequate and appropriate infrastructure, material, and human resources.

Fourth, the effect of material resources on child cocoa labour supports the importance of high-quality human resources and teaching-learning materials, which make learning relevant. The National Development Plan (Ivorian Ministry of Planning and Development, 2021) recognizes teachers as important to school and education quality: many teachers are under-trained, lack

professional support, and have access to limited teaching material for teaching students. The Ivorian government plans to increase teacher training from 2 to 3 years, conduct regular pedagogical monitoring of teachers, and improve teaching and learning materials. We forward that attention should be given to the material resources to align with the needs of the community so that households perceive the learning in schools as relevant. Though our study did not examine whether teaching materials were relevant in the community, teaching materials aligning with the language of instruction have been found to impact learning outcomes (Ball et al., 2022, 2024); therefore, we posit that relevant teaching materials may increase school quality and thereby decrease child labour. It may be that if parents (and children) see their learning as immediately relevant to their lives and understand the material, it may motivate higher engagement with school in lieu of immediate household benefit. Investing in school quality as a lever against child work represents value added to this government investment (The Department for International Development, 2013). A quality education will develop human capability irrespective of whether the long-term outcome for this education is coupled with the labour market. We urge policy-makers and practitioners to consider that investments in high-quality education in Cote d'Ivoire can lead to not only higher levels of literacy and numeracy, but also improved health outcomes, from a combination of access to clean water and sanitation at schools, as well as reduced exposure to physical, chemical, and social hazards while engaged in child labour. Coupled with an economic environment that facilitates and encourages private sector development in these areas, such as through successful microentrepreneurship, or the establishment of fair-trade co-ops which engage in better farming practices, investments in high-quality education that draw children out of child labour has the potential to break the cycle of persistent intergenerational poverty and unleash the human capital and sustainable development of the nation.

Fifth, the direct and indirect costs of accessing education must be considered. Direct costs refer to tuition and enrolment costs, while indirect costs refer to external costs such as books, uniforms, supplies, and transportation. In general, education costs tend to be higher for those in rural than urban areas because access is a driver of higher costs. Urban areas are often more abundant with educational resources like schools, libraries, and other educational facilities, while rural areas are sparsely supported (UNICEF, 2023; Wood, 2023). This lack of access in rural areas leads to higher indirect costs. One such rural penalty is higher transportation costs due to longer travel distances or lack of quality or reliable transportation infrastructure (e.g. AU/UNECA, 2005; Gertler and Glewwe, 1990; Porter, 2010). Rural costs are further compounded by indirect opportunity-cost of children's time. In the context of LMICs and households in poverty, children's work, including housework and agricultural labour, is often a significant contribution to family income (e.g. Gertler and Glewwe, 1990).

Estimates from the 2021 Rural Development Report found that globally, 70% of people in extreme poverty and 74% in moderate poverty live in rural areas. As families in rural communities tend to be more impoverished, especially in Côte d'Ivoire (Fonds monétaire international, 2009), 'reaching the poorest children will necessarily involve higher costs because their learning needs are greater than richer children and require substantial support from education systems' (UNICEF, 2023: 5). For these reasons, it is recommended that governments take an equitable approach to educational spending (UNICEF, 2023; United Nations Children Fund, 2019). In other words, additional funding targeted specifically at increasing access to quality education to support learners with the greatest schooling needs, especially in rural areas.

Limitations and future directions

Our findings reveal important links between school quality and child agricultural cocoa labour and suggest potential mechanisms by which improved school quality may reduce child labour. However,

it should be noted that our findings reveal *correlations* between school quality and child work, rather than *causality*. While our data do not conclusively narrow down one or more mechanisms that link increased school quality to a reduction of child work, our findings call for causal studies of school quality and child labour given the global investments in school quality and the recognition of the importance of eradicating child labour. It is important that the potential pathways between school quality and child labour are fully tested in future research. Indeed, in a parallel research study (ongoing randomized evaluation in Côte d'Ivoire, see Jasińska et al., 2021), we specifically measure if improving school quality causes a reduction of child agricultural cocoa labour in Côte d'Ivoire.

Future studies can also narrow down the specific aspects of school quality that pull children into school and away from labour – for example, pinpointing the specific aspects of school infrastructure (e.g. WASH facilities) that have the greatest impact on child labour reduction may allow for more targeted and impactful educational investments within LMICs.

As costs associated with schooling in Côte d'Ivoire can be prohibitive, this is also an important area of future research. As families with higher SES and those with more educated parents may allocate more financial resources towards schooling (Buchmann, 2000; Davis-Kean, 2005; Wolf and McCoy, 2019), future work can investigate whether SES and parental education and investments moderate the relation between school quality and child work activities.

Child work data was reported by children in this study. Since the effect of the type of respondent (parent, child) on child work statistics is not clear a priori (e.g. Dammert and Galdo, 2013), we must interpret these findings with caution. However, child-reported information may be more accurate than proxy responses (e.g. parent) if the child knows best what work activities(s) he participates in (Lichand and Wolf, 2022). While we did not use proxy respondents, a proxy respondent may be familiar with the children's activities and the frequency and continuity of work activities. The broader measurement error literature highlights relevant factors such as the salience of work activities, and recall decay bias (e.g., Bound et al., 2001). This literature, however, also suggests that our reports of child work might be downward biased, providing a lower bound for the effect of school quality and other predictors. In fact, given the already high prevalence of child labour in our study area (>30% according to recent estimates), the recall bias will likely only reduce the propensity that the child reports being engaged in child labour. Furthermore, proxy respondents (i.e. parents) may be also inaccurate; for example, social desirability biases may lead parents to underreport their child's work. Further, there is no reason to expect that biases in child work reports would differ from high to low quality schools.

We emphasize that this study focuses on the type of child agricultural cocoa labour that is common in rural cocoa-growing communities of Côte d'Ivoire: a majority of these children who are enrolled in school are faced with managing the dual demands of attending school and child work activities, whether domestic, economic, or agricultural. Our exploration stops at the border of school quality being a push-pull factor for those children who are enrolled in school while engaged in work activities. Since our sample excludes those children who are not enrolled in school, we do not know if poor school quality can push children out of schools entirely (although recent research in Côte d'Ivoire suggests that school quality is protective factor against dropout; Wortsman et al., 2024). Yet our study may impact out-of-school children; if school quality is high, parents' and students' incentives to attend school may increase (i.e. if WASH facilities and canteens are adequate and learning outcomes afford children more opportunities, parents may deem a school as safer and more valuable) – high-quality schools may *pull in* these out-of-school children. Given the prevalence of domestic, economic, and agricultural activities in these communities, more research is needed to understand the factors that push or pull children away from school completely, so that we may better inform child labour interventions and policies to increase educational attainment.

Lastly, though our work focused on several broad dimensions of school quality, additional measures pertaining to education in Côte d'Ivoire could shed more light onto the domains in which governments and education professionals can intervene in order to bolster children's academic achievement. Teacher-quality, for example, was limited to professional demographics such as years of teacher satisfaction, experience, and education level. However, we believe there are valuable additions that could better inform research into high-quality teachers. For example, though the current study focuses on primary school where one homeroom teacher teaches every subject, research has shown that it is common for teachers in sub-Saharan Africa have not mastered the teaching curricula or have weak subject knowledge, a factor that contributes to poor student outcomes (Bainton et al., 2016; Bold et al., 2017). Additionally, significant linguistic diversity within Côte d'Ivoire (Assanvo, 2017) may affect a teacher's ability to provide sufficient instruction. In the current study, only one-third of teachers spoke the Ivorian language of the village in which they taught. Future work should use additional measures of teacher quality such as subject-level knowledge, didactic skills, professional goals and values, and burnout (Bietenbeck et al., 2023; Buckler, 2015; Madigan and Kim, 2021) to better understand this important dimension of education quality. Further, a combination of teacher-reported data, classroom observations, government indicators, and children's learning outcomes would provide more informed insights into education quality (including school quality). Given the important links we have observed, an important next step in this research agenda is the inclusion of a broader range of school and education quality measures. Further, a combination of teacher-reported data, classroom observations, government indicators, and children's learning outcomes would provide more informed insights into education quality (including school quality). Given the important links we have observed, an important next step in this research agenda is the inclusion of a broader range of school and education quality measures.

Conclusion

While there is extensive research showing *child labour disrupts education*, there is scant research about the reciprocal relationship: *education disrupts child labour.* A large body of literature has explored how children's school participation and learning outcomes are impacted by child labour (e.g. Adonteng-Kissi, 2023; Guarcello et al., 2015; Guarcello and Rosati, 2007; ICI, 2019). Indeed one criteria of 'child labour' is that the work a child does interferes with their schooling. Our research on the relation between school quality and child work rates found that higher school quality (i.e. better school infrastructure and teaching materials) was associated with a lower probability of working on a cocoa plantation. This suggests the potential for leveraging investments in education quality as an intervention against child labour, within the context of cocoa labour in rural Côte d'Ivoire. Our results represent an intriguing finding given the high levels of global investment in quality schooling and the post-COVID recognition of the importance of high-quality basic school infrastructure. Our findings suggest the value of further investigation into the parent-level, teacher-level, and child-level mechanisms by which education quality influences the household decision of child work. We believe that this study opens an exciting new pathway for addressing this problematic global phenomenon and move us further in our goal of eradicating child labour (SDG 8.7) and providing access to high-quality education for all (SDG 4).

Note

Child labour is a complex phenomenon and many factors promote or maintain this phenomenon including the unavailability or prohibitive cost of schooling, gender-based cultural norms, and

individual family needs. Dammert et al. (2018) typologize five common policy and legislative approaches to combat this are: (1) increasing labour market access through labour-oriented programs (e.g. micro-entrepreneurial activity, public works); (2) increasing household income for the unbanked or under-banked through microfinance programs (e.g., business loans); (3) cash transfers programs (cash, in-kind non-fungible goods, and services such as food for education) to households either with no-strings-attached, or conditional upon compliance with schooling and health requirements (e.g. school enrolment, health visits); (4) targeted child labour programs (e.g. information campaigns to parents, employers, children, and policy makers about the negative consequences of child labour, integrated interventions to reduce risk of working such as incentivizing school attendance through take-home rations alongside raising parental awareness); and (5) schooling incentives (e.g. reducing cost of education, expanding pre-schools). They also point out that these have met with varying success and in some cases increased child labour rates, pointing to the complex set of factors that influence this phenomenon.

Acknowledgements

We especially extend our thanks to Dr. Samuel Kembou for his insightful comments and feedback on an earlier version of this manuscript. We would like to thank all the research assistants for their help in the data collection and the children and teachers who took part in this study. We wish to thank the Transforming Education in Cocoa Communities (TRECC) program for their support. We particularly wish to express our gratitude to the Ivorian Ministry of Education for their support of our research efforts as well as for the exchanges and information meetings that took place during the project.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was funded by a Jacobs Foundation Early Career Fellowship (2015118455; PI: K. Jasinska), a Jacobs Foundation research grant (PIs: K. Jasińska, A. Ogan) and a science capacity building grant to support Ivorian scholars through the Transforming Education in Cocoa Communities (TRECC) program (2015-1184; PI: K. Jasińska).

ORCID iDs

Brooke Wortsman https://orcid.org/0000-0001-9518-6669
Kaja Jasińska https://orcid.org/0000-0002-8851-1627

Supplemental Material

Supplemental material for this article is available online.

Notes

1. The definition of child labour is bounded by International Labour Organization (ILO) Convention No. 138 on minimum age for admission to employment, ILO Recommendation No. 146 (1973), ILO Convention No. 182 on prohibition and immediate action for eliminating the worst forms of child labour, ILO Recommendation No. 190 (1999), and the United Nations Convention on the Rights of the Child.

2. No relevant regional differences in child work activity rates were observed, see Supplemental Materials.
3. It is important to consider that teachers who in fact did not have this certification may have been reluctant to report their accurate credentials, or lack thereof, in our questionnaire.

References

Abou EP (2014) A Re-examination of the determinants of child labour in Côte d'Ivoire. In: *AERC Research Paper 289*. Nairobi: African Economic Research Consortium.

Abou EP (2016) Does the unavailability of educational resources in schools determine child labour in Sub-Saharan Africa? A micro-econometric analysis from Côte d'Ivoire. *International Journal of Economics and Management Sciences* 5(2): 326.

Abou EP (2021) Impact of school quality on schooling and child labour in selected zones of ivory coast. In: *AERC Research Paper 451*. Nairobi: African Economic Research Consortium.

Adonteng-Kissi O (2023) Interactions between child labour and schooling: parental perceptions in rural and urban Ghana. *Social Policy and Society* 23: 1–15. doi: 10.1017/S1474746422000690

African Development Fund (2018) Republic of Côte d'Ivoire cocoa sector governance project (PAGFIC) appraisal report. https://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/ECGF_COTE_D_IVOIRE_APPROVED_COCOA_SECTOR_GOVERNANCE_SUPPORT__PAGFIC_.pdf. Last accessed 16 Oct 2021.

Akabayashi H and Psacharopoulos G (1999) The trade-off between child labour and human capital formation: a Tanzanian case study. *Journal of Development Studies* 35(5): 120–140.

Allais FB (2009) *Assessing the Gender Gap: Evidence from SIMPOC Surveys*. Geneva: International Labour Organization.

Ango TG, Börjeson L, Wisborg P, et al. (2022) Coffee, child labour, and education: examining a triple social–ecological trade-off in an Afromontane forest landscape. *International Journal of Educational Development* 95: 102681. DOI: 10.1016/j.ijedudev.2022.102681.

Assanvo AD (2017) Langues maternelles et défi à l'émergence «horizon 2020»: Quelles réalités pour la Côte d'Ivoire? [Mother tongue languages and the challenge to the emergence of «horizon 2020»: What are the realities for Côte d'Ivoire?]. *Anadiss* 2(24): 2–14.

Aturupane H, Glewwe P and Wisniewski S (2013) The impact of school quality, socioeconomic factors, and child health on students' academic performance: evidence from Sri Lankan primary schools. *Education Economics* 21(1): 2–37.

AU/UNECA Africa Union and UN Economic Commission for Africa (2005) Transport and the millennium development goals in africa. Working document prepared by the Africa Union and UN Economic Commission for Africa, in collaboration with ADB, World Bank and the EU, February 2005.

Azevedo JP, Goldemberg D, Montoya S, et al. (2021) Will every child be able to read by 2030? Defining learning poverty and mapping the dimensions of the challenge.

Bacolod MP and Ranjan P (2008) Why children work, attend school, or stay idle: the roles of ability and household wealth. *Economic Development and Cultural Change* 56(4): 791–828.

Bainton D, Barrett AM and Tikly L (2016) Improving secondary school teacher quality in Sub-saharan Africa.

Ball M-C, Curran E, Tanoh F, et al. (2022) Learning to read in environments with high risk of illiteracy: the role of bilingualism and bilingual education in supporting reading. *Journal of Educational Psychology* 114(5): 1156–1177. doi: 10.1037/edu0000723

Ball M-C, Bhattacharya J, Zhao H, et al. (2024) Effective bilingual education in francophone West Africa: constraints and possibilities. *International Journal of Bilingual Education and Bilingualism* 27: 1–15. doi: 10.1080/13670050.2023.2290482

Barrett P, Treves A, Shmis T, et al. (2019) The impact of school infrastructure on learning: a synthesis of the evidence. In: *International Development in Focus*. Washington, DC: World Bank. DOI: 10.1596/978-1-4648-1378-8.

Barro RJ (1991) Economic growth in a cross section of countries. *Quarterly Journal of Economics* 106(2): 407–443.

Basu K and Tzannatos Z (2003) The global child labour problem: what do we know and what can we do? *The World Bank Economic Review* 17(2): 147–173.

Basu K and Van PH (1998) The economics of child labour. *The American Economic Review* 88: 412–427.

Bates D, Mächler M, Bolker B, et al. (2015) Fitting linear mixed-effects models using lme4. *Journal of Statistical Software* 67(1): 1–48. DOI: 10.18637/jss.v067.i01.

Bietenbeck J, Irmert N and Sepahvand MH (2023) Teacher quality and cross-country differences in learning in francophone Sub-Saharan Africa. *Economics of Education Review* 96: 102437.

Bold T, Filmer D, Martin G, et al. (2017) What do teachers know and do? Does it matter? Evidence from primary schools in Africa. In: *Does it Matter*. Washington, DC: World Bank Group.

Bonke J (2010) Children's housework--Are girls more active than boys? *Electronic International Journal of Time Use Research* 7(1): 1–16.

Bound J, Brown C and Mathiowetz N (2001) Measurement error in survey data. In: *Handbook of Econometrics*. Amsterdam: Elsevier, Vol. 5, 3705–3843.

Boutin D (2012) Family farming, child labour and the wealth paradox: evidence from Mali. *Economics Bulletin* 32(4): 3471–3479.

Brice H, Zinszer B, Kablan D, et al. (2024) Individual differences in leveraging regularity in emergent L2 readers in rural Côte d'Ivoire. *Scientific Studies of Reading* 28: 1–20. doi: 10.1080/10888438.2024.2317934

Britto PR, Yoshikawa H and Boller K (2011) Quality of early childhood development programs in global contexts: rationale for investment, conceptual framework and implications for equity and commentaries. *Social Policy Report* 25(2): 1–31.

Brooks ME, Kristensen K, Benthem K, et al. (2017) glmmTMB balances speed and flexibility among packages for zero-inflated generalized linear mixed modeling. *The R Journal* 9(2): 378–400.

Brown D (2001) Child labour in Latin America: policy and evidence. *The World Economy* 24(6): 761–778. DOI: 10.1111/1467-9701.00381.

Buchmann C (2000) Family structure, parental perceptions, and child labor in Kenya: what factors determine who is enrolled in school? *Social Forces* 78(4): 1349–1378.

Buckler A (2015) Quality teaching in rural Sub-Saharan Africa: different perspectives, values and capabilities. *International Journal of Educational Development* 40: 126–133.

Cash CS (1993) *Building Condition and Student Achievement and Behavior*. Blacksburg, VA: Virginia Polytechnic Institute and State University.

Cash CS (1994) The relationship between building condition and student achievement and behavior. *Educational Facility Planner* 32: 19.

Chaudhury N, Hammer J, Kremer M, et al. (2006) Missing in action: teacher and health worker absence in developing countries. *The Journal of Economic Perspectives: A Journal of the American Economic Association* 20(1): 91–116.

Chen Q, Kong Y, Gao W, et al. (2018) Effects of socioeconomic status, parent-child relationship, and learning motivation on reading ability. *Frontiers in Psychology* 9: 1297. DOI: 10.3389/fpsyg.2018.01297.

Cheong Cheng Y and Ming Tam W (1997) Multi-models of quality in education. *Quality Assurance in Education* 5(1): 22–31.

Chirgwin H, Cairncross S, Zehra D, et al. (2021) Interventions promoting uptake of water, sanitation and hygiene (WASH) technologies in low- and middle-income countries: an evidence and gap map of effectiveness studies. *Campbell Systematic Reviews* 17(4): e1194. DOI: 10.1002/cl2.1194.

Colclough C, Rose P and Tembon M (2000) Gender inequalities in primary schooling: the roles of poverty and adverse cultural practice. *International Journal of Educational Development* 20(1): 5–27.

Conceicao P (2020) *Human Development Report 2020: The Next Frontier: Human Development and the Anthropocene*. New York, NY: United Nations Development Programme. https://hdr.undp.org/sites/default/files/hdr2020.pdf. Last accessed 16 October 2021.

Conn KM (2017) Identifying effective education interventions in sub-Saharan Africa: a meta-analysis of impact evaluations. *Review of Educational Research* 87(5): 863–898.

Dammert AC and Galdo J (2013) Child labor variation by type of respondent: evidence from a large-scale study. *World Development* 51: 207–220.

Dammert AC, De Hoop J, Mvukiyehe E, et al. (2018) Effects of public policy on child labor: current knowledge, gaps, and implications for program design. *World Development* 110: 104–123. DOI: 10.1016/j.worlddev.2018.05.001.

Davis-Kean PE, Sexton HR and Magnuson KA (2005) *How Does Parents' Education Level Influence Parenting and Children's Achievement*. Ann Arbor, MI: Institute for Social Research, 48106.

De Hoop J, Friedman J, Kandpal E, et al. (2019) Child schooling and child work in the presence of a partial education subsidy. *Journal of Human Resources* 54(2): 503–531.

Del Carpio XV and Macours K (2010) *Leveling the Intra-household Playing Field: Compensation and Specialization in Child Labour Allocation*. Bingley: Emerald Group Publishing Limited.

Dendir S (2007) Household shocks and child labour in rural Malawi. *Economics Bulletin* 4(1): 1–8.

Diamond A, Gill M, Rebolledo Dellepiane MA, et al. (2016) Estimating poverty rates in target populations: an assessment of the simple poverty scorecard and alternative approaches. World Bank Policy Research Working Paper (7793).

Dumas C (2013) Market imperfections and child labor. *World Development* 42: 127–142. DOI: 10.1016/j.worlddev.2012.08.004.

Edmonds EV and Pavcnik N (2005) Child labor in the global economy. *The Journal of Economic Perspectives* 19(1): 199–220.

Emerson PM and Souza AP (2003) Is there a child labour trap? Intergenerational persistence of child labour in Brazil. *Economic Development and Cultural Change* 51(2): 375–398.

Emerson PM, Ponczek V and Souza AP (2017) Child labor and learning. *Economic Development and Cultural Change* 65(2): 265–296.

Ersado L (2005) Child labor and schooling decisions in urban and rural areas: comparative evidence from Nepal, Peru, and Zimbabwe. *World Development* 33(3): 455–480.

Evans DK and Mendez Acosta A (2021) Education in Africa: what are we learning? *Journal of African Economies* 30(1): 13–54.

Fairtrade International, (2018) Cocoa farmer income. The household income of cocoa farmers in Côte d'Ivoire and strategies for improvement. https://files.fairtrade.net/publications/2018_FairtradeCocoaFarmerIncomeCDI.pdf. Last accessed 16 October 2021.

Fares J and Raju D (2007) Child labor across the developing world: patterns and correlations. World Bank Policy Research Working Paper (4119).

Filmer D and Pritchett LH (2001) Estimating wealth effects without expenditure data—or tears: an application to educational enrollments in states of India. *Demography* 38(1): 115–132.

Fonds Monétaire International (2009) *Stratégie de Relance du Développement et de Réduction de la Pauvreté*. Côte d'Ivoire: Fonds Monétaire International.

Friedman T, Schwantner U, Spink J, et al. (2016) *Improving Quality Education and Children's Learning Outcomes and Effective Practices in the Eastern and Southern Africa Region: Main Report*.

Fuller B (1990) What Investments raise achievement in the Third World? *Improving educational quality: a global perspective*. UNESCO, 17–44.

Gertler P and Glewwe P (1990) The willingness to pay for education in developing countries: evidence from rural Peru. *Journal of Public Economics* 42(3): 251–275.

Gibbons ED, Huebler F and Loaiza E (2005) Child labour, education and the principle of non-discrimination. *Capítulo* 10: 214.

Glewwe P, Kremer M and Moulin S (2009) Many children left behind? Textbooks and test scores in Kenya. *American Economic Journal: Applied Economics* 1(1): 112–135.

Global Partnership for Education (2017) Education sector plan 2016-2025 - Côte d'Ivoire. https://www.globalpartnership.org/fr/content/plan-sectoriel-de-leducation-2016-2025-cote-divoire. Last accessed 16 October 2021.

Gove AK and Wetterberg A (eds) (2011) *The Early Grade Reading Assessment: Applications and Interventions to Improve Basic Literacy*. North Carolina: RTI Press.

Grootaert C and Kanbur R (1995) Child labour: an economic perspective. *International Labour Review* 134(2): 1–18.

Guarcello L and Rosati FC (2007) Does school quality matter for working children? Understanding Children's Work Programme Working Paper Series (Rome).

Guarcello L, Lyon S and Valdivia C (2015) Evolution of the relationship between child labour and education since 2000: evidence from 19 developing countries. *Background Paper Prepared for the Education for All Global Monitoring Report*. Rome: Understanding Children's Work Programme, 2000–2015.

Gunnarsson V, Orazem PF and Sánchez MA (2006) Child labor and school achievement in Latin America. *The World Bank Economic Review* 20(1): 31–54.

Hagemann F, Diallo Y, Etienne A, et al. (2006) *Global Child Labour Trends 2000 to 2004*. Geneva: International Labour Office.

Harris PA, Taylor R, Thielke R, et al. (2009) Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics* 42(2): 377–381.

Harris PA, Taylor R, Minor BL, REDCap Consortium, et al. (2019) The REDCap consortium: building an international community of software platform partners. *Journal of Biomedical Informatics* 95: 103208.

Heady C (2003) The effect of child labor on learning achievement. *World Development* 31(2): 385–398. DOI: 10.1016/S0305-750X(02)00186-9.

Heneveld W (1994) Planning and monitoring the quality of primary education in Sub-saharan Africa. AFTHR Technical Note No. 14.

Heyneman SP and Loxley WA (1983) The effect of primary-school quality on academic achievement across twenty-nine high-and low-income countries. *AJS; American journal of sociology* 88(6): 1162–1194.

Howe LD, Galobardes B, Matijasevich A, et al. (2012) Measuring socio-economic position for epidemiological studies in low-and middle-income countries: a methods of measurement in epidemiology paper. *International Journal of Epidemiology* 41(3): 871–886.

Human Rights Watch (2005) *World Report 2005: Events of 2004*. New York, NY: Human Rights Watch. https://www.hrw.org/sites/default/files/world_report_download/wr2005.pdf.

Hutton G, Haller L and Water S, World Health Organization (2004) *Evaluation of the Costs and Benefits of Water and Sanitation Improvements at the Global Level*. Geneva: World Health Organization. No. WHO/SDE/WSH/04.04).

Ibrahim A, Abdalla SM, Jafer M, et al. (2019) Child labor and health: a systematic literature review of the impacts of child labor on child's health in low- and middle-income countries. *Journal of Public Health* 41(1): 18–26.

Institut National de la Statistique du Côte d'Ivoire (2015) Enquete sur le niveau de vie des menages en Côte d'Ivoire (ENV 2015). In: Institut National de la Statistique Ministère d'état (Ed.), *Ministère du plan et du*

développement: Direction Générale du Plan et de la Lutte contre la Pauvreté. Abidjan: Institut National de la Statistique du Côte d'Ivoire.

International Cocoa Initiative (2019) Annual report 2019. ICI secretariat in Switzerland. https://cocoainitiative.org/wp-content/uploads/2020/06/ICI_English_Annual_Report_2019.pdf

International Cocoa Initiative (2020) *Hazardous Child Labour in Côte d'Ivoire's Cocoa Communities during COVID-19: Rapid Analysis of Data Collected during Partial Lockdown*. Geneva: UNICEF and ILO. https://cocoainitiative.org/wp-content/uploads/2020/07/ICI_rapid-analysis-covid-impact-child-labour-identifiation_1July2020-1.pdf. Retrieved 16 October 2021.

International Finance Corporation (2020) Creating markets in Côte d'Ivoire: mobilizing the private sector in support of economic transformation in Côte d'Ivoire. https://www.ifc.org/wps/wcm/connect/c3d1ae63-80d1-44a7-8b5f-959e38b4fd09/CPSD-Cote-d-Ivoire.pdf?MOD=AJPERES&CVID=nk4XA5J. Last accessed 16 October 2021.

International Labour Office (2017) *Global Estimates of Child Labour: Results and Trends, 2012–2016*. Geneva: International Labour Office (ILO). https://www.ilo.org/wcmsp5/groups/public/—dgreports/—dcomm/documents/publication/wcms_575499.pdf. Last accessed 16 October 2021.

International Labour Office (2018) *Ending Child Labour by 2025: A Review of Policies and Programmes*. 2nd edition. Geneva: International Labour Office (ILO).

International Labour Office and United Nations Children's Fund (2021) *Child Labour: Global Estimates 2020, Trends and the Road Forward*. New York: ILO and UNICEF. License: CC BY 4.0.

Ivorian Ministry of Education (2021) Pocket school statistics 2020–2021. Strategy, Planning and Statistics Directorate. https://www.men-dpes.org/static/docs/poche/poche_20202021fr.pdf.

Ivorian Ministry of Planning and Development (2021) National development plan NDP 2021-2025: strategic direction. Republic of Côte d'Ivoire, Volume 2.

Jasińska KK and Guei S (2018) Neuroimaging field methods using functional near infrared spectroscopy (NIRS) neuroimaging to study global child development: rural sub-saharan africa. *Journal of Visualized Experiments: JoVE* 2018(132): 57165–57171.

Jasińska KK and Guei S (2022) Ivory coast: promoting learning outcomes at the bottom of the pyramid. In: Wagner DA, Castillo NM and Lewis SG (eds) *Learning, Marginalization, and Improving the Quality of Education in Low-Income Countries*. Cambridge: Open Book Publishers, 343–359.

Jasińska KK, Kembou S, Ogan A, et al. (2021) Soutenir les Enfants à la Maison et à l'École. AEA RCT Registry. DOI: 10.1257/rct.4738-1.0.

Jasińska K, Zinszer B, Xu Z, et al. (2022b) Home learning environment and physical development impact children's executive function development and literacy in rural Côte d'Ivoire. *Cognitive Development* 64: 101265. DOI: 10.1016/j.cogdev.2022.101265.

Jasińska KK, Akpé H, Seri BAD, Zinszer B, Agui-Kouadio RY, Mulford K, Curran E, Ball M-C and Tanoh F (2022a) Evaluating bilingual children's native language abilities in Côte d'Ivoire: introducing the ivorian children's language assessment toolkit for Attié, Abidji, and Baoulé. *Applied Linguistics* 43: 1116–1142. doi: 10.1093/applin/amac025

Jasińska KK, Ball M-C and Guei S (2023) Literacy in Côte d'Ivoire. In: Joshi RM, McBride CA and Kaani B (eds). *Handbook of Literacy in Africa*. Berlin: Springer International Publishing, 235–254.

Jensen P and Nielsen HS (1997) Child labor or school attendance? Evidence from Zambia. *Journal of Population Economics* 10(4): 407–424. DOI: 10.1007/s001480050051.

Kanga D, Moussa R and Sanogo V (2019) Cocoa sector in Côte D'ivoire: are public-private coordination platforms helpful. Global Development Network Working Paper Series: Working Paper No. 96.

Kembou S, Wolf S, Jasinska K, et al. (2022) Child labor activities and schooling decisions in rural Côte d'Ivoire.

Khan F, Wortsman B, Whitehead H, et al. (2024) Modeling the associations between socioeconomic risk factors, executive function components, and reading among children in rural Côte d'Ivoire. *Cognitive Development* 70: 101436. doi: 10.1016/j.cogdev.2024.101436

Krueger A (1996) International labour standards and trade. In: *Annual World Bank Conference on Development Economics*. Washington, DC: World Bank, 281–302.

Kruger DI (2007) Coffee production effects on child labor and schooling in rural Brazil. *Journal of Development Economics* 82(2): 448–463. DOI: 10.1016/j.jdeveco.2006.04.003.

Kuznetsova A, Brockhoff PB and Christense RHB (2017) lmerTest package: tests in linear mixed effects models. *Journal of Statistical Software* 82(13): 1–26. DOI: 10.18637/jss.

Lauwerier T and Akkari A (2015) Teachers and the quality of basic education in sub-Saharan Africa. *Education Research and Foresight: Working Papers Series* 11: 1–11.

Lee VE and Zuze TL (2011) School resources and academic performance in Sub-Saharan Africa. *Comparative Education Review* 55(3): 369–397.

Lee M, Goodman C, Dandapani N, et al. (2015) Review of international research on factors underlying teacher absenteeism. REL 2015-087. *Regional Educational Labouratory Pacific*. https://files.eric.ed.gov/fulltext/ED555740.pdf. Last accessed 16 October 2021.

Lee J, Kim H and Rhee DE (2021) No harmless child labor: the effect of child labor on academic achievement in francophone Western and Central Africa. *International Journal of Educational Development* 80: 102308. DOI: 10.1016/j.ijedudev.2020.102308.

Leinberger-Jabari A, Parker DL and Oberg C (2005) Child labor, gender, and health. *Public Health Reports* 120(6): 642–647.

Lichand G and Wolf S (2022) *Measuring Child Labour: Whom Should Be Asked, and Why it Matters*. Available at SSRN.

Lüdecke (2021) Assessment, testing and comparison of statistical models using R. *Journal of Open Source Software* 6(59): 3112. DOI: 10.31234/osf.io/vtq8f.

Madigan DJ and Kim LE (2021) Towards an understanding of teacher attrition: a meta-analysis of burnout, job satisfaction, and teachers' intentions to quit. *Teaching and Teacher Education* 105: 103425.

Mohammed AR (2023) Children's lives in an era of school closures: exploring the implications of COVID-19 for child labour in Ghana. *Children & Society* 37(1): 91–106. DOI: 10.1111/chso.12611.

Momo MS, Cabus SJ, De Witte K, et al. (2019) A systematic review of the literature on the causes of early school leaving in Africa and Asia. *The Review of Education* 7(3): 496–522.

Moscoviz L and Bélanger J (2019) Quality indicators in public and private pre-schools: evidence from Côte d'Ivoire. In Presentation by Education Partnerships Group.

Moyi P (2011) Child labor and school attendance in Kenya. *Educational Research and Reviews* 6(1): 26.

Mull LD and Kirkhorn SR (2005) Child labor in Ghana cocoa production: focus upon agricultural tasks, ergonomic exposures, and associated injuries and illnesses. *Public Health Reports* 120(6): 649–655.

Mundy K and Manion C (2021) The education for all initiative and the sustainable development goals: history and prospects. *Education and International Development: An Introduction* 57: 57–77.

Muthwii MJ (2004) Language of instruction: a qualitative analysis of the perceptions of parents, pupils and teachers among the Kalenjin in Kenya. *Language Culture and Curriculum* 17(1): 15–32.

Njong AM (2010) The effects of educational attainment on poverty reduction in Cameroon. *International Journal of Educational Administration and Policy Studies* 2(1): 1–8.

Nkamleu GB and Kielland A (2006) Modeling farmers' decisions on child labor and schooling in the cocoa sector: a multinomial logit analysis in Côte d'Ivoire. *Agricultural Economics* 35(3): 319–333.

Nkamleu GB and Ndoye O (2003) Cocoa based farming systems in humid forest zone of west and central africa: constraints and opportunities. In: Paper presented at: science and technology strategies for improved agricultural productivity and food security in West and Central Africa (WCA). Dakar, Senegal, 2003.

OECD (2019) *Indicator D2. What is the student-teacher ratio and how big are classes?* What is the student-teacher ratio and how big are classes? | Education at a Glance 2019 : OECD Indicators. Paris: OECD iLibrary. https://www.oecd-ilibrary.org/sites/a1ef3bfe-en/index.html?itemId=%2Fcontent%2Fcomponent%2Fa1ef3bfe-en

Paruzzolo S (2009) *The Impact of Programs Relating to Child Labour Prevention and Children's Protection: A Review of Impact Evaluations up to 2007*. Vancouver: UCW.

Patrinos HA and Psacharopoulos G (1995) Educational performance and child labor in Paraguay. *International Journal of Educational Development* 15(1): 47–60.

Patrinos HA and Psacharopoulos G (1997) Family size, schooling and child labor in Peru -- an empirical analysis. *Journal of Population Economics* 10(4): 387–405.

Pearson R (2020) GoodmanKruskal: association analysis for categorical variables. R package version 0.0.3. https://CRAN.R-project.org/package=GoodmanKruskal

Pells K (2011) Poverty and gender inequalities: evidence from young lives, Policy Paper 3, Oxford: Young Lives.

Pinheiro J, Bates D, DebRoy S, R Core Team, et al. (2020) Nlme: linear and nonlinear mixed effects models. *R package version* 3: 1–151. https://CRAN.R-project.org/package=nlme

Piper B, Dryden-Peterson S and Kim YS (2006) *International Education for the Millennium: Toward Access, Equity, and Quality. Harvard Educational Review Reprint Series*. Cambridge, MA: Harvard Education Press. 8 Story Street First Floor, 02138.

Piper B, Simmons Zuilkowski S, Dubeck M, et al. (2018) Identifying the essential ingredients to literacy and numeracy improvement: teacher professional development and coaching, student textbooks, and structured teachers' guides. *World Development* 106: 324–336.

Porter G (2010) Transport planning in sub-Saharan Africa III: the challenges of meeting children and young people's mobility and transport needs. *Progress in Development Studies* 10(2): 169–180.

Posso A (2017) Child Labour's effect on long-run earnings: an analysis of cohorts. *Economic Modelling* 64: 465–472.

Psacharopoulos G and Patrinos HA (2004a) Returns to investment in education: a further update. *Education Economics* 12(2): 111–134.

Psacharopoulos G and Patrinos HA (2004b) Human capital and rates of return. *International handbook on the economics of education*. Edward Elgar Publishing, 1, 1–57.

Putnick DL and Bornstein MH (2015) Is child labour a barrier to school enrollment in low-and middle-income countries? *International Journal of Educational Development* 41: 112–120. DOI: 10.1016/j.ijedudev.2015.02.001.

R Core Team (2021) *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. URL https://www.R-project.org/

Ranjan P (1999) An economic analysis of child labor. *Economics Letters* 64(1): 99–105.

Rosati FC and Rossi M (2003) Children's working hours and school enrollment: evidence from Pakistan and Nicaragua. *The World Bank Economic Review* 17(2): 283–295.

RTI International (2015) *Early Grade Reading Assessment (EGRA) Toolkit*. 2nd edition. Washington, DC: United States Agency for International Development.

Sadhu S, Kysia K, Onyango L, et al. (2020) Assessing progress in reducing child labour in cocoa production in cocoa growing areas of Côte d'Ivoire and Ghana. *NORC Final Report*. https://www.norc.org/PDFs/Cocoa_Report/NORC,202020

Sen AK (1999) *Development as Freedom*. New Delhi: Oxford University Press.

Shafiq MN (2007) Household schooling and child labor decisions in rural Bangladesh. *Journal of Asian Economics* 18(6): 946–966.

Slot PL, Leseman PP, Verhagen J, et al. (2015) Associations between structural quality aspects and process quality in Dutch early childhood education and care settings. *Early Childhood Research Quarterly* 33: 64–76.

Spears D (2012) *Effects of Rural Sanitation on Infant Mortality and Human Capital: Evidence from India's Total Sanitation Campaign*. Princeton, NJ: Princeton University.

Spears D and Lamba S (2016) Effects of early-life exposure to sanitation on childhood cognitive skills: evidence from India's Total Sanitation Campaign. *Journal of Human Resources* 51(2): 298–327.

Sprenger-Charolles L (2008) *Early Grade Reading Assessment (EGRA). Results from Senegalese Primary School Students Learning to Read in French and in Wolof–Report for*. Washington, DC: The World Bank.

Tessema ZT, Tamirat KS, Teshale AB, et al. (2021) Prevalence of low birth weight and its associated factor at birth in Sub-Saharan Africa: a generalized linear mixed model. *PLoS One* 16(3): e0248417.

The Department for International Development (2013) Education position paper: improving learning, expanding opportunities. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/225715/Education_Position_Paper_July_2013.pdf. Last accessed 16 October 2021.

Tulane University (2015) *Survey Research on Child Labour in West African Cocoa Growing Areas. School of Public Health and Tropical Medicine*. New Orleans, LA: Tulane University.

UNESCO (2016) *Education 2030: Incheon Declaration and Framework for Action for the Implementation of Sustainable Development Goal 4: Ensure Inclusive and Equitable Quality Education and Promote Lifelong Learning*. Paris: UNESCO.

UNESCO Institute for Statistics (UIS) (2019) Côte d'Ivoire | UNESCO UIS. Data File. Retrieved from: https://uis.unesco.org/en/country/CI

UNICEF (2023) *Child Labor Statistics*. New York: UNICEF DATA. https://data.unicef.org/topic/child-protection/child-labour/

United Nations Children's Fund (1997) *The State of the World's Children*. New York: UNICEF.

United Nations Children's Fund (2019) *A World Ready to Learn: Prioritizing Quality Early Childhood Education – Advocacy Brief*. New York: UNICEF.

United Nations, Department of Economic and Social Affairs (2015) Transforming our world: the 2030 agenda for sustainable development. 21 October 2015, A/RES/70/1 https://www.un.org.cn/info/6/620.html (Last accessed 16 October 2021).

United Nations, Department of Economic and Social Affairs (2020) The sustainable development goals report 2020. https://www.un.org/sustainabledevelopment/progress-report/. Last accessed 16 October 2021.

United Nations, Department of Economic and Social Affairs (2023) *2022 International Trade Statistics Yearbook, Vol. I: Trade by Country | Desa Publications*. New York: United Nations. https://desapublications.un.org/publications/2022-international-trade-statistics-yearbook-vol-i-trade-country

United Nations, Department of Economic and Social Affairs, Population Division (2019) World population prospects 2019, volume II: demographic profiles (ST/ESA/SER.A/427). https://population.un.org/wpp/Publications/Files/WPP2019_Volume-II-Demographic-Profiles.pdf. Last accessed 16 October 2021.

United Nations, Department of Economic and Social Affairs, Statistics Division (2021) 2020 international trade statistics yearbook volume 1: trade by country. https://comtrade.un.org/pb/downloads/2020/VolI2020.pdf. Last accessed 16 October 2021.

Urwick J and Junaidu SU (1991) The effects of school physical facilities on the processes of education: a qualitative study of Nigerian primary schools. *International Journal of Educational Development* 11(1): 19–29.

Varghese NV (1995) School facilities and learner achievement: towards a methodology of analyzing school facilities in India. *Perspectives in Education* 11(2): 97–108.

Vuri D (2008) The effect of availability and distance to school on children's time allocation in Ghana and Guatemala. *SSRN Electronic Journal*. doi: 10.2139/ssrn.1780142

Webbink E, Smits J and De Jong E (2012) Hidden child labor: determinants of housework and family business work of children in 16 developing countries. *World Development* 40(3): 631–642.

Webbink E, Smits J and de Jong E (2013) Household and context determinants of child labor in 221 districts of 18 developing countries. *Social Indicators Research* 110(2): 819–836.

Whitehead H, Ball M, Brice H, et al. (2024) Variability in the age of schooling contributes to the link between literacy and numeracy in Côte d'Ivoire. *Child Development* 95(3): 93–109. doi: 10.1111/cdev.14018

Wickham H (2016) *ggplot2: Elegant Graphics for Data Analysis*. New York: Springer-Verlag.

Wolf S and McCoy DC (2019) Household socioeconomic status and parental investments: direct and indirect relations with school readiness in Ghana. *Child Development* 90(1): 260–278.

Wood RM (2023) A review of education differences in urban and rural areas. *International Research Journal of Educational Research* 14(2): 1–3.

World Bank (2018) Government expenditure on education, total (% of GDP) - Côte d'Ivoire. Retrieved from: https://data.worldbank.org/indicator/SE.XPD.TOTL.GD.ZS?location

World Bank (2019) In the country of cocoa: how to transform Côte d'Ivoire. Economic Situation in Côte D'ivoire, Ninth edition. Source: AFD/ Barry Callebaut, Cocoa farmers' agricultural practices and livelihoods in Côte d'Ivoire, 2016.

Wortsman B, Brice H, Capani A, et al. (2024) Risk and resilience factors for primary school dropout in Côte d'Ivoire. *Journal of Applied Developmental Psychology* 92: 101654.

Zinszer B, Hannon J, Kouadio E, et al. (2023a) Statistical learning and children's emergent literacy in rural Côte d'Ivoire. *Developmental Science* 00: e13448. doi: 10.1111/desc.13448

Zinszer B, Hannon J, Kouadio E, et al. (2023b) Does non-linguistic segmentation still predict literacy in an L2 education? Statistical learning in Ivorian primary schools. *Language Learning* 73: 1039–1086. DOI: 10.1111/lang.12603.

Author biographies

Brooke Wortsman is an M.A. student in School and Clinical Child Psychology at the Ontario Institute for Studies in Education at the University of Toronto.

Jasodhara Bhattacharya is an Ed.D. student in International Education Leadership and Policy at the Ontario Institute for Studies in Education at the University of Toronto.

Joshua Lim is a Ph.D. student in the Curriculum and Pedagogy program with a specialization in Comparative, International, and Development Education at the Ontario Institute for Studies in Education at the University of Toronto.

Dr. Fabrice Tanoh is an Assistant Professor in Economic Sociology in the UFR of Social Sciences, Department of Sociology, at University Péléfero Gon Coulibaly de Korhogo.

Shamina Shaheen is a Ph.D. student in Developmental Psychology and Education at University of Toronto.

Dr. Amy Ogan is an Associate Professor of Learning Sciences in the Human-Computer Interaction Institute at Carnegie Mellon University.

Dr. Kaja Jasińska is an Assistant Professor in the Department of Applied Psychology and Human Development at the Ontario Institute for Studies in Education at the University of Toronto.