Differences in Educational Outcomes of Primary School Pupils: Giving Equal Opportunity to pupils with disabilities and pupils without disabilities in Sub-Saharan Africa.

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Abstract

This study aims at analyzing the differences between pupils with disabilities and pupils without disabilities in terms of proficiency in mathematics and in reading/language in sub-Saharan Africa. We also investigated whether the effect of disability on pupils' proficiency in mathematics and in reading/language differs by certain sociodemographic characteristics such as gender, socioeconomic status, and the location area. To achieve these objectives, we employed a binary logistic model given the dichotomous nature of the dependent variable. Then, the propensity score matching was used to account for endogeneity biases related to the sample selection problem. Using data from PASEC (2014) conducted in 10 sub-Saharan African countries, the results showed that disability status has a negative and statistically significant effect on both proficiency in mathematics and proficiency in reading. The results also revealed that the effect of disability status on proficiency in mathematics differs by gender, location and socioeconomic status; while the effect of disability status on reading/language skills differs only by socioeconomic status. Based on these results, some policy recommendations have been formulated.

Keywords: disability, pupils, performance, Africa

JEL classification: A20, D04, I28, O55

1. Introduction

Despite the special attention given at the World level to people with disabilities, especially the recognition of the right to education for all in international instruments (the Universal Declaration of Human Rights of 1948; the Salamanca Statement and Framework for Action in 1994, calling for inclusive education), children with disabilities continue to face enormous difficulties in accessing education, particularly in sub-Saharan Africa. Several

studies show that compared to pupils without disabilities, pupils with disabilities have lower schooling participation and attendance (Filmer, 2008; Mizunoya et al., 2018, for example). Using 14 household surveys from developing countries, Filmer (2008) shows that people of ages 6–17 with disabilities are significantly less likely to start school or to be enrolled. The work of Filmer highlighted the fact that the order of magnitude of the school participation deficit associated with disability is often larger than deficits related to other characteristics, such as gender, rural residence, or economic status differentials. Analyzing the gap in enrolment in both primary and secondary education between children with disabilities and children without disabilities in 15 developing countries, Mizunoya et al. (2018) highlight a consistent and statistically significant disability gap in both primary and secondary school attendance.

This negative effect of disability on access to quality education could contribute to exacerbating the difficulties of people with disabilities in accessing employment and increasing poverty and precarity among individuals with disabilities. Several studies have found a positive relationship between poverty and disability status (Mitra et al, 2013; Mizunoya & Mitra, 2013 for example). Drawing an economic profile of persons with disabilities in 15 developing countries, Mitra et al. (2013) showed that in most countries, disability is significantly associated with higher multidimensional poverty as well as lower educational attainment, lower employment rates, and higher medical expenditures. Examining differences in employment rates between persons with and without disabilities in 15 developing countries, Mizunoya & Mitra (2013) also showed that people with disabilities have lower employment rates than people without disabilities in nine countries.

Given the global commitment to leave no one behind, analyzing the academic outcomes of students with disabilities is of paramount importance to economic policy makers concerned with achieving the Sustainable Development Goals (SDGs). Among other things, SDG4 aims to ensure equal access to quality education for all and to promote lifelong learning

opportunities. Equality between girls and boys is addressed in target 4.1 of SDG4, while target 4.5 focuses on eliminating gender inequalities in education and ensuring equal access for vulnerable people, including people with disabilities. Yet, very little emphasis has been placed on analyzing the academic outcomes of pupils with disabilities in sub-Saharan Africa so far. Most studies have taken place in developed countries and have provided mixed results (Horn & Berktold, 1999; Richardson, 2001; Gavilan College, 2002; Richardson & Roy, 2002; Jorgensen et al, 2005; Lichtenberger, 2010). Some studies have analyzed the effect of disability status on access to education, poverty, and access to employment in developing countries (Mitra et al, 2013 and Mizunoya & Mitra, 2013 for example). But these studies did not take into account differences in skills between students with disabilities and students without disabilities. In addition, these studies did not specifically focus on sub-Saharan African countries. Other more recent studies have examined the determinants of student performance in Sub-Saharan Africa but have not focused on differences in students' performance due to disability status (e.g., Kadio, 2022). The present study aims to fill this gap.

The main objective of this study is to analyze the differences between pupils with disabilities and pupils without disabilities in terms of their proficiency in mathematics and in reading/language in sub-Saharan Africa. The paper also investigated whether the effect of disability on pupils' proficiency in mathematics and in reading/language differs by certain sociodemographic characteristics such as gender, socioeconomic status, and the location area. To achieve these objectives, we used data collected from a sample of the second grade and the sixth-grade primary school pupils, their teachers and headmasters in over 1800 schools across ten sub-Saharan African countries, by the "Programme d'Analyse des Systèmes Éducatifs" (PASEC) in 2014. We employed a binary logistic model given the dichotomous nature of the dependent variable in the study. Then, the propensity score matching method was used to account for endogeneity biases related to the sample selection problem (Heckman, 2010).

The remainder of this paper is organised into four sections. The second section presents a literature review on the drivers of pupils' academic outcomes while the third section details the empirical strategy and data source. The fourth section sets out the results and discussions before the fifth section concludes the paper.

2. What explains differences in student performance? Theoretical and empirical arguments

The question of the drivers of students' school performance has been widely studied in the literature, both theoretically and empirically, with most of the work coming from developed countries.

2.1. Theoretical explanations for differences in student performance

There are at least four explanatory theories of student performance: the social origin theory, the school effect theory, the teacher effect theory and the class effect theory. The theory of students' social origin, developed by sociologists Bourdieu & Passeron (1972), explains students' academic performance in terms of the cultural baggage they have accumulated during their development in their social groups of reference. According to this theory, the variation in students' academic performance is due to their cultural and social differences (level of education, occupation and parental income); students from economically well-off families perform better than those from disadvantaged families because of their initially greater cultural endowment.

According to school effect theory constructed from the work of Beck & Murphy (1998), the academic performance of students depends on the type of school they attend. According to this theory, certain school-specific characteristics influence student performance. These characteristics (history, clientele, infrastructure, pedagogical resources and type of management) form an internal environment favorable to a learning system that guarantees

student performance. Furthermore, François & Poupeau (2008) show that the political, social, cultural, economic and technological environments, the geographical location and the socio-cultural aspects of the school influence student performance. Thus, these authors classify schools into two categories: so-called advantaged and disadvantaged schools.

From the perspective of the teacher-effect theory, student performance varies from one teacher or group of teachers to another. This variation in performance is due to differences in the teacher's qualification levels, the teaching method applied by the teacher and the teacher's experience. Furthermore, Bressoux (2006) distinguishes between two categories of teachers: effective teachers and ineffective teachers. Effective teachers are those who have some experience, who organize individual work, class discussions, group work, question and answer sessions, provide explanations, and give special guidance to students with learning difficulties. Low-performing teachers, on the other hand, neglect students with learning difficulties; they reduce the content of the program and stick to the simple elements instead of helping them. Thus, for this theory, students' academic performance depends on the quality of the teacher, his or her pedagogy, training and experiences.

The class effect theory, based on the work of Hanushek (1971), explains the academic performance of students by the social composition of the class. Hanushek (1971) observes that students' results depend on the class to which they belong. Thus, according to Veldman & Brophy (1974), a class composed solely of children from affluent families guarantees a higher success rate than a class composed mainly of disadvantaged children. Nevertheless, this theory advocates a mixed class, which benefits disadvantaged children without harming children from more affluent families.

2.2. Some empirical evidences

Building on Bourdieu & Passeron's (1972) seminal study, Maani & Sluti (1990) showed that students' success in school in Uganda is related to their family background, i.e., parents'

education, family income, parents' marital status, and parents' attitudes toward their children's education. Thus, with respect to family income, Maani & Sluti (1990) showed that students from wealthy families do better in school than students from poor families. Similarly, Alcuizar & Alcuizar (2016) showed that the determinants of nutrition and living conditions are the most related factors that have significant effects on the low academic performance of students in Rogongon, Iligan City, Philippines. Despite the existence of numerous studies that seem to corroborate the social origin thesis, the literature remains mixed on the issue. Some studies show that students from poor backgrounds are more likely to succeed than students from rich families. This is the case, for example, of Duru-Bellat (2003), who, in his study of the school systems of Finland and South Korea, showed that a child from a working-class background in these countries has, all other things being equal, a better chance of succeeding in school than a disadvantaged child in countries such as France, Germany or England. This author concludes that the most disadvantaged students in some countries perform better than the most advantaged students in other countries.

In a study carried out in France on 2,500 pupils, Duru-Bellat & Mingat (1988) revealed the importance of the school context for the progress of average pupils, and particularly for pupils from working-class backgrounds. Based on the theory of the school effect, they found that the average level of students in advantaged schools remained higher than that of students in working-class schools. They also demonstrated that the chances of academic success in France depended on the school attended and that the impact of the school on student performance was as decisive as the individual characteristics of the students. Similarly, Das et al (2007) and Glewwe et al (2004) have shown a significant effect of school attended on student performance. The literature on the school effect is mixed, however. In a study in Sweden conducted on data from 10,000 students from the Progress in Reading Literacy Study 2001 (PIRLS 2001), Myrberg (2007) showed that the effect of school type on student achievement disappeared when the parents' level of education was controlled for.

Related to the teacher-effect theory, some studies have shown the relationship between teacher qualification and student performance (Fred & Tamale, 2013; Johansson et al., 2015; Myrberg, 2007; Südkamp et al., 2012). For example, Fred & Tamale (2013) analyzed data from a sample of 128 upper elementary school social studies teachers in eastern Uganda. They found that students who were taught by more qualified teachers performed better than those whose teachers were less qualified. Similarly, Johansson et al. (2015) showed that teacher competence is positively and significantly related to student outcomes in Sweden when using a two-level structural equation model on data from 5271 students and 351 teachers. Again, the results remain mixed. Myrberg (2007), for example, showed that teacher certification has a significant effect on Swedish students' average reading test scores in both public and private schools. However, he found no significant effect of teacher experience, age, gender, in-service training or cooperation.

A high proportion of low-performing students in a classroom may slow the growth of cognitive achievement, but it may also accelerate it, through the effects of specialized instruction focused on the needs of low-performing students. For example, Peetsma et al (2006), analyzing the cognitive and social-emotional development of 8,684 students aged 9-12, found that the increase in mathematics achievement was smaller in classrooms with relatively large numbers of students from migrant parents. They also found that the increase in students' Dutch language proficiency scores was lower in classes with relatively large numbers of students whose parents had low levels of education. Therefore, they concluded that the effects of class composition differ among groups of students. Howie (2005), on the other hand, found that class size had a direct effect on the overall performance of South African students in mathematics.

2.3. How can disability status affect students' academic achievement?

Disability status can contribute to inequalities in educational outcomes between students with disabilities and students without disabilities through the barriers that students with

disabilities face both before accessing school and once in school. Studies have pointed negative societal attitudes surrounding disabilities (Baffoe, 2013; Green, 2014 for example). Once at school, children with disabilities may also encounter inaccessible environments, including communication barriers, the absence of suitable transportation, and the lack of assistive technologies (Bose & Heymann, 2020; United Nations, 2018).

Although there are reasons why students with disabilities may perform less well academically than students without disabilities, empirical studies have produced mixed results (e.g., Horn & Berktold, 1999; Richardson, 2001; Gavilan College, 2002; Richardson & Roy, 2002; Jorgensen et al., 2005; Lichtenberger, 2010). Moreover, most of them have focused on developed countries. In the United States, Gavilan College (2002) showed that students with learning disabilities and other disabilities performed as well as students without disabilities in mathematics and English courses, while Horn & Berktold (1999) reported that students with disabilities who first enrolled in a postsecondary institution in 1989-90 were less likely than students without disabilities to remain enrolled or to earn a postsecondary degree or credential within five years. Results from the Jorgensen et al. (2005) and Lichtenberger (2010) studies also provided conflicting results regarding the performance of students with disabilities compared to students without disabilities. In the United Kingdom, comparing a large group of students with visual impairments to students with no reported disabilities, Richardson & Roy (2002) found that students with visual impairments were less likely to complete their program of study than students without disabilities, and this result remained significant even when baseline variables (age, gender, ethnicity, entry qualifications, and program variables) were controlled for. In contrast, Richardson (2001) found that hearing loss had no effect on the academic measures examined when differences in similar baseline variables were taken into account. The results therefore vary according to the context and the type of disability considered, which justifies specific studies in the context of Sub-Saharan African countries.

Some studies have analyzed the effect of disability status on access to education, poverty, and access to employment in developing countries (Mitra et al, 2013 and Mizunoya & Mitra, 2013 for example). But these studies did not take into account differences in skills between students with disabilities and students without disabilities. In addition, these studies did not specifically focus on sub-Saharan African countries. Other more recent studies have examined the determinants of student performance in Sub-Saharan Africa but have not focused on differences in students' performance due to disability status (e.g., Kadio, 2022).

3. Materials and methods

3.1. Description of the data underlying the study

In this study, we used data from the international assessment conducted by the "Programme d'Analyse des Systèmes Éducatifs" (PASEC) in 2014. These data were collected from a sample of the second grade and the sixth-grade primary school pupils, their teachers and headmasters in over 1800 schools across ten sub-Saharan African countries (Benin, Burkina Faso, Burundi, Cameroon, Chad, Congo, Côte d'Ivoire, Niger, Senegal and Togo). As a result of this international PASEC evaluation (2014), a database was formed for each of the two grades. Only the data from the sixth-grade database were used in this study. This database contains information on 676 schools and 31,213 pupils. The information was collected through three categories of measurement tools, namely tracking sheets, cognitive tests and contextual questionnaires. The tracking sheets are of two types: pupils tracking sheets and school tracking sheets. The cognitive tests or booklets consist of reading and mathematics tests and a contextual questionnaire addressed to pupils to measure their personal characteristics and those of their family environment. The contextual questionnaires were administered to the teachers of the classes whose pupils were selected and to the headmasters whose schools were sampled.

3.2. Description of the main variables of the study

Dependent variable. The dependent variable of the study is the pupil's level of academic performance, specifically, the level of performance in reading and the level of performance in

mathematics. Reading and mathematics performance were measured by the average score obtained by the pupil on the cognitive reading test and the average score obtained on the cognitive mathematics test, respectively. Pupils who have reached a sufficient level of proficiency in mathematics and in reading / language were coded 1 while those who have not reached this level were coded 0. In reading/language, a sufficient level of proficiency is reached when the pupil's score is above 518.4 while a sufficient level of proficiency is reached in mathematics when the pupil's score is above 521.5.

Explanatory Variables. Pupil disability status is the explanatory variable of interest in this study. Previous studies have also used this variable as an explanatory factor of pupil performance (Jorgensen et al., 2005; Lombardi et al., 2012; Fruth & Woods, 2015; Wasielewski, 2017). This variable was identified in the database by the following questions: "Do you have difficulty hearing? ", "Do you have difficulty seeing? ". We code 1 when the pupil answered "Yes" to any of these questions and 0 otherwise. This means that we consider a student to have a disability when he or she has difficulty hearing or seeing. Based on the assumption of no special supports for students with disabilities, they should perform less well than students without disabilities. Therefore, a negative sign of this variable on pupils' academic performance is expected (Wasielewski, 2017).

Apart from the pupil's disability status, pupil's personal characteristics such as age, gender, and the pupil's work outside of school hours were controlled. Some previous studies have also used these variables to explain students' academic performance (Halpern 2007; Aturupane et al., 2013; Chakraborty & Jayaraman 2019). A student's maturity can positively influence academic performance under the assumption that mature students are more likely to show desirable approaches to learning. This is the example of some previous studies (Jansen & Bruinsma, 2005; Wojciechowski & Palmer, 2005) that found that student maturity has a positive and significant effect on academic performance. We then expect a positive sign of age.

For the pupil's gender, we code 1 if the student is a boy and 0 otherwise. Several studies have highlighted gender differences in favor of boys in student performance (Ellison & Swanson, 2010; Robinson & Lubienski, 2011; Nix et al., 2015; Perez-Felkner et al., 2017; Anaya et al., 2022 for example). Thus, the expected sign of gender is positive. In this study, we measured the pupil's work outside of school hours by these three questions: "Do you do housework when you are not in school?", "Do you do field work when you are not in school?", "Do you do business when you are not in school?". We code these three variables as 1 if the pupil answered "Yes" and 0 otherwise. Whether a student does work outside of school hours can affect his academic performance. A student who works more often will be less likely to have a sufficient level of skills because he or she has less time to learn. Therefore, a negative sign of this variable is expected (Halpern, 2007).

We also controlled for the student's social origin using the parental literacy and the socio-economic status of the pupil's family. According social origin theory (Bourdieu, and Passeron, 1972), the student's academic performance depends on the level of education, the occupation and the income of the student's parents. These variables have also been used in some previous studies (Galster, 2012; Alcuizar & Alcuizar, 2016; Gottfried & Gee 2017). We coded parental literacy as 1 if one of the parents of the student is literate and 0 otherwise. The socio-economic status of families is measured through an index based on the possession of a number of durable goods (electricity, television, computer, radio, telephone, freezer, air conditioner, car, tractor, moped, running water tap, latrine with running water, etc.).

School characteristics such as type (public or private), location and infrastructure are also taken into account. The school effect theory (Beck & Murphy, 1998) states that students' academic performance depends on certain school characteristics such as clientele, infrastructure, teaching resources, geographical location, type of school, etc. Studies such as Glewwe et al. (2004) and Das et al. (2007) have shown the significance of the school effect on

student performance. The fact that a student attends a public or private school can therefore affect his or her performance. We coded the school type variable by 1 if it is a community school, 2 if it is a public school and 3 if it is a private school. The geographical location of the school can also affect student performance insofar as a school located in a city has several advantages (electricity, internet connection, infrastructure, etc.) over one located in a village. These advantages provided by the city could allow students attending in the city to perform better than those attending in the village. The "infrastructure" variable is measured by the school's infrastructure index, which is constructed from a set of contextual variables derived from questionnaires to principals, namely the number of functional classrooms in the school in relation to the total number of students, the availability of certain facilities (a separate office for the principal, a store for storing materials, a specific room for teachers, a playground, an independent sports field, etc.) and the presence of toilets or latrines. It is expected that this variable will have a positive effect on student performance.

Teacher characteristics such as age, gender, education level, certification, teaching method, and experience are also controlled. The teacher-effect theory states that students' performance varies from one teacher to another or from one group of teachers to another and that this variation in performance is due to teacher characteristics such as level of qualification, teaching method applied, experience etc. These variables have also been used in some previous studies (Myrberg 2007; Südkamp, Kaiser et al., 2012; Fred & Tamale 2013; Johansson et al., 2015). Teaching method according to Tendo et al. (2016) is also a determinant of students' academic performance. We code this variable 1 if the teacher uses the Competency-Based Approach (CBA), 2 if he or she uses the Situation-Based Approach (SBA), 3 if he or she uses the Goal-Based Pedagogy (GBP), 4 if he or she uses the Large Group Pedagogy (LGP), and 5 if he or she works in small groups.

Table 1: correlation matrix of the main explanatory variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1) Disability	1																	
(2) Sex	0,00	1																
(3) SES	-0,02	0,05	1															
(4) Age	0,06	0,03	0,23	1														
(5) Domestic work	0,00	0,09	-0,09	-0,05	1													
(6) Agricultural work	-0,01	-0,09	-0,26	-0,13	0,27	1												
(7) Trade	-0,05	0,03	0,03	-0,02	0,17	0,18	1											
(8) Number of pupils per class	0,05	-0,03	-0,17	0,09	0,05	0,14	-0,01	1										
(9) School infrastructure index	0,01	-0,05	-0,37	-0,19	0,09	0,23	0,05	0,21	1									
(10) Classroom Learning Resource Index	-0,01	-0,05	-0,20	-0,13	0,02	0,11	0,04	0,05	0,39	1								
(11) Public school	0,02	-0,01	0,20	0,21	-0,07	-0,19	-0,02	0,18	-0,26	0,00	1							
(12) Private school	-0,02	0,00	-0,26	-0,25	0,07	0,22	0,03	-0,15	0,33	0,09	-0,91	1						
(13) Gender	0,06	-0,02	0,09	0,21	-0,01	0,02	0,02	0,08	-0,07	0,00	0,11	-0,10	1					
(14) The teachers 'age	-0,01	-0,02	-0,11	-0,08	-0,01	0,05	-0,03	0,08	0,11	0,11	0,05	-0,03	-0,10	1				
(15) Professional degree	-0,01	0,01	-0,07	-0,09	0,03	0,08	0,01	-0,17	0,08	-0,04	-0,47	0,43	-0,08	-0,08	1			
(16) Years of experience of the teacher	0,00	-0,03	-0,08	-0,04	-0,03	0,03	-0,02	0,11	0,10	0,16	0,08	-0,05	-0,07	0,82	-0,12	1		
(17) Parental literacy	0,03	-0,02	-0,23	-0,07	0,01	0,11	0,00	0,06	0,14	0,07	-0,15	0,17	0,07	0,05	0,05	0,03	1	
(18) Level of education of the teacher	0,01	-0,01	-0,09	0,00	0,04	0,04	0,00	0,13	0,12	0,08	0,04	-0,03	-0,04	-0,13	-0,09	-0,20	0,02	1

Finally, we also consider class characteristics (class size and teaching resources) as explanatory variables of students' academic performance. According to the class effect theory (Hanushek, 1971), students' achievement depends on the class to which they belong. Previous studies (Brandsma & Knuver 1989; Dolton et al., 2003; Howie, 2005; Bratti & Staffolani, 2013) have also considered these variables. In this study, class size is measured by the number of students in the class. The fact that the total number of students in the class is large, may have a negative effect on the overall performance of students (Howie, 2005). We therefore expect a negative sign for this variable. The "teaching resources" variable was measured by the index of teaching resources in the classroom, constructed from a set of contextual variables from the teacher questionnaires and relating to: (i) the number of math and reading textbooks available per student in the classroom; (ii) the availability of textbooks, teaching guides and reading and math programs for the teacher; (iii) the availability of teaching materials such as a board, chalk,

a dictionary, a map of the world, Africa and the country, measuring materials (square, compass, ruler) and a clock; (iv) the availability of a desk and chair for the teacher, a cupboard and shelves for books; (v) a reading corner and a sufficient number of bench tables for the students in the class. It is expected that this variable will have a positive effect on student performance. Simple correlation coefficients between the main explanatory variables of the study are presented in Table 1. Overall, correlations between the main explanatory variables can be said to be very low.

3.3.Empirical strategy for studying the effect of disability status on pupil performance

We analyzed how disability status affects pupils' proficiency in mathematics and reading/language. We adopted a binary measure of pupils' proficiency. Pupils who have reached a sufficient level of competence were coded 1 while those who have not reached this level are coded 0. Recall that in reading/language, a sufficient level of proficiency is reached when the pupil's score is above 518.4. In this case, the pupil is at least able to combine two explicit pieces of information in a document passage or make simple inferences in a narrative or informational text. He/she can also extract implicit information from written materials by making sense of implicit connectors, anaphora, or referents. The student is also able to locate explicit information in long texts and documents with discontinuous text. In mathematics, a sufficient level of proficiency is reached when the pupil's score is above 521.5. In this case, pupils are at least able to answer short arithmetic, measurement, and geometry questions using the three processes assessed: knowing, applying, and reasoning. Some questions call for factual knowledge or a specific procedure, others require analysis of the situation to determine the appropriate approach. In arithmetic, students are able to perform operations with decimal numbers and solve common problems by analyzing the statement or by taking data from a double entry table. They are able to complete logical sequences with decimal numbers or fractions. In measurement, students are able to tell time and can perform unit conversions with or without the aid of a conversion chart. They are also able to solve arithmetic problems

involving operations on days, hours, and minutes or length measurements. In geometry, students know the names of some solids, basic geometric figures, and some notable lines (diagonal, median). Given the dichotomous nature of the dependent variable, a logit specification was employed. The general model is as follows:

$$P_i = \alpha_0 + \alpha_1 D_i + \alpha_2 K_i + \varepsilon_i \quad (1)$$

where *P* indicates whether or not a pupil has a sufficient level of competence in mathematics or in reading / language. *D* indicates whether or not a pupil is disabled and *K* is the set of other explanatory variables in the model; the α are the parameters to be estimated; ε is a random error term. The estimated model is as follows:

$$Prob(Performance = 1|X) = \alpha_0 + \alpha_1 D_i + \alpha_2 K_i + \varepsilon_i \quad (2)$$

The parameters of equation (2) were estimated using the maximum likelihood technique. Of interest is to know whether or not the effect of disability on pupils' performance differs by certain sociodemographic characteristics such as gender, socioeconomic status and the location area. Implicit in equation (2) is the assumption that the differential effect of the disability dummy is constant across the two categories of gender, socioeconomic status and the location area; and the differential effects of gender, socioeconomic status and the location area are also constant across the two categories of the disability dummy. Such an assumption may be untenable, the effect of disability status on the competence of the pupils in mathematics and lecture / language may vary by gender, socioeconomic status and location area. To test this hypothesis, we include in the model not only the main effect of disability, but also its interaction with gender, socioeconomic status and location area. The model is then written as follows:

$$Prob(Performance = 1|X) = \alpha_0 + \alpha_1 D_i + \alpha_2 group_i + \alpha_3 (D_i \times group_i) + \alpha_4 K_i + \varepsilon_i \quad (3)$$

Where D denotes the disability status of the pupil; group, the sociodemographic group; *K* denotes all other explanatory variables in the model. The total effect of disability status is obtained by deriving equation (3) as follows:

$$\frac{\partial Prob(Performance=1|X)}{\partial D_i} = \alpha_1 + \alpha_3 group_i \quad (4)$$

4. Results and discussions

4.1. Descriptive statistics of proficiency level in mathematics and reading / language by sociodemographic characteristics

We first present some descriptive statistics on pupils' proficiency levels in mathematics and reading/language by sociodemographic characteristics such as disability status, socio-economic status of the student's family, gender, parental literacy and area of residence (Table 2). Across the 10 countries, 62.65% of pupils with disabilities did not meet the sufficient reading skill threshold compared to 55.71% of pupils without disabilities. Similarly, 61.68% of pupils with disabilities did not meet the proficiency threshold in mathematics compared to 58.09% of students without disabilities. Mean difference tests (Table 3) showed at the 1% significance level that the average score for reading/language proficiency is higher for students without disabilities. The same is true for mathematics skills. The disability situation seems to reduce the reading and mathematics skills of the students. This is also generally true when analyzing on a country-by-country basis.

According to the socio-economic status of the students' family, in general, we noticed a decrease in the rate of students who have not reached the sufficient threshold of reading skills as we move from the poorest quintiles to the richest quintiles (71.96% of the students in quintile 1, 68.33% of the students in quintiles 2, 61.65% of the students in quintile 3, 49.28% of the students in quintile 4 and 32.21% of the students in quintile 5). With regard to student gender, overall, girls met the sufficient thresholds for reading and math skills more than boys (44.53% of girls versus 40.29% of boys for reading performance and 40.95% of girls versus 40.80% of boys for mathematics performance). Girls appear to perform better in reading and mathematics than boys. However, the gap between girls and boys is smaller in mathematics. Mean difference tests between girls and boys confirm these results at the 1% significance level. The mean

differences between girls and boys are estimated at 7.8 points for reading/language skills versus only 0.8 points for mathematics skills (statistics for all mean difference tests are available and can be obtained upon request). This result appears to contradict previous work highlighting gender differences in favor of boys in student performance (Ellison & Swanson, 2010; Robinson & Lubienski, 2011; Nix et al., 2015; Perez-Felkner et al., 2017; Anaya et al., 2022 for example). However, this result hides differences between countries. In Burkina Faso, Niger and Senegal, boys outperform girls in reading and mathematics. In Chad, boys outperform girls only in reading; and in Togo, boys outperform girls only in mathematics.

Table 2: Descriptive statistics of pupils' proficiency levels in mathematics and reading / language by sociodemographic characteristics

	Performance levels in reading / language						Performance levels in mathematics				
	Less than 365	Level 1	Level 2	Level 3	Level 4	Total	Less than 433.28	Level 1	Level 2	Level 3	Total
Disability											
No	7.36	21.45	26.90	26.65	17.64	100	26.40	31.69	27.28	14.63	100
Yes	7.08	22.86	32.71	25.75	11.60	100	28.34	33.34	26.32	12.00	100
SES groups											
quintile 1	12.72	29.21	30.03	24.13	3.90	100	34.86	28.72	23.75	12.67	100
quintile 2	9.48	25.13	33.72	25.61	6.07	100	30.41	33.50	24.70	11.39	100
quintile 3	6.26	23.72	31.67	26.36	12.00	100	29.04	35.01	25.99	9.96	100
quintile 4	3.81	17.66	27.81	28.30	22.42	100	22.40	35.01	28.78	13.81	100
quintile 5	2.28	10.60	19.33	28.45	39.34	100	14.78	29.79	33.04	22.40	100
Gender of the pupil											
Girl	7.14	20.66	27.67	27.57	16.96	100	27.71	31.34	26.07	14.88	100
Boy	7.41	22.93	29.38	25.35	14.94	100	26.30	32.90	27.83	12.97	100
Pupil's work outside of school hours											
No	5.04	20.38	25.78	25.90	22.90	100	26.62	31.53	28.54	13.31	100
Yes	7.34	21.90	28.66	26.41	15.69	100	26.97	32.19	26.96	13.88	100
Place of residence											
Urban	2.70	11.89	22.46	30.27	32.67	100	15.69	30.79	33.51	20.01	100
Rural	9.80	27.35	31.94	24.23	6.68	100	33.18	32.95	23.40	10.47	100
Parental literacy											
No	11.94	27.90	29.34	22.56	8.27	100	35.85	33.46	21.96	8.73	100
Yes	5.35	19.35	28.26	27.99	19.06	100	23.27	31.63	29.10	16.00	100
Pupil speaks the official language at home											
No	7.30	21.93	28.87	26.77	15.12	100	26.79	32.08	27.08	14.05	100
Yes	7.05	21.07	25.28	22.16	24.44	100	28.93	33.09	26.08	11.90	100

Table 3. Two-sample t-test with equal variances for scores in mathematics and reading by sociodemographic characteristics

	obs1	obs2	Mean1	Mean2	difference	St Err	t value	p-value
Reading score by disability status: 0 1	21517	8753	503.03	491.1	11.93	1.2	9.9	0

Mathematics score by disability status: 0 1	21517	8753	502.48	494.34	8.14	1.21	6.7	0
Reading score by sex: 0 1	14245	16025	503.70	495.93	7.77	1.09	7.1	0
Mathematics score by sex: 0 1	14245	16025	500.56	499.74	0.83	1.1	0.75	0.46
Reading score by location: 0 1	19549	10721	472.921	548.201	-75.28	1.057	-71.25	0
Mathematics score by location: 0 1	19549	10721	483.57	530.32	-46.74	1.12	-41.7	0
Mathematics score by SES status: 0 1	17772	12498	509.70	486.52	23.18	1.11	20.85	0
Reading score by SES: 0 1	17772	12498	522.75	466.64	56.12	1.06	52.85	0

According to the place of location, the results seem to reveal that students living in urban areas perform better in reading/language and mathematics than those living in rural areas (62.94% and 53.52% of students living in urban areas reached the sufficient threshold of competency in reading and mathematics respectively against 30.91% and 33.87% of those living in rural areas). These results were also confirmed by the mean difference tests. The mean difference in proficiency between rural and urban students was estimated at 75.3 points for reading proficiency (versus 46.7 points for proficiency in mathematics), in favor of urban students. This may be explained by the fact that a school located in a city has several advantages (electricity, internet connection, infrastructure, etc.) over one located in a village.

4.2.Results of the logistic regressions and discussions

The estimates based on equations (2) and (3) are reported in Table 4 (only marginal effects are reported). Before interpreting the results, a few words about goodness of fit should be said. For all models, the Wald test showed that the null hypothesis (i.e., that all regression coefficients are jointly zero) is rejected at the 1% significance level. This suggests that the variables included in the regression create a statistically significant improvement in model fit. The predictions are also correct in a high proportion (more than 71% for the prediction of reading performance and more than 75% for mathematics performance), which reflects a good quality of fit.

Estimates based on equation (2) showed at the 1% level significance that, other things being equal, pupils with a disability are less likely to achieve proficiency in math and reading (columns (1) and (2) of Table 4). All else equal, the chances of a pupil with a disability to achieve an adequate level of proficiency in reading decreased by more than 6 percentage points compared to pupils without a disability. Similarly, the chances that a pupil with a disability will achieve an adequate level of proficiency in mathematics decreased by more than 7 percentage points compared to pupils without a disability. This result is consistent with the existing literature (Jorgensen et al., 2005; Lombardi et al., 2012; Fruth & Woods, 2015; Wasielewski, 2016). For the same level of resources, pupils with disabilities should have fewer skills than students without disabilities. For example, apart from the availability of books, students with vision difficulties will need additional medical glasses, for example, to be able to develop their reading skills as much as a pupil without a disability at a comparable level. Similarly, pupils with hearing difficulties will need additional hearing aids. The chances of success for pupils with disabilities also depend on the accommodation capacity of their receiving institutions. If accommodations for students with disabilities are properly implemented in schools, students with disabilities should have the same skills as those without disabilities, all else being equal. In most Sub-Saharan African countries, the lack of accommodation for pupils with disabilities could be the reason why pupils with disabilities perform less well than pupils without disabilities. In order to ensure that disabled pupils are not left behind, actions targeting disabled pupils should be undertaken. In particular, governments should improve the capacity of schools to accommodate students with disabilities. Referring to Amartya Sen's capability approach (Sen, 1992), two individuals with the same resources do not necessarily have the same level of well-being, given the heterogeneity in the conversion of these resources into achievement. Thus, all other things being equal, pupils with disabilities will perform less well because they need special support. The lack of this special support for pupils with disabilities due to the low or non-existent special facilities they need in schools could explain their poor performance

compared to pupils without disabilities. In order to enable pupils with disabilities to be on an equal basis with non-disabled students, governments should provide schools with the additional special resources needed for the particular treatment of pupils with disabilities. This is necessary to meet the global commitment to leave no one behind.

The results highlighted the fact that boys are less likely to have a sufficient level of reading/language skills than girls while girls are less likely to have a sufficient level of mathematics skills, all else being equal. Several studies have highlighted gender differences in favor of boys in student performance in mathematics (Ellison & Swanson, 2010; Robinson & Lubienski, 2011; Nix et al., 2015; Perez-Felkner et al., 2017; Anaya et al., 2022 for example). Ellison & Swanson (2010) showed that girls are underrepresented in the upper end of the math achievement distribution. For Robinson & Lubienski (2011), while girls and boys enter kindergarten with similar levels of math ability, a math achievement gap, in favor of boys, emerges in the first year of school, with a larger gap among the highest performing students in mathematics. Anaya et al. (2022) investigated the role of gender differences in childhood achievement and perceived math ability, as well as parental occupation (science or non-science jobs), in the subsequent decision to major in science in college. They showed a loss of enrollment in Science, Technology, Engineering and Mathematics by young women. Nix et al. (2015) and Perez-Felkner et al. (2017) show that among high school students, boys have higher levels of self-perceived math skills than girls. Given the promising future of employment opportunities in science, technology, engineering, and mathematics-related occupations (Anaya et al., 2022), and that higher levels of mathematical ability significantly predict the likelihood of enrolling in mathematically intensive courses in high school and majoring in mathematically intensive fields during college (Nix et al, 2015; Perez-Felkner et al., 2017), gaps in mathematics performance between girls and boys need to be narrowed in order to reduce gender inequalities in access to promising fields.

The results show that students from poor families are less likely to achieve proficiency in reading and mathematics, all else being equal. The probability of achieving proficiency in reading decrease by 4 percentage points when the student's family is in the poorest socioeconomic status categories, all else being equal. The results show that students with a literate parent are also more likely to reach a sufficient level of proficiency in reading and in mathematics, all else being equal. These results confirm the predictions of social origin theory (Bourdieu & Passeron, 1972), according to which the variation in students' academic performance is due to their cultural and social differences, particularly the parents' level of education, profession and income. Thus, students from economically well-off families perform better than those from disadvantaged families because of their initially greater cultural endowment. Several empirical studies have documented the effect of social background on student performance (Maani & Sluti, 1990; Alcuizar & Rebecca Alcuizar, 2016).

We find that working outside of school hours significantly influences student performance. More interestingly, the influence depends on the nature and intensity of the work performed by the student. Thus, homework seems to have a positive influence on student performance, provided that it is not so frequent that it takes away from the time available for learning. Indeed, all other things being equal, students who do homework frequently or a few times when they are not in class are more likely to achieve a sufficient level of proficiency in reading and mathematics than those who always do homework when they are not in class. But students who never do homework are less likely to have a sufficient level of proficiency. This finding is not surprising given that in many African cultures, housework is part of a child's upbringing and helps discipline the child. Students who do housework within reasonable limits are therefore more disciplined and better able to perform at school.

In contrast, when students are engaged in an economic activity (field work and trade) when they are not in class, they are less likely to achieve proficiency in reading and

mathematics. In reading, all else equal, students who are engaged frequently, a few times, or never in fieldwork are nearly 4, 6, and 10 percentage points more likely to achieve proficiency than students who are always engaged in fieldwork when not in class, respectively. The results are similar for business activities; students who are engaged frequently, a few times, or never in business activities are 4.5, 5, and 8 percentage points more likely to achieve a sufficient level of proficiency than students who are always engaged in business when not in class, respectively. The results are similar for mathematics skills, regardless of whether the student is engaged in a field or business activity. In the context of developing countries, children's engagement in economic activities is related to parental poverty. Students from poor families are therefore expected to be economically active outside of school hours (and even sometimes during school hours) in order to contribute to the survival of their households. According to Gurgand (2005), in agricultural households, child labor is traditionally used, and trains those who will remain to work the land. Moreover, the poorest households have their children work as wage earners, not because they do not value their leisure time, but because they are forced to do so in order to survive. The opportunity cost for poor parents to enroll their children in school is therefore high given the possibility that their children will be economically active. To ensure that students from disadvantaged families are not left behind, conditional social transfers targeting poor families could help reduce the length of time that students from poor families are economically active and thus improve their educational outcomes. Several studies have documented the positive impact of conditional cash transfer programs on student enrollment and attendance, as well as on poverty reduction in developing countries (Schultz, 2004; Handa & Davis, 2006; Edmonds & Schady 2012; Borga & D'Ambrosio, 2021).

School resources have a positive and statistically significant effect on student performance, although the marginal effects associated with these variables are small in magnitude. An increase in the school infrastructure index or an increase in the student's classroom instructional resources index leads to an increase in the probability of being

proficient in mathematics and reading/language. These results seem to corroborate the school effect theory (Beck & Murphy, 1998) according to which certain characteristics of the school, such as infrastructure and teaching resources, influence student performance. Several studies (Duru-Bellat & Mingat, 1988; Glewwe et al., 2004; Das et al., 2007; Kadio, 2022) have found a significant effect of the school attended on student performance. Kadio (2022) has shown in sub-Saharan Africa that learning inequalities are mainly explained by differences in school characteristics. The type of school and the location area also influence academic achievements. Students living in rural areas are less likely to be proficient in math and reading / language than students living in urban or suburban areas, all else being equal. It may be because a school located in a city has several advantages (electricity, internet connection, infrastructure, etc.) over one located in a village. These advantages provided by the city may allow students attending in the city to perform better than those attending in the village.

The results also show that attending a public school reduces the likelihood of achieving proficiency in math and reading compared to attending a community school. In contrast, attending a private school increases the likelihood of achieving proficiency in math and reading. Previous studies have also found similar results (Okon & Archibong, 2015; Kadio, 2022). Several countries in sub-Saharan Africa have implemented a policy of free public primary schooling without increasing material and human resources. The result is an increase in student enrollment while resources are insufficient, which contributes to a reduction in student performance in public schools. This phenomenon is often accentuated in rural areas, which are less well served by school infrastructure and material and pedagogical resources than urban areas.

Teacher experience and his level of education positively affect student performance in mathematics and language/reading. The more experienced the teacher, the more likely his or her students are to achieve a sufficient level of proficiency in mathematics and

reading/language, all else being equal. Similarly, the likelihood of having sufficient level of proficiency in mathematics and language/reading increases with the teacher's education level, all else equal. These results corroborate the predictions of the teacher-effect theory, which considers that student performance varies across teachers or groups of teachers because of differences in teacher qualification levels; the pedagogical method applied; and the experience of the teacher. Several previous studies have also highlighted this finding (Myrberg, 2007; Südkamp et al., 2012; Fred & Tamale, 2013; Johansson et al., 2015).

Table 4: Main drivers of pupils' performance in reading / language and in mathematics

Variables	Sufficient level of proficiency in reading / language	Sufficient level of proficiency in mathematics
	(1)	(2)
The pupil has a disability =Yes	-0.065	-0.023
	(11.17)***	(4.20)***
Sex of the pupil=male	-0.015	0.031
	(2.86)***	(6.34)***
Belonging to the poorest socioeconomic status=Yes	-0.042	-0.004
	(6.86)***	(0.75)
Free school canteen=Yes	0.038	0.062
	(5.56)***	(9.18)***
Age of the pupil	-0.020	0.003
	(11.80)***	(2.09)**
Household work = often	0.029	0.019
	(4.38)***	(3.07)***
Household work = sometime	0.038	0.051
	(5.20)***	(7.42)***
Household work = never	-0.070	-0.082
	(6.70)***	(7.25)***
Agricultural work=often	0.038	0.029
	(4.82)***	(4.14)***
Agricultural work=sometime	0.064	0.053
	(7.64)***	(7.01)***
Agricultural work=never	0.106	0.054
	(12.81)***	(7.04)***
Do trade when not in school = often	0.045	0.037
	(4.51)***	(3.81)***
Do trade when not in school = sometime	0.053	0.081
	(5.33)***	(8.56)***
Do trade when not in school = never	0.088	0.084
	(10.05)***	(9.92)***
Number of pupils per class	0.000	0.001
	(2.54)**	(4.08)***
School infrastructure index	0.007	0.005
	(19.96)***	(15.74)***
Classroom Learning Resource Index	0.005	0.004
	(15.97)***	(15.38)***
Public school	-0.075	-0.068
	(4.03)***	(4.44)***
Private school	0.094	0.090
	(4.84)***	(5.26)***
Place of residence= A big-city suburb	0.058	0.080

Variables	Sufficient level of proficiency in reading / language	Sufficient level of proficiency in mathematics
	(1)	(2)
	(4.38)***	(6.86)***
Place of residence= A large village	-0.137	-0.085
	(17.18)***	(11.41)***
Place of residence= A small village	-0.075	-0.011
	(8.18)***	(1.38)
Gender of the teacher = Female	0.172	0.135
	(26.93)***	(19.10)***
The teachers 'age	-0.006	-0.003
	(10.35)***	(4.66)***
The teacher does not have a professional degree=yes	0.010	0.013
	(1.02)	(1.34)
Years of experience of the teacher	0.004	0.002
	(7.54)***	(2.97)***
Learning method=2	0.129	-0.020
	(3.60)***	(0.51)
Learning method=3	0.120	0.109
	(4.58)***	(3.79)***
Learning method=4	0.188	0.143
	(6.43)***	(4.61)***
Learning method=5	0.145	0.106
	(5.90)***	(3.85)***
Parental literacy=literate	0.055	0.059
	(9.37)***	(11.16)***
Level of education of the teacher=secondary	0.165	0.336
	(4.73)***	(7.19)***
Level of education of the teacher=university	0.181	0.361
	(5.16)***	(7.71)***
Prob > chi2	0.00	0.00
Pseudo R2	0.18	0.13
Percentage correctly classified	71.14	75.20
N	28,199	28,199

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

We now investigate whether or not the effect of disability on pupils' performance differs by certain sociodemographic characteristics such as gender, socioeconomic status, and the location area. The estimates of the marginal effects using equation (3) are reported in Table 5. The results show that the effect of disability on the probability of having a sufficient level of proficiency in mathematics and reading/language does not vary significantly by gender, since the marginal effect associated with the interaction between gender and disability status is not statistically significant (columns (1) and (4) of Table 5). Similarly, the effect of disability on reading/language skills does not vary by location. On the other hand, the marginal effect associated with the interaction between disability status and location is statistically significant at the 1% level. This means that the effect of disability status on the probability of having a

sufficient level of mathematical skills varies according to place of location. All other things being equal, students with disabilities residing in rural areas are less likely to reach sufficient level of mathematics skills than those residing in urban areas. The total effect of residence is estimated to be 0.043, or 0.043=0.087-0.044 (column (6) of Table 5). This result means that the probability of achieving a sufficient level of mathematics proficiency increases by 4.3 percentage points for students with disabilities living in urban areas compared with students with disabilities living in rural areas.

The effect of disability on mathematics and reading/language skills differs by socioeconomic status. All else being equal, students with disabilities from poor families are less likely to have sufficient level of proficiency in mathematics and reading/language than those from wealthy families. These results suggest that in designing their special needs strategies for students with disabilities, governments in Sub-Saharan Africa should particularly target students living in rural areas and belonging to disadvantaged groups such as the poorest SES quintiles.

Table 5: Interaction effect of disability and sociodemographic groups

Variables	Sufficient level of proficiency in reading / language			Sufficient level of proficiency in mathematics		
	(1)	(2)	(3)	(4)	(5)	(6)
The pupil has a disability =Yes	-0.061 (7.27)***	-0.084 (11.62)***	-0.059 (7.98)***	-0.028 (3.63)***	-0.062 (8.67)***	-0.012 (1.85)*
Gender of the pupil	-0.013 (2.17)**	-0.016 (3.07)***	-0.016 (2.95)***	0.028 (4.72)***	0.029 (5.93)***	0.030 (6.11)***
Location area	0.118 (17.88)***	0.118 (17.87)***	0.123 (16.39)***	0.073 (10.43)***	0.073 (10.35)***	0.087 (10.82)***
Belonging to the poorest SES	-0.033 (5.41)***	-0.048 (6.86)***	-0.033 (5.38)***	0.004 (0.72)	-0.022 (3.39)***	0.005 (0.83)
Disability crossed with the pupil's gender	-0.007 (0.58)			0.010 (0.94)		
Disability crossed with belonging to the poorest SES		0.052 (4.41)***			0.089 (8.33)***	
Disability crossed with location area			-0.016 (1.38)			-0.044 (3.62)***
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Prob > chi2	0.00	0.00	0.00	0.00	0.00	0.00
Pseudo R2	0.18	0.18	0.18	0.12	0.13	0.13
Percentage correctly classified	70.9	71	70.9	75.2	75.3	75.3
N	28,199	28,199	28,199	28,199	28,199	28,199

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.3.Robustness checks

Results based on logistic regressions showed that students with disabilities are less likely to have sufficient levels of proficiency in mathematics and reading/language than students without disabilities. However, these logistic results may be biased because the sample of students with disabilities was not randomly selected (Heckman, 1990). It is possible that students with disabilities have certain characteristics that are unique to them and that could have led them to perform less well in mathematics and reading/language than others even in the absence of disabilities. In order to account for this potential endogeneity bias and to test the robustness of our results, we employed the propensity score matching method.

Let D_i be an indicator variable taking the value 1 if a pupil is disabled and the value 0 otherwise. Let Y_i, be the outcome of individual *i*. $Y_i = 1$ if a pupil had a sufficient level of proficiency in mathematics (or in reading / language) and 0 otherwise. There are two potential outcomes for each pupil: $Y_i(D_i = 1)$, if a pupil had a sufficient level of proficiency in mathematics (or in reading / language); and $Y_i(D_i = 0)$, if a pupil did not have a sufficient level of proficiency in mathematics (or in reading / language). We employed the propensity score matching method to overcome the difficulty of not being able to observe both outcomes simultaneously. This approach is widely used in the literature to account for selection bias (Wang et al., 2017; Ataké, 2018). Matching is based on the idea of contrasting the outcomes of program participants with the outcomes of "comparable" nonparticipants. Differences in the outcomes between the two groups are attributed to the program. In this study, we infer the causal effect of the disability status on academic outcomes (had a sufficient level of proficiency in mathematics (or in reading / language), ensuring that the treatment and control groups are as comparable as possible based on propensity scores. According to Rosenbaum & Rubin (1983),

the propensity score is defined as a function of a vector of covariates such the covariates are independent of the assignment to treatment. In this study, the propensity score was estimated using the following logit regression:

$$Propensity\ score = P(D_i = 1|X)$$

$$= \alpha + X'\beta + \varepsilon \quad (5)$$

Where *D* indicates whether a pupil is disabled or not; *X* denotes the set of covariates observed for the pupil *i*. The selected covariates include age, gender, public / private school, socioeconomic status and whether or not the pupil does domestic, agricultural or commercial work when not at school. These variables have been identified in the literature as key predictors of pupil performance (Halpern, 2007; Aturupane et al., 2013; Okon & Archibong, 2015 ; Chakraborty & Jayaraman, 2019; Kadio, 2022). The selection of the matching variables was also based on empirical analysis of the data to ensure that the two main assumptions (the conditional independence assumption (CIA) and common support) were verified. Covariance balance tests, Kernel distribution tests and common support checks were employed.

The results of the Kernel density estimations of the propensity scores of the treatment and control groups before and after matching (see Figure 1 in appendix) showed that the post-matching propensity score distributions for the two groups fit perfectly. Based on these results, we can conclude that the only factor distinguishing the two groups was whether a pupil has a disability. The results suggested that there are no significant differences at the baseline between the treatment and control groups for each of the covariates used (see Figure 2 in appendix). The results also showed that there were similar propensity scores values between treatment and controls. The region of common support was 0.173, 0.531. This result implied that the treatment and the control groups were sufficiently similar for the comparison to be made, on the basis of the same covariates. Therefore, the hypothesis of common support was verified.

The matching technique eliminates bias due to selection on observable characteristics, but bias can still result from unobserved heterogeneity. To check for the presence of a hidden bias, we performed the Mantel-Haenszel (1959) sensitivity test for different values of gamma (the differential of probability of assignment to the treatment group due to unobserved factors), between 1 and 2 and for intervals of 0.05. The results (Table 6) revealed that for each value of gamma considered (Except for gamma values between 1.3 and 1.4 for performance in reading / language; and for gamma values between 1.45 and 1.6 for performance in mathematics), the hypothesis (of underestimation or overestimation of the impact of the disability status due to an unobserved variable) could be rejected at 1% level of significance. We can conclude that the presence of an unobservable variable affecting both the probability of having a disability and the probability of having a sufficient level of proficiency in mathematics and in reading / language did not significantly affect the results of this study.

Table 6: Mantel-Haenszel sensitivity test to check for hidden bias

Sufficient level of proficiency in reading / language					Sufficient level of proficiency in mathematics				
Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-	Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	14.2	14.2	0	0	1	7.9	7.9	0	0
1.05	15.8	12.7	0	0	1.05	9.2	6.5	0	0
1.1	17.3	11.2		0	1.1	10.5	5.2	0	0
1.15	18.7	9.8	0	0	1.15	11.8	4	0	0
1.2	20.1	8.4	0	0	1.2	13	2.8	0	0
1.25	21.4	7.1	0	0	1.25	14.1	1.7	0	0.05
1.3	22.7	5.8	0	0	1.3	15.2	0.6	0	0.3
1.35	23.9	4.6	0	0	1.35	16.3	0.5	0	0.3
1.40	25.1	3.5	0	0	1.4	17.3	1.5	0	0.07
1.45	26.3	2.4	0	0.1	1.45	18.3	2.4	0	0
1.5	27.4	1.3	0	0.4	1.5	19.3	3.4	0	0
1.55	28.4	0.2	0	0.2	1.55	20.2	4.3	0	0
1.6	29.5	0.8	0	0.04	1.6	21.1	5.2	0	0
1.65	30.5	1.7	0	0	1.65	22.1	6.0	0	0
1.7	31.5	2.7	0	0	1.7	22.9	6.9	0	0
1.75	32.4	3.6	0	0	1.75	23.7	7.7	0	0
1.8	33.4	4.5	0	0	1.8	24.5	8.5	0	0
1.85	34.3	5.4	0	0	1.85	25.3	9.2	0	0
1.9	35.2	6.2	0	0	1.9	26.1	10	0	0
1.95	36.0	7.1	0	0	1.95	26.9	10.7	0	0

Sufficient level of proficiency in reading / language					Sufficient level of proficiency in mathematics				
Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-	Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
2.0	36.9	7.9	0	0	2.0	27.6	11.4	0	0

Gamma: odds of differential assignment due to unobserved factors
Q_mh+: Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh-: Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+: significance level (assumption: overestimation of treatment effect)
p_mh-: significance level (assumption: underestimation of treatment effect)

We estimated the average treatment effect on the treated (ATT) by the difference in the expected outcome (having a sufficient level of proficiency in mathematics and in reading / language) with and without treatment for cases that received treatment:

$$ATT = E[Y = 1|D = 1] - E[Y = 0|D = 1] \quad (6)$$

We used the nearest neighbor approach with a caliper of 0.2. That is a treatment group was matched with a control group on the basis of the closest propensity score, but subject to a maximum distance of 0.2 standard deviation, to avoid matching very different pupils. We also applied stratification and radius methods for robustness checks. Regardless of the matching technique employed, the results (Table 7) confirmed the negative impact of disability on the probability to have a sufficient level of proficiency in mathematics and in reading / language. All other things being equal, the probability of having a sufficient level of proficiency in reading / language decreased by between 5.5 and 7 percentage points (depending on the matching technique employed) among pupils with disabilities.

The same is true for mathematics skills. However, the magnitude of the decrease in the probability of achieving proficiency in mathematics is very small (between 1 and 1.5 percentage points). The probability of a girl with a disability achieving proficiency in reading/language decreases by between 5.2 and 8.7 percentage points compared to a girl without a disability. For boys with disabilities, the likelihood of achieving proficiency in reading/language decreases between 4.8 and 5.9 percentage points. For students with disabilities living in urban areas, the probability of achieving proficiency in reading/language decreases by between 7 and 9.4

percentage points (compared to between 4.5 and 5.9 percentage points in rural areas) compared to students without disabilities living in rural areas. Finally, for students with disabilities from poor families, the likelihood of achieving a sufficient level of reading/language proficiency decreases by between 1.2 and 2.2 percentage points (compared to between 8.6 and 10.3 percentage points for students with disabilities from wealthy families) compared to students without disabilities from poor families. Although the results are not very conclusive for mathematical skills, where in some cases disability status seems to have a positive effect on the probability of achieving a sufficient level of proficiency, they highlight inequalities in performance between students with and without disabilities and according to students' socio-demographic characteristics. These results suggest that it is important that special care strategies be put in place in schools for students with disabilities. In developing this strategy, governments in Sub-Saharan Africa should particularly target students from poor families and living in rural areas. This is necessary to ensure that students from disadvantaged social backgrounds are not left out.

Table 7: ATT estimates by sociodemographic characteristics

Sociodemographic groups	Matching methods								
	Nearest Neighbor			Stratification			Radius		
	Treated	Control	ATT (%)	Treated	Control	ATT (%)	Treated	Control	ATT (%)
Sufficient level of proficiency in reading / language									
All	8,402	18,025	-5.9***	8,402	20,88	-5.5***	8,4	20,876	-6.9***
			(0.007)			(0.006)			(0.006)
Girls	3,955	8,482	-5.2***	3,955	9,813	-5.7***	3,953	9,813	-8.7***
			(0.01)			(0.01)			(0.01)
Boys	4,447	9,516	-5.9***	4,447	11,063	-5.1***	4,446	11,062	-4.8***
			(0.01)			(0.01)			(0.01)
Urban	2,881	6,241	-7.0***	2,881	7,573	-7.6***	2,878	7,573	-9.4***
			(0.012)			(0.012)			(0.011)
Rural	5,521	11,759	-5.2***	5,521	13,302	-4.5***	5,520	13,301	-5.9***
			(0.01)			(0.01)			(0.01)
Poor	3,339	7,437	-2.2**	3,339	8,779	-1.2	3,338	8,778	-1.5
			(0.011)			(0.01)			(0.01)
Non-poor	5,063	12,095	-8.6***	5,063	12,095	-8.6***	5,061	12,095	-10.3***
			(0.01)			(0.01)			(0.01)
Sufficient level of proficiency in mathematics									

All	8,402	20,876	-1.0	8,402	20,876	-1.0**	8,400	20,876	-1.5***
			(0.006)			(0.005)			(0.006)
Girls	3,955	8,482	-2.8**	3,955	9,813	-2.4**	3,953	9,813	-4.1**
			(0.009)			(0.008)			(0.009)
Boys	4,447	9,516	0.0	4,447	11,063	0.0	4,446	11,062	0.0
			(0.009)			(0.08)			(0.00)
Urban	2,881	6,241	-3.6***	2,881	7,573	-3.6***	2,878	7,573	-4.6***
			(0.009)			(0.008)			(0.008)
Rural	5,521	11,759	-1.0	5,521	13,302	0.0	5,520	13,301	0.0
			(0.008)			(0.006)			(0.008)
Poor	3,339	7,437	3.5***	3,339	8,779	5.3***	3,339	8,779	5.3***
			(0.011)			(0.009)			(0.01)
Non-poor	5,063	10,606	-5.3***	5,063	12,095	-5.4***	5,061	12,095	-6.8***
			(0.008)			(0.008)			(0.007)

*** p<0.01, ** p<0.05, * p<0.1.
Standard errors in parenthesis
ATT: Average treatment effect on the treated

5. Concluding remarks

This study aims at analyzing the differences between pupils with disabilities and pupils without disabilities in terms of proficiency in mathematics and in reading / language in sub-Saharan Africa. The paper also investigated whether the effect of disability on pupils' proficiency in mathematics and in reading / language differs by certain sociodemographic characteristics such as gender, socioeconomic status, and the location area. To achieve these objectives, we employed a binary logistic model given the dichotomous nature of the dependent variable in the study. Then, the propensity score matching method was used to account for endogeneity biases related to the sample selection problem. Using data from PASEC (2014) conducted in 10 sub-Saharan African countries, the results revealed that disability status has a negative and statistically significant effect on both proficiency in mathematics and proficiency in reading. This result implies that governments should provide schools with the additional special facilities needed for the particular accommodation of pupils with disabilities in order to enable pupils with disabilities to be on an equal basis with non-disabled pupils. This is necessary to meet the global commitment to leave no one behind. The results also revealed that the effect

of disability on mathematics and reading/language skills differs by sociodemographic characteristics. This result suggests that in designing their special needs strategies for students with disabilities, governments in Sub-Saharan Africa should particularly target students living in rural areas and belonging to disadvantaged groups such as the poorest SES quintiles. We find that girls are less likely to have a sufficient level of mathematics skills. Given the promising future of employment opportunities in science, technology, engineering, and mathematics-related occupations, gaps in mathematics performance between girls and boys need to be narrowed in order to reduce gender inequalities in access to promising fields.

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Appendix

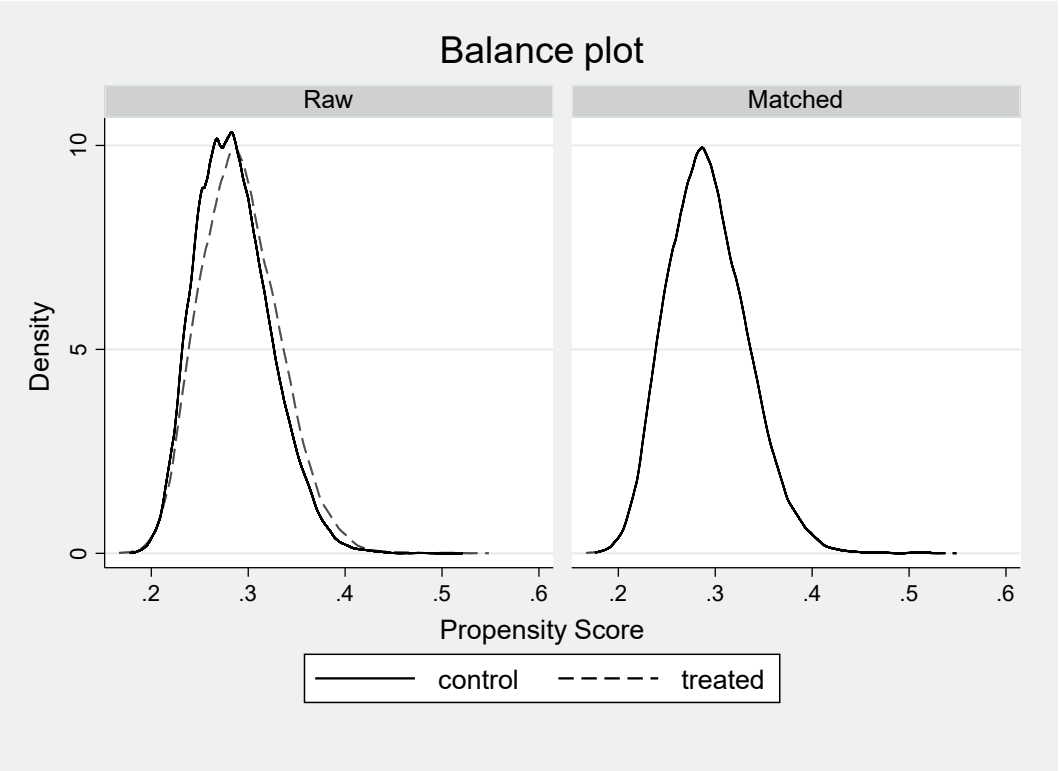

Figure 1: Distribution of propensity scores density in the treatment (pupils with a disability) and the control (pupils without a disability) groups before and after matching. The left side of the figure shows the distribution of propensity scores before matching for both groups while the right side shows the distribution of propensity scores after matching in both groups.

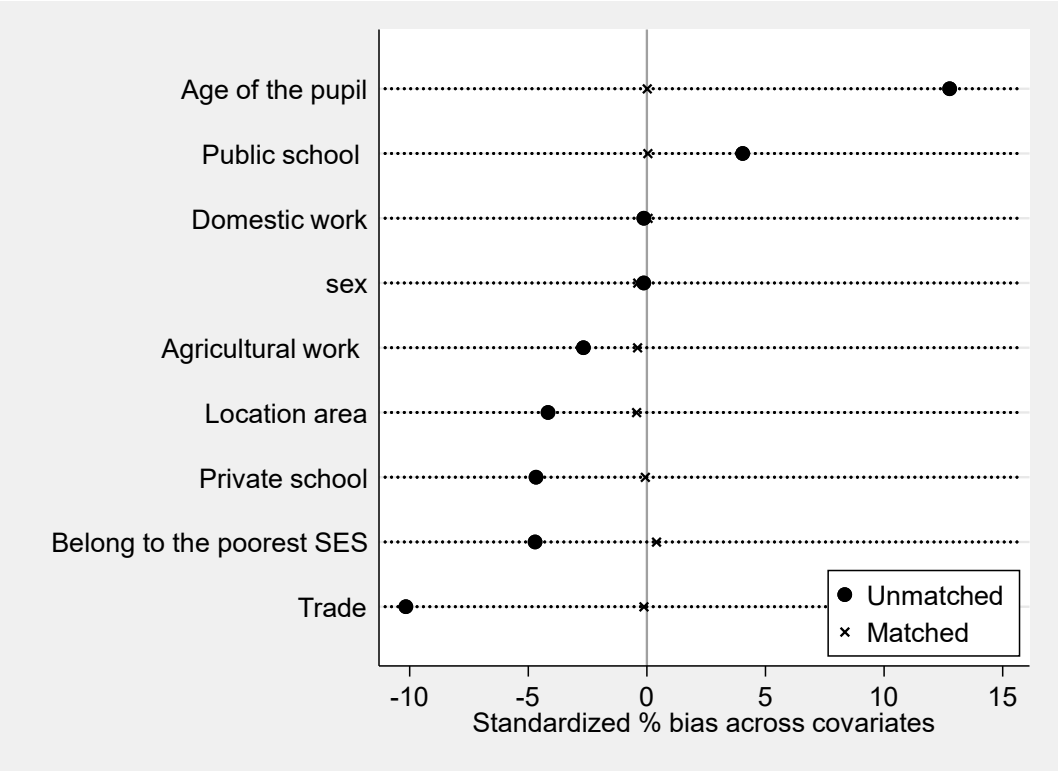

Figure 2 : Figure showing the accuracy of the propensity score matching for the mean of the covariates used. The black circles are the mean differences between the treatment (pupils with a disability) and control (pupils without a disability) groups at the baseline before matching. The crosses are the mean differences between the two matched groups at the baseline.

Table 3: Descriptive statistics of pupils' proficiency levels in mathematics and reading / language by sociodemographic characteristics in Benin

	Proficiency levels in reading / language						Proficiency levels in mathematics				
	Less than 365	Level 1	Level 2	Level 3	Level 4	Total	Less than 433.28	Level 1	Level 2	Level 3	Total
Disability											
No	4.16	20.31	29.20	26.89	19.44	100.00	27.02	40.17	24.43	8.38	100.00
Yes	8.29	27.72	32.55	20.17	11.26	100.00	39.60	37.13	19.68	3.59	100.00
SES groups											
quintile 1	7.76	25.65	35.53	24.94	6.12	100.00	31.53	44.24	21.18	3.06	100.00
quintile 2	9.41	30.79	34.35	18.58	6.87	100.00	41.48	41.22	15.01	2.29	100.00
quintile 3	6.17	26.88	32.08	23.97	10.90	100.00	36.32	40.07	20.82	2.78	100.00
quintile 4	3.41	20.57	30.38	27.52	18.12	100.00	28.34	40.87	24.52	6.27	100.00
quintile 5	1.37	9.90	20.48	28.16	40.10	100.00	16.04	31.91	31.74	20.31	100.00
Gender of the pupil											
Girl	4.87	21.85	31.52	25.72	16.04	100.00	27.90	40.01	24.28	7.80	100.00
Boy	5.78	22.90	28.46	24.29	18.58	100.00	33.43	38.55	21.80	6.22	100.00
Pupil's work outside of school hours											
No	1.96	19.61	39.22	25.49	13.73	100.00	39.22	31.37	21.57	7.84	100.00
Yes	5.35	22.38	29.95	25.05	17.27	100.00	30.29	39.48	23.17	7.06	100.00
Place of residence											
Urban	1.78	10.14	22.69	33.54	31.85	100.00	16.37	36.30	32.83	14.50	100.00
Rural	7.43	29.76	34.63	19.89	8.29	100.00	39.02	41.19	17.24	2.55	100.00
Parental literacy											
No	6.84	27.77	35.21	22.64	7.55	100.00	36.22	42.25	18.81	2.72	100.00
Yes	4.51	19.59	27.54	26.28	22.08	100.00	27.54	37.87	25.32	9.27	100.00
Pupil speaks the official language at home											
No	5.20	21.60	30.15	25.59	17.46	100.00	29.73	39.52	23.65	7.10	100.00
Yes	7.14	37.14	29.29	14.29	12.14	100.00	45.00	35.71	12.86	6.43	100.00

Table 4 : Descriptive statistics of pupils' proficiency levels in mathematics and reading / language by sociodemographic characteristics in Burkina Faso

	Proficiency levels in reading / language						Proficiency levels in mathematics				
	Less than 365	Level 1	Level 2	Level 3	Level 4	Total	Less than 433.28	Level 1	Level 2	Level 3	Total
Disability											
No	3.18	11.71	26.06	36.12	22.93	100.00	15.18	26.97	36.54	21.32	100.00
Yes	3.99	15.34	37.08	31.83	11.76	100.00	16.49	35.29	34.98	13.24	100.00
SES groups											
quintile 1	6.39	15.57	31.94	35.53	10.58	100.00	19.36	33.13	34.33	13.17	100.00
quintile 2	4.12	14.48	32.77	35.82	12.80	100.00	16.77	31.10	36.43	15.70	100.00
quintile 3	3.39	14.04	30.64	34.77	17.16	100.00	17.71	30.09	35.50	16.70	100.00
quintile 4	2.48	11.24	30.36	34.31	21.61	100.00	14.74	29.20	36.20	19.85	100.00
quintile 5	0.45	6.08	15.09	34.23	44.14	100.00	5.41	20.50	38.96	35.14	100.00
Gender of the pupil											
Girl	2.79	13.27	30.38	34.75	18.80	100.00	15.83	32.36	36.03	15.77	100.00
Boy	4.04	12.18	27.91	35.08	20.80	100.00	15.25	26.16	36.17	22.42	100.00
Pupil's work outside of school hours											
No	5.00	22.50	27.50	27.50	17.50	100.00	28.75	25.00	26.25	20.00	100.00
Yes	3.37	12.50	29.21	35.09	19.84	100.00	15.23	29.42	36.34	19.02	100.00
Place of residence											
Urban	2.05	6.03	21.23	38.55	32.14	100.00	8.40	23.99	39.45	28.16	100.00
Rural	4.57	18.48	35.97	31.79	9.19	100.00	21.67	33.88	33.22	11.22	100.00
Parental literacy											
No	4.37	12.80	30.84	37.39	14.60	100.00	15.22	30.21	37.24	17.33	100.00
Yes	2.81	12.69	28.15	33.40	22.95	100.00	15.74	28.77	35.40	20.09	100.00
Pupil speaks the official language at home											
No	3.36	12.20	29.11	35.19	20.14	100.00	14.99	29.23	36.51	19.26	100.00
Yes	4.23	21.69	30.16	30.16	13.76	100.00	24.87	30.69	29.10	15.34	100.00

Table 5: Descriptive statistics of pupils' proficiency levels in mathematics and reading / language by sociodemographic characteristics in Burundi

	Proficiency levels in reading / language						Proficiency levels in mathematics				
	Less than 365	Level 1	Level 2	Level 3	Level 4	Total	Less than 433.28	Level 1	Level 2	Level 3	Total
Disability											
No	0.05	2.65	32.32	56.28	8.70	100.00	0.30	7.85	43.22	48.62	100.00
Yes	0.00	4.16	43.16	48.31	4.37	100.00	0.49	12.55	51.48	35.47	100.00
SES groups											
quintile 1	0.05	3.39	38.14	54.71	3.71	100.00	0.59	9.52	47.61	42.28	100.00
quintile 2	0.00	3.87	40.05	52.60	3.47	100.00	0.13	10.95	47.80	41.12	100.00
quintile 3	0.00	3.78	36.89	53.56	5.78	100.00	0.00	10.67	48.00	41.33	100.00
quintile 4	0.00	0.94	29.11	52.11	17.84	100.00	0.47	9.39	46.48	43.66	100.00
quintile 5	0.00	0.68	14.38	32.19	52.74	100.00	0.00	5.48	24.66	69.86	100.00
Gender of the pupil											
Girl	0.00	2.30	30.76	58.90	8.04	100.00	0.26	5.11	38.16	56.48	100.00
Boy	0.05	4.11	41.95	47.95	5.95	100.00	0.49	13.78	53.84	31.89	100.00
Pupil's work outside of school hours											
No	0.00	1.47	25.00	42.65	30.88	100.00	1.47	7.35	36.76	54.41	100.00
Yes	0.03	3.31	37.06	53.18	6.42	100.00	0.36	9.85	46.85	42.94	100.00
Place of residence											
Urban	0.00	2.58	28.78	47.23	21.40	100.00	0.37	11.44	44.46	43.73	100.00
Rural	0.04	3.43	38.43	54.01	4.10	100.00	0.39	9.56	47.04	43.02	100.00
Parental literacy											
No	0.17	3.64	41.16	51.24	3.80	100.00	0.66	12.23	45.12	41.98	100.00
Yes	0.00	3.20	35.88	53.34	7.57	100.00	0.32	9.28	46.98	43.42	100.00
Pupil speaks the official language at home											
No	0.03	3.02	36.43	53.45	7.07	100.00	0.30	9.58	46.64	43.47	100.00
Yes	0.00	11.01	48.62	38.53	1.83	100.00	2.75	16.51	46.79	33.94	100.00

Table 6: Descriptive statistics of pupils' proficiency levels in mathematics and reading / language by sociodemographic characteristics in Cameroon

	Proficiency levels in reading / language						Proficiency levels in mathematics				
	Less than 365	Level 1	Level 2	Level 3	Level 4	Total	Less than 433.28	Level 1	Level 2	Level 3	Total
Disability											
No	4.14	17.75	22.94	25.95	29.22	100.00	26.73	33.06	28.04	12.17	100.00
Yes	5.67	22.09	25.82	23.88	22.54	100.00	34.70	34.93	20.90	9.48	100.00
SES groups											
quintile 1	14.34	43.02	26.79	13.77	2.08	100.00	61.89	30.75	6.98	0.38	100.00
quintile 2	7.73	31.96	30.93	23.71	5.67	100.00	46.91	39.69	11.60	1.80	100.00
quintile 3	4.73	21.78	29.23	25.92	18.34	100.00	33.14	38.11	23.20	5.56	100.00
quintile 4	1.48	11.58	24.14	30.05	32.76	100.00	20.07	34.98	31.65	13.30	100.00
quintile 5	1.23	6.91	15.80	27.06	49.01	100.00	11.83	28.67	36.61	22.89	100.00
Gender of the pupil											
Girl	4.58	16.34	23.58	26.25	29.26	100.00	29.03	33.49	25.67	11.82	100.00
Boy	4.82	22.08	24.38	24.23	24.49	100.00	30.26	33.98	25.17	10.59	100.00
Pupil's work outside of school hours											
No	2.99	14.93	20.90	25.37	35.82	100.00	32.84	20.90	32.84	13.43	100.00
Yes	4.74	19.43	24.06	25.18	26.58	100.00	29.61	33.99	25.27	11.13	100.00
Place of residence											
Urban	0.15	2.42	13.38	28.87	55.18	100.00	5.97	26.76	41.27	26.00	100.00
Rural	7.32	29.05	30.09	23.07	10.48	100.00	43.25	37.75	16.32	2.68	100.00
Parental literacy											
No	9.60	25.49	26.09	23.69	15.14	100.00	38.98	35.53	21.29	4.20	100.00
Yes	3.61	17.97	23.53	25.52	29.37	100.00	27.58	33.34	26.33	12.74	100.00
Pupil speaks the official language at home											
No	5.01	20.24	24.41	25.41	24.93	100.00	30.95	34.43	24.34	10.28	100.00
Yes	3.04	14.46	21.79	23.93	36.79	100.00	22.68	30.00	31.25	16.07	100.00

Table 7: Descriptive statistics of pupils' proficiency levels in mathematics and reading / language by sociodemographic characteristics in Congo

	Proficiency levels in reading / language						Proficiency levels in mathematics				
	Less than 365	Level 1	Level 2	Level 3	Level 4	Total	Less than 433.28	Level 1	Level 2	Level 3	Total
Disability											
No	2.71	17.91	31.06	25.94	22.38	100.00	18.11	42.20	32.16	7.53	100.00
Yes	2.64	23.37	33.22	21.97	18.80	100.00	23.37	45.17	26.19	5.27	100.00
SES groups											
quintile 1	6.72	36.83	35.75	15.32	5.38	100.00	27.42	48.66	22.31	1.61	100.00
quintile 2	8.09	29.79	42.55	14.04	5.53	100.00	29.36	50.21	19.15	1.28	100.00
quintile 3	2.62	25.15	41.25	23.34	7.65	100.00	23.54	49.90	23.74	2.82	100.00
quintile 4	1.45	14.67	36.05	26.45	21.38	100.00	18.12	44.93	28.44	8.51	100.00
quintile 5	0.44	8.40	18.90	32.04	40.22	100.00	11.60	33.48	42.76	12.15	100.00
Gender of the pupil											
Girl	2.08	17.23	31.09	26.68	22.92	100.00	23.80	39.10	30.13	6.97	100.00
Boy	3.27	20.93	31.96	23.52	20.32	100.00	14.99	46.42	31.51	7.08	100.00
Pupil's work outside of school hours											
No	0.00	14.21	30.00	34.21	21.58	100.00	13.16	45.79	36.32	4.74	100.00
Yes	2.91	19.52	31.66	24.33	21.59	100.00	19.77	42.62	30.40	7.21	100.00
Place of residence											
Urban	0.54	6.65	22.71	32.80	37.31	100.00	11.54	35.78	40.06	12.61	100.00
Rural	4.94	32.14	40.75	16.99	5.18	100.00	27.35	50.24	21.21	1.20	100.00
Parental literacy											
No	4.40	24.18	35.90	21.98	13.55	100.00	24.54	49.82	23.08	2.56	100.00
Yes	2.49	18.52	31.02	25.43	22.54	100.00	18.65	42.03	31.76	7.56	100.00
Pupil speaks the official language at home											
No	3.04	21.30	32.87	25.14	17.66	100.00	20.25	43.64	29.68	6.43	100.00
Yes	1.44	11.31	26.75	24.78	35.73	100.00	15.80	40.04	35.01	9.16	100.00

Table 8: Descriptive statistics of pupils' proficiency levels in mathematics and reading / language by sociodemographic characteristics in Côte d'Ivoire

	Proficiency levels in reading / language						Proficiency levels in mathematics				
	Less than 365	Level 1	Level 2	Level 3	Level 4	Total	Less than 433.28	Level 1	Level 2	Level 3	Total
Disability											
No	3.83	17.99	27.59	26.47	24.12	100.00	25.55	45.94	25.75	2.76	100.00
Yes	4.44	25.62	33.57	23.66	12.71	100.00	36.98	47.52	14.05	1.45	100.00
SES groups											
quintile 1	6.18	31.18	33.43	20.51	8.71	100.00	37.92	44.94	15.45	1.69	100.00
quintile 2	6.74	28.14	35.12	23.95	6.05	100.00	34.65	49.30	15.12	0.93	100.00
quintile 3	5.94	23.21	32.79	24.56	13.50	100.00	35.63	44.53	18.35	1.48	100.00
quintile 4	1.73	18.35	25.43	28.32	26.16	100.00	25.14	47.40	25.58	1.88	100.00
quintile 5	1.56	9.77	24.93	27.34	36.40	100.00	19.26	46.60	29.32	4.82	100.00
Gender of the pupil											
Girl	4.40	20.23	28.96	24.02	22.39	100.00	33.36	45.56	19.23	1.85	100.00
Boy	3.74	20.74	30.06	26.75	18.71	100.00	26.13	47.18	23.99	2.70	100.00
Pupil's work outside of school hours											
No	4.55	21.21	20.45	17.42	36.36	100.00	28.03	36.36	31.06	4.55	100.00
Yes	4.01	20.48	30.00	25.92	19.58	100.00	29.39	46.94	21.45	2.22	100.00
Place of residence											
Urban	1.91	13.73	22.34	28.01	34.02	100.00	21.45	44.74	29.99	3.83	100.00
Rural	6.16	27.31	36.82	23.07	6.64	100.00	37.23	48.19	13.76	0.82	100.00
Parental literacy											
No	5.28	26.80	33.38	22.94	11.60	100.00	36.60	46.26	15.59	1.55	100.00
Yes	3.58	18.24	28.20	26.48	23.50	100.00	26.71	46.53	24.15	2.61	100.00
Pupil speaks the official language at home											
No	3.68	20.31	30.52	26.00	19.50	100.00	28.70	47.12	21.93	2.24	100.00
Yes	6.76	22.06	22.35	22.06	26.76	100.00	34.12	41.47	21.47	2.94	100.00

Table 9: Descriptive statistics of pupils' proficiency levels in mathematics and reading / language by sociodemographic characteristics in Niger

	Proficiency levels in reading						Proficiency levels in mathematics				
	Less than 365	Level 1	Level 2	Level 3	Level 4	Total	Less than 433.28	Level 1	Level 2	Level 3	Total
Disability											
No	26.91	43.09	18.41	8.42	3.18	100.00	65.62	24.47	8.09	1.82	100.00
Yes	26.93	43.74	22.30	6.35	0.69	100.00	69.13	25.39	5.32	0.17	100.00
SES groups											
quintile 1	34.73	46.01	14.73	4.32	0.22	100.00	73.70	21.90	4.32	0.07	100.00
quintile 2	29.07	42.44	21.80	6.10	0.58	100.00	68.31	25.29	6.10	0.29	100.00
quintile 3	21.59	48.01	21.80	7.34	1.26	100.00	65.83	26.83	6.71	0.63	100.00
quintile 4	21.87	43.47	24.80	8.00	1.87	100.00	63.47	27.73	7.20	1.60	100.00
quintile 5	10.66	30.16	23.36	21.54	14.29	100.00	44.67	27.66	19.95	7.71	100.00
Gender of the pupil											
Girl	28.85	42.60	18.59	7.21	2.75	100.00	68.62	24.61	5.58	1.19	100.00
Boy	25.35	43.71	19.63	8.67	2.65	100.00	64.42	24.68	9.15	1.75	100.00
Pupil's work outside of school hours											
No	31.15	42.62	16.39	8.20	1.64	100.00	75.41	21.31	1.64	1.64	100.00
Yes	26.83	43.23	19.22	8.01	2.72	100.00	66.11	24.72	7.67	1.49	100.00
Place of residence											
Urban	11.84	32.75	27.96	17.88	9.57	100.00	47.48	30.23	16.88	5.42	100.00
Rural	32.32	46.97	16.00	4.48	0.23	100.00	73.06	22.65	4.20	0.09	100.00
Parental literacy											
No	32.72	44.85	16.26	5.83	0.34	100.00	71.21	23.31	5.28	0.20	100.00
Yes	21.31	41.63	21.96	10.13	4.97	100.00	61.57	25.95	9.74	2.75	100.00
Pupil speaks the official language at home											
No	26.65	42.99	19.37	8.24	2.76	100.00	65.60	25.09	7.76	1.55	100.00
Yes	34.29	49.52	13.33	1.90	0.95	100.00	85.71	12.38	1.90	0.00	100.00

Table 10: Descriptive statistics of pupils' proficiency levels in mathematics and reading / language by sociodemographic characteristics in Senegal

	Proficiency levels in reading / language						Proficiency levels in mathematics				
	Less than 365	Level 1	Level 2	Level 3	Level 4	Total	Less than 433.28	Level 1	Level 2	Level 3	Total
Disability											
No	3.10	14.63	22.58	29.55	30.14	100.00	14.49	27.18	33.38	24.95	100.00
Yes	9.59	25.62	30.35	20.63	13.80	100.00	29.70	35.61	22.73	11.96	100.00
SES groups											
quintile 1	7.47	27.71	31.57	23.61	9.64	100.00	23.61	37.59	28.67	10.12	100.00
quintile 2	8.92	25.20	31.23	22.83	11.81	100.00	29.66	32.28	27.56	10.50	100.00
quintile 3	3.97	20.59	27.06	28.38	20.00	100.00	22.50	30.29	31.47	15.74	100.00
quintile 4	4.32	12.81	20.06	31.79	31.02	100.00	14.35	27.47	33.33	24.85	100.00
quintile 5	2.43	9.00	18.86	26.14	43.57	100.00	9.71	24.00	29.71	36.57	100.00
Gender of the pupil											
Girl	4.87	21.85	31.52	25.72	16.04	100.00	19.72	29.75	31.91	18.61	100.00
Boy	5.16	17.63	24.40	26.79	26.02	100.00	17.24	29.10	28.87	24.79	100.00
Pupil's work outside of school hours											
No	2.86	12.86	18.57	31.43	34.29	100.00	12.86	27.14	30.00	30.00	100.00
Yes	4.90	17.71	24.83	27.04	25.52	100.00	18.73	29.51	30.53	21.23	100.00
Place of residence											
Urban	1.01	5.94	15.42	26.68	50.95	100.00	6.45	18.33	32.49	42.73	100.00
Rural	6.34	22.12	28.27	27.34	15.93	100.00	23.30	33.78	29.74	13.18	100.00
Parental literacy											
No	6.58	22.06	28.44	26.42	16.50	100.00	24.19	31.68	29.15	14.98	100.00
Yes	3.92	15.19	22.65	27.54	30.70	100.00	15.57	28.25	31.25	24.93	100.00
Pupil speaks the official language at home											
No	4.57	16.95	24.54	27.62	26.32	100.00	17.84	29.11	31.00	22.04	100.00
Yes	10.37	30.37	27.41	17.78	14.07	100.00	33.33	36.30	20.74	9.63	100.00

Table 11: Descriptive statistics of pupils' proficiency levels in mathematics and reading / language by sociodemographic characteristics in Tchad

	Proficiency levels in reading / language						Proficiency levels in mathematics				
	Less than 365	Level 1	Level 2	Level 3	Level 4	Total	Less than 433.28	Level 1	Level 2	Level 3	Total
Disability											
No	18.95	39.94	25.95	12.13	3.03	100.00	45.60	38.02	14.29	2.10	100.00
Yes	16.83	41.18	28.27	12.09	1.63	100.00	41.67	40.85	16.01	1.47	100.00
SES groups											
quintile 1	22.91	44.68	23.30	8.15	0.96	100.00	52.25	34.90	12.27	0.58	100.00
quintile 2	22.22	36.88	26.71	11.82	2.36	100.00	45.39	39.48	13.48	1.65	100.00
quintile 3	14.16	40.67	29.89	12.13	3.15	100.00	40.90	42.92	14.16	2.02	100.00
quintile 4	6.60	41.62	34.52	13.71	3.55	100.00	34.01	48.73	14.72	2.54	100.00
quintile 5	8.72	23.85	27.98	29.82	9.63	100.00	23.39	38.07	30.28	8.26	100.00
Gender of the pupil											
Girl	22.41	43.51	21.89	10.35	1.83	100.00	52.56	35.91	10.62	0.92	100.00
Boy	16.43	38.68	28.84	12.98	3.07	100.00	40.66	40.15	16.75	2.43	100.00
Pupil's work outside of school hours											
No	7.69	39.74	28.21	19.23	5.13	100.00	39.74	39.74	20.51	0.00	100.00
Yes	18.76	40.28	26.50	11.87	2.58	100.00	44.73	38.73	14.54	2.00	100.00
Place of residence											
Urban	9.77	36.99	33.70	15.70	3.84	100.00	35.89	44.02	17.01	3.07	100.00
Rural	23.94	42.37	21.96	9.82	1.91	100.00	50.14	35.38	13.28	1.20	100.00
Parental literacy											
No	18.79	39.79	26.80	12.41	2.20	100.00	46.98	38.52	12.88	1.62	100.00
Yes	18.16	40.55	26.42	11.95	2.94	100.00	43.14	38.91	15.84	2.12	100.00
Pupil speaks the official language at home											
No	17.87	40.00	26.71	12.64	2.78	100.00	43.52	38.84	15.60	2.04	100.00
Yes	25.15	43.71	24.55	5.39	1.20	100.00	58.08	37.72	3.59	0.60	100.00

Table 12: Descriptive statistics of pupils' proficiency levels in mathematics and reading / language by sociodemographic characteristics in Togo

	Proficiency levels in reading / language						Proficiency levels in mathematics				
	Less than 365	Level 1	Level 2	Level 3	Level 4	Total	Less than 433.28	Level 1	Level 2	Level 3	Total
Disability											
No	6.07	27.86	33.61	20.14	12.30	100.00	23.24	33.61	27.06	16.08	100.00
Yes	6.47	26.01	32.48	21.70	13.34	100.00	21.16	33.69	28.98	16.17	100.00
SES groups											
quintile 1	6.98	36.05	37.11	15.50	4.36	100.00	28.78	40.12	24.03	7.07	100.00
quintile 2	10.98	32.95	37.10	14.98	3.99	100.00	30.78	38.60	23.63	6.99	100.00
quintile 3	6.34	25.38	36.55	23.31	8.41	100.00	22.76	33.10	31.31	12.83	100.00
quintile 4	1.70	19.11	29.94	26.54	22.72	100.00	12.74	26.54	33.55	27.18	100.00
quintile 5	1.75	10.50	16.25	29.50	42.00	100.00	7.00	18.75	28.25	46.00	100.00
Gender of the pupil											
Girl	6.87	27.29	32.03	20.82	12.99	100.00	25.36	32.44	27.29	14.91	100.00
Boy	5.58	27.56	34.44	20.24	12.18	100.00	20.63	34.61	27.68	17.08	100.00
Pupil's work outside of school hours											
No	5.41	27.03	35.14	13.51	18.92	100.00	21.62	27.03	29.73	21.62	100.00
Yes	6.17	27.44	33.33	20.58	12.47	100.00	22.78	33.71	27.47	16.04	100.00
Place of residence											
Urban	1.10	9.83	23.65	32.49	32.93	100.00	7.29	21.44	34.59	36.69	100.00
Rural	8.13	34.29	37.13	15.83	4.60	100.00	28.79	38.38	24.74	8.09	100.00
Parental literacy											
No	11.27	36.30	34.23	14.58	3.62	100.00	33.30	38.47	21.92	6.31	100.00
Yes	3.98	23.65	32.98	23.03	16.36	100.00	18.26	31.56	29.89	20.29	100.00
Pupil speaks the official language at home											
No	5.96	28.01	34.14	20.10	11.80	100.00	22.70	34.37	27.68	15.26	100.00
Yes	9.28	18.56	21.13	26.80	24.23	100.00	23.71	22.16	24.74	29.38	100.00