

Home environment, pre-schooling and children's literacy in sub-Saharan Africa francophone



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Background: The sustainable development goal (SDG) 4.2 calls to 'ensure that all girls and boys have access to quality early childhood development, care and preprimary education so that they are ready for primary education'. It is then important to identify early childhood literacy drivers for better decision-making in education.

Objectives: This research investigates the impact of pre-schooling and home environment effect on children's literacy in sub-Saharan Africa francophone countries.

Method: A total of 21 933 Grade 2 children participated in the regional assessment of literacy in 14 countries. Items on cognitive skills were used to assess children's literacy skill. A contextual questionnaire was used to collect data on the home environment and children's characteristics. Descriptive statistics, logistic regression and inverse-probability-weighted regression adjustment were used to estimate the impact of pre-schooling and home environment on children's literacy skill.

Results: At least 57% of children in Grade 2 did not have the literacy skill required to pursue their learning without difficulty. Only 28% of children attended preschool. Home-language and reading at home have the highest effect size on children's literacy skill. Attending preschool improves the percentage of children capable to pursue their learning without difficulty by 10%. Furthermore, that improvement is 15.7% for children who attended preschool. Impact of pre-schooling varies between countries and slightly across gender.

Conclusion: Findings of this research call for better access to pre-schooling and better home environment to improve children's literacy skill. The research will contribute to efforts of the sub-Saharan Africa francophone countries to achieve the SDG 4.2.

Contribution: This research contributed to fill the knowledge gaps on Early Childhood literacy in the Global South. It highlighted home environment drivers and the impact of preschooling on children's literacy skills in the Global South.

Keywords: preschool; evaluation; literacy; early childhood; home environment; education; gender; francophone; Africa.

Introduction

The early childhood years (0–8 years) are critical for learning and have effects into adulthood (Kauerz 2022:186). Literacy proficiency in the early grades is an essential element for academic success in school and lifelong learning (Chapman 2000). Babies' brains grow faster at a speed of 700 new neural connections a second and before three years of age a child has 1000 trillion synapses, representing four times the number in an adult brain (Kiser 2015). High-quality programmes during this period are beneficial for children and the society.

The international agenda on sustainable development goals (SDGs) calls for 'no one left behind' and to 'Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all' (SDG 4) (United Nations 2015). The target 4.2 of SDG 4 highlights the importance to 'ensure that all girls and boys have access to quality early childhood development, care and preprimary education so that they are ready for primary education' (United Nations 2015).

Economist researchers on early childhood interventions highlight the returns on investments in children's early years (Heckman et al. 2010). They found that the total return on investment in children is 2.5–10.8 for each one dollar invested. It is therefore wise for organisations and countries to invest in best practices that benefit young children (Reynolds et al. 2011; Stipek et al. 2017).

Sociologists investigated equity in early childhood interventions. They found inequalities in opportunities and outcomes for children from low socioeconomic status, disrupted family and diagnosed disabilities (Henig 2013). Reardon and Portilla (2016) highlight achievement gaps in the United States of America (USA) by the time children enter kindergarten and no significant change occurs between kindergarten and fourth grade.

Most of the studies on early childhood literacy are done in developed countries, and there is a knowledge gap about early childhood education and children's literacy skills in Africa francophone countries. Especially, little is known about the pre-schooling impact on children's literacy skills in second grade in Africa francophone countries. Because children grow up in diverse environments like family, community and society, studies on early education should be contextualised in Africa. Consequently, it is important to investigate the following research questions: Does home environment such as home-language, books, reading at home and the presence of someone at home who read French are drivers of children's literacy skills in sub-Saharan Africa francophone countries? What is the impact of pre-schooling on children's literacy skill? Does pre-schooling impact differently across gender and countries?

The purpose of the research is to fill the knowledge gaps of the pre-schooling impact and home environment effects on children's literacy skills in sub-Saharan Africa francophone countries. This research investigates (1) the drivers of the home environment such as home-language, books, reading at home and the presence of someone at home who reads French, that affect children's literacy skills, (2) the impact of pre-schooling on children's literacy skills, and (3) the impact of pre-schooling across gender and countries. Findings of this research could help families, organisations and governments for better decision-making on children's literacy in Africa.

Background

In sub-Saharan Africa francophone countries, enormous efforts have been made in recent years to improve access to school (Loye et al. 2020a). However, this improvement is not translated into quality learning for all children. According to the regional assessment Programme d'Analyse des Systèmes Éducatifs de la CONFEMEN (PASEC) report of 2019, roughly one out of two children in second grade or grade 2 (55.0%) does not have the literacy skills required to pursue their learning. By the end of the primary school (grade 6), 52.1% of children still do not have sufficient literacy skills to better integrate into society. Such a situation could impact the adulthood of those children (Kauerz 2022).

Researchers found that early literacy is a predictor of literacy skills later (Fantuzzi-Chapman 2012; Wylie & Thompson 2003). Furthermore, early literacy impacts lives in adulthood: the higher literacy skills, the better opportunities to be employed and the better salaries (Fantuzzi-Chapman 2012). Regarding the benefits of early literacy, it is important to

understand the factors that affect children's literacy to leave no child behind.

Home environment and children's literacy

Home environment has been widely investigated in the field of early development (Collins et al. 2000). Such an environment provides an important contribution to children's development, learning and school success (Collins et al. 2000). Bradley and colleagues demonstrated that home learning environment constitutes an array of characteristics, including educational interactions and activities, and making learning materials available at home affects children's literacy (Bradley & Caldwell 1995). Home learning environment is an indicator of the quality and parental practices of resource provision, educational activities and interactions aiming to facilitate and to invest in children's cognitive development and learning (Bradley et al. 2001; Son & Morrison 2010). Son and Peterson (2017) showed that family income is important for improving the home social environment. Smith and Dixon (1995) revealed that the quality and the number of literacy activities influence children's literacy skills.

In Africa, especially in sub-Saharan Africa francophone countries, many home-languages are different from the teaching language that is generally French. That difference could be a barrier to children's reading performance. Furthermore, many children in those countries live in rural area where French is rarely used in daily activities (Agence Française de Développement [AFD] 2010). However, Scott et al. (2020) used the Hopkins Verbal Learning Test-Revised (HVLT-R) to assess students' performance at age 18 or older in South Africa; they did not find difference in performance between students who were educated in isiXhosa and those who were educated in English.

Socioeconomic status and children's literacy

Research highlights the impact of the socioeconomic status of the family on academic skills. Children from disadvantaged socioeconomic families demonstrate weaknesses in academic skills compared with children from wealthy families (Fantuzzi-Chapman 2012; Fantuzzo et al. 2005). Fantuzzi-Chapman (2012) showed that the socioeconomic status of the family had the most robust impact on early literacy skills compared with other variables such as reading and supportiveness. Furthermore, poor mother's education exposes children at risk for poor academic skills. Fantuzzo et al. (2005) found that poor socioeconomic status of the family, poverty and poor maternal education are barriers to children's academic skills.

Pre-schooling and children's literacy

Schonberg et al. (2019) identified home literacy environment, maternal education, maternal employment and the child's age as predictors of preschool enrolment. Whitehurst and Lonigan (1998) highlight the significant impact of preschool literacy activities on the development of children's literacy. Exposure to books is important in children's literacy

development. Findings from literacy research pointed out that children who get off to a poor start in literacy rarely catch up (Torgesen & Burgess 1998). Consequently, the poor first-grade reader remains poor reader because of accumulation of literacy gaps over time. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) report on inclusion and education, the gross enrolment in pre-primary education is 33% in sub-Saharan Africa countries (UNESCO 2020). Regarding the low enrolment rate in pre-primary education, many children will miss the opportunity to get ready for primary education.

Research methods and design

Data

The study uses quantitative data from the 2019 regional assessment of Grade 2 children in literacy and mathematics. Such an assessment is conducted by the *Programme d'Analyse des Systèmes Éducatifs de la Conférence des ministres de l'éducation des États et gouvernements de la Francophonie* (PASEC) [Education Systems Analysis Programme of the Conference of Ministers of Education of Francophone States and Governments]. The data are available for researchers on demand. We received the data for the purpose of this research.

Sampling strategy

The PASEC assessment is a three-stage sampling design:

1. At the first stage, after identifying schools having at least one Grade 2 class and allocating these schools to the different strata, 90 schools were selected with a proportional probability to the numbers of children enrolled in Grade 2. Within each stratum, an even number of schools were selected.
2. For the second stage, one Grade 2 class is selected from the list of Grade 2 classes in the selected schools. If the school has only one class of that Grade 2, that one is selected. The third stage involves selecting 16 children from the selected Grade 2 classes.
3. Pupils of 14 countries shown in Figure 1 (Benin, Burkina Faso, Burundi, Cameroon, Congo, Cote d'Ivoire, Gabon, Guinea, Madagascar, Niger, Democratic Republic of Congo, Senegal, Chad, and Togo) participated in the literacy assessment. A total of 21933 Grade 2 children including 47.9% females participated in the assessment. Participants are on average 8 years old. Weights are computed based on the sampling design.

For the purpose of this research, observations having missing values for pre-schooling were deleted from the dataset. The sample size is then 20679 children for the analysis.

Data collection tools

Booklets of items on cognitive skills were used to assess children's literacy skills. A contextual questionnaire was administered to households' heads for data collection on family environment and children's characteristics.

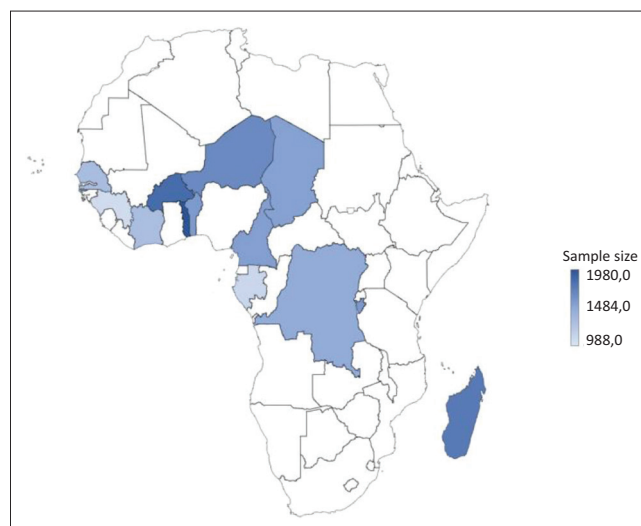


FIGURE 1: Sample size per participating country to the literacy assessment.

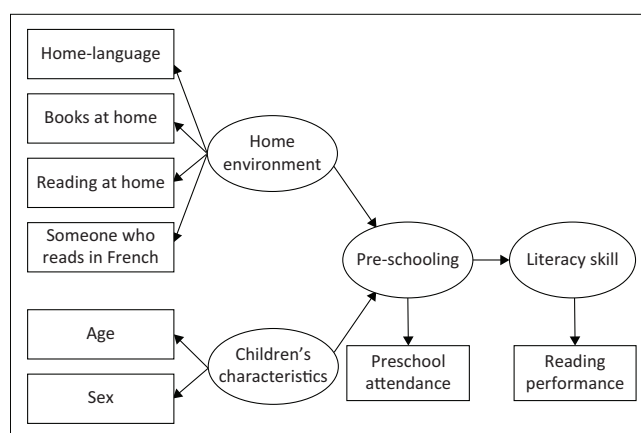


FIGURE 2: Variables definition.

Variables

In the database of the Grade 2 assessment, the following variables were available: children's literacy skill, student test items, student and family characteristics, teacher's personal characteristics and classroom learning conditions, the principal's personal characteristics and learning conditions in the school, schools' and children's weights. For this research, student's literacy skill and characteristics, family environment were investigated (Figure 2).

Children's literacy skill is a score estimated by the PASEC team using the Rasch model. For the purpose of this research, literacy is measured through children's reading performance to the assessment. It is a binary variable based on the literacy score. Performing children are those who reach at least the level 3 of the four on literacy skill noted 1 (score higher than 540) and 0 otherwise (PASEC 2019). Performing children can combine two explicit pieces of information in a document or make inferences in a narrative or informational text. They can extract implicit information from written materials by making sense of implicit connectors, or referents. They are also able to locate explicit information in long texts and documents with discontinuous text.

Children's characteristics are measured as age and sex. Pre-schooling refers to preschool attendance. It is a binary variable taking 1 if the child attended preschool and 0 otherwise. Home environment refers to home-language, availability of someone in the family who can read in French, availability of books at home, child literacy attitude at home.

Analysis methods

Firstly, children's profiles were presented through descriptive statistics using frequency tables and means. The sampling weights for children were used to have reliable estimates.

Secondly, to answer the first research questions on drivers of children's literacy skill in the family environment, all the independent variables were entered in a binary logistic regression model to estimate the effect of each variable controlling for others. Logistic regression is powerful for cross-sectional data with binary outcome. The effects of each independent variable are interpreted using the odds ratio (OR) derived from the model. The p -value is set to 5% for the level of significance. Therefore, when the p -value is lower than 5%, the effect of the independent variable is considered to have a significant effect on literacy skill. When the OR for a group is higher than 1, children belonging to such a group have OR times the likelihood of the reference group in literacy skill. If OR is lower than 1, children in the group have 1 – OR times the likelihood to perform less in literacy than the reference group.

Despite the use of the p -value to judge the significance of an effect, measurement of effect size is important to understand the magnitude of difference between groups. Azuero (2016) recommended to compute an effect size based on OR as follows: $d = \ln(OR) \times \sqrt{6} / \pi$. When d is lower than 0.20, the effect size is small; for $0.5 \leq d < 0.80$, the effect size is moderate; and for $d \geq 0.8$, the effect size is large (Cohen 2003).

Thirdly, to answer the second research question on the impact of pre-schooling on children's literacy skill, inverse-probability-weighted regression adjustment (IPWRA) was used. Inverse-probability-weighted regression adjustment is a double-robust method (Wooldridge 2007) used to estimate the effect of pre-schooling on children's skills, controlling for family environment and children's characteristics. The model was applied to the global data of the 14 countries. Average treatment effects (ATE) and average treatment effects on treated (ATET) were the estimates used in this model. Average treatment effects is the effect of pre-schooling on literacy skill if all Grade 2 children attended preschool, while ATET is the effect of pre-schooling on children who attended preschool.

Fourthly, IPWRA was applied to each country dataset, and on females and males' data to look at the differences in terms of impact of pre-schooling on children's literacy skill in Grade 2. This allows us to answer the fourth research question. Stata 17 was used to perform the analyses. Excel was used for graphic design.

Ethical considerations

This article followed all ethical standards for research without direct contact with human or animal subjects.

Results

This section presents children's profile, drivers of children's literacy from the home environment, and the impact of pre-schooling on children's literacy in participating countries and different genders.

Children's profile

Children in Grade 2 were 8 years old on average and 28.2% of them attended preschool (Table 1): those who attended preschool were younger (7.8 years old) than those who did not (8.5 years old). Children who attended preschool were more likely to have someone at home who could read in French and 68% of them spoke at least that language at home compared with children who did not attend preschool, who only spoke the local vernacular. At least half of children (56.5%) who attended preschool had books at home and 68.2% of them use to read at home. For children who did not attend preschool, only 31.5% had books at home and 45.4% use to read there.

Regarding the participating countries, children in Gabon are more likely to attend a preschool (72.4%) compared with other countries (Figure 3). Chad has the lowest rate of pre-schooling among the participating countries. The majority (12 countries) had lower than 50% pre-schooling attendance.

Considering the literacy skill in each country, Figure 4 highlights that Burundi was the country having the best literacy skill (80.0%), followed by Gabon (66.3%), Congo (62.8%) and Madagascar (54.6%). At least 53% of children in other countries did not reach literacy skills required to pursue their learning. Guinea, Togo and Cote d'Ivoire were the three countries at the bottoms of literacy skill in Grade 2.

TABLE 1: Children's profile.

Variables	Preschooling weighted		
	No	Yes	Total
Someone at home who can read in French (%)			
No	34.4	15.5	29.1
Yes	65.6	84.5	70.9
Home-language (%)			
Never speak French at home	54.2	32.0	47.9
Speak at least French at home	45.8	68.0	52.1
Have books at home (%)			
No	68.2	43.5	61.2
Yes	31.8	56.5	38.8
Reading at home (%)			
No	54.6	31.8	48.2
Yes	45.4	68.2	51.8
Sex of children (%)			
Female	49.4	50.0	49.6
Male	50.6	50.0	50.4
Average age of children (Years)			
	8.5	7.8	8.3
Total (%)	71.8	28.2	100

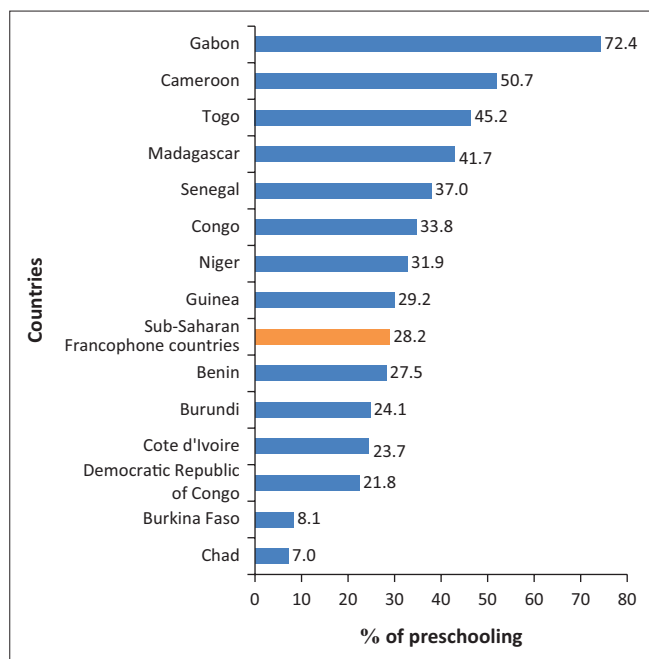


FIGURE 3: Percentage of pre-schooling in the participating countries.

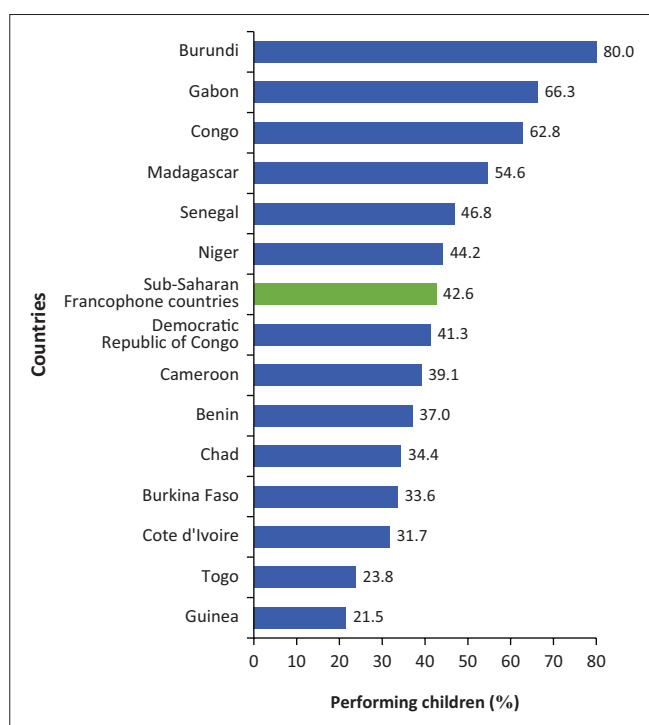


FIGURE 4: Distribution of performing children in participating countries.

Drivers of children's literacy in the home environment

The overall value of the model is given by the pseudo squared: the model explains 10.2% of the variation in children's literacy performance. Analysis confirmed that home environments were significant factors that influence children's literacy (Table 2). The home-language was one of the home environment factors that predict children's literacy in grade 2. Indeed, children who speak French at home or whose home-language is French were 2.26 times (odd = 2.26, $p < 0.001$) more likely to develop high literacy competence

TABLE 2: Drivers of children's literacy skills in the family environment.

Variables	Odds ratio	Effect size (<i>d</i>)
Home-language		
Never speak French at home	-	-
Speak at least French at home	2.26***	0.64
Reading at home		
No	-	-
Yes	2.01***	0.54
Someone at home who can read in French		
No	-	-
Yes	1.54***	0.34
Have books at home		
No	-	-
Yes	1.18**	0.13
Sex of children		
Female	-	-
Male	1.11	0.08
Age of children		
	1.10***	0.08

Note: Pseudo $R^2 = 10.2\%$.

*, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$.

than children who speak other languages. The effect size (*d*) is moderate according to Cohen (2003) definition. The second important factor was literacy at home. Children who read at home had twice (odd = 2.01, $p < 0.001$) the likelihood of those who did not read at home to perform over the sufficient competency skills threshold in literacy.

Having someone at home who can read in French and having books at home were also important for children's literacy skills. Those home environmental factors had a small effect size but made some difference. In fact, children who had someone at home who can read in French were 1.54 times more likely to perform better than others. In addition, children who had books at home were 1.18 times more likely to perform better than others.

Impact of pre-schooling on children's literacy

Results on the impact of pre-schooling pointed out a significant contribution to children's literacy: pre-schooling in the sub-Saharan Africa francophone countries could be improved by 9.7% (Table 3) in grade 2 if all children attended preschool (ATE = 9.7, $p < 0.001$). In other words, roughly one child over 10 children would have developed a sufficient literacy skill in grade 2 if they attended preschool: the performing children would be 58.4% instead of 48.7% in grade 2. The impact on children who attended preschool (ATET) was higher: an improvement of 15.7% cumulating the performing children percentage to 68.4% instead of 52.8% among children who attended preschool.

On gender lens, pre-schooling was beneficial for both male (ATE = 12.6, $p < 0.001$) and female (ATE = 14.3, $p < 0.001$) children with a slight advantage for females. That difference remains when considering the ATET.

Across countries, pre-schooling impact varied from 4.09% in Congo to 31.7% in Chad. In Chad, pre-schooling could improve children's literacy in grade 2 significantly: the share of performing children would reach 71.8% instead of 40.1%

TABLE 3: Impact of pre-schooling on children's literacy skill.

Level of the impact	ATE (%)	Potential outcome (for ATE: %)	ATET (%)	Potential outcome (for ATET: %)
Global	9.70***	48.7***	15.7***	52.8***
Female	14.30***	46.6***	16.8***	51.2***
Male	12.60***	49.4***	14.5***	54.5***
Benin	12.00***	44.8***	15.3***	49.6***
Burkina Faso	16.20	42.4***	16.7**	56.0***
Burundi	-	-	-	-
Cameroon	17.50***	39.4***	21.7***	45.0***
Congo	4.09	70.7***	8.4**	83.8***
Côte d'Ivoire	17.60***	38.2***	24.5***	46.6***
Gabon	8.70*	70.9***	7.3	74.1***
Guinea	19.00***	24.5***	23.6***	33.2***
Madagascar	11.30***	58.3***	13.5***	57.8***
Niger	7.40*	50.3***	11.8***	56.3***
Democratic Republic of Congo	15.20**	47.3***	18.1***	52.3***
Senegal	6.60	52.1***	8.8*	54.1***
Chad	31.70***	40.1***	30.3***	48.2***
Togo	5.80**	27.5***	7.1**	31.9***

ATE, Average treatment effect; ATET, Average treatment effect on treated; -, Estimates not available.

*, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$.

if all children attended preschool. In Congo, even if the improved-on children's literacy was 4.09%, it remains insignificant ($p > 0.05$).

The following countries would benefit from pre-schooling to significantly above the sufficient competence threshold: Guinea (19.0%), Cote d'Ivoire (17.6%), Cameroon (17.5%), Democratic Republic of Congo (15.2%) and Madagascar (11.3%). Remaining countries with significant impact ($p < 0.05$) of pre-schooling are Gabon (8.7%), Niger (7.4%) and Togo (5.8%). Burkina Faso and Senegal have a slightly less significant impact of pre-schooling ($p < 0.10$).

The ATE on treated highlights the same impact with a significant impact of pre-schooling in Burkina Faso (ATE = 16.7%, $p < 0.01$), Senegal (ATE = 8.8%, $p < 0.05$) and Congo (ATE = 8.4%, $p < 0.01$).

Discussion

The purpose of this research was to investigate the impact of pre-schooling and home environment on children's literacy skills in sub-Saharan Africa francophone countries. Using multivariate logistic regression and IPWRA represented a step forward in the understanding of the relationship between home environment, pre-schooling and children's literacy skills.

Findings of this research aligned with those of other research outside the sub-Saharan Africa francophone countries. Indeed, we found that home environment and pre-schooling had an impact on children's literacy skills as investigated by Bradley et al. (2011), and Son and Peterson (2017). They found that home learning environment is strongly associated with children's pre-academic outcomes. In this research, the home-language is very important on children's literacy skills. The fact that children speak the teaching language (French) at home is a driver of their literacy skills in grade 2.

Because French is not their mother tongue, children who did not attend preschool are unlikely to speak French before school at home.

Access to preschool in sub-Saharan Africa francophone countries is a challenge because most of the infrastructures are based in towns and cities (Loye et al. 2020b). In addition, regarding the costs of pre-schooling, only children from wealthy families are likely to attend preschool. As revealed in this research, only 28.2% of children attended a preschool in the 14 countries. Consequently, many children will not reach readiness for school in sub-Saharan Africa francophone countries. This could have a negative effect on children's learning and lives in adulthood because children who have sufficient literacy skills are more likely to be employed, to work more weeks in a year and to earn higher salaries than adults with lower literacy skills (Fantuzzi-Chapman 2012). This statement is endorsed by Espinosa (2002) who pointed out that quality preschool leads to academic and social success in kindergarten and beyond.

On the countries level, there were differences of the impact of pre-schooling on literacy. Those differences come from the country-specific context and preschools curriculums and organisation. Knowledge generated by this research is essential to decision-making and reflection on the early childhood education in the sub-Saharan Africa francophone countries. Considering the benefits of children's literacy, countries might invest in early childhood development.

Without a quality preschool, achievement of sustainable development goal number four (SDG 4) will be unmet. For a better quality pre-schooling, Charron et al. (2021) proposed to analyse the structure, process quality and pedagogical orientation. The structural quality refers to the teacher-child ratio, class size, qualification of teachers and staff while process quality emphasises on experiences in educational settings such as child-teacher interactions on activities, materials and relationship with parents. The pedagogical orientation focuses on beliefs, values, educational approaches, teachers' perceptions of their role toward the children. We think that these dimensions of quality might affect children's literacy and explain differences between countries.

Conclusion

Findings in this research emphasise the importance of pre-schooling, the home environment through language, reading, books and someone who speak the teaching language at home. There is a need to invest in pre-schooling to foster literacy skill development of children. This skill development effort will help children in adulthood to better integrate through their work, employment and wider society. Early interventions in literacy have long-term effects. Countries should anticipate the problem and endeavour to:

- develop standards for preschool programmes
- increase the number of teachers and preschools similar to those in primary education schools and teachers

- develop valid measures of early educational quality by considering recent research on early literacy
- provide continuous training and quality improvement efforts to preschool teachers.

Future research on children's literacy should investigate the quality of preschool using at least the three criteria mentioned above: structural quality, process quality and pedagogical orientation.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

A.S.L. was the lead investigator. He developed the research proposal and analysis. M.J.v.R. reviewed the methodology. E.O. reviewed visualisation. All authors drafted the report.

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Data availability

Raw data were generated at PASEC. Derived data supporting the findings of this study are available from the corresponding author, A.S.L., on request.

Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

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