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To cite this article: J. Joana Kyei & Pearl S. Kyei (07 May 2026): The home matters: influences of household and student factors on early grade learning outcomes in Ghana, Early Child Development and Care, DOI: [10.1080/03004430.2026.2669275](https://doi.org/10.1080/03004430.2026.2669275)

To link to this article: <https://doi.org/10.1080/03004430.2026.2669275>



Published online: 07 May 2026.



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The home matters: influences of household and student factors on early grade learning outcomes in Ghana

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ABSTRACT

Using a sample of 3,742 Ghanaian children ($M = 6.1$, $SD = 1.2$) in Kindergarten 1 through Primary 1 across the Greater Accra and Central regions, this cross sectional study examined the influence of household and student characteristics on early grade learning. Regression analyses showed that caregiver engagement, specifically reading and homework support, was positively associated with academic performance, whereas limited home resources were negatively associated. Moderated mediation analyses revealed a significant mediation effect of caregiver engagement on the relationship between home resources and academic performance in two-parent and mother-only households, but not in father-only or neither-parent households. However, the strength of this mediated effect did not differ across family structures. Age and grade predicted learning outcomes, highlighting the importance of developmentally appropriate support and school entry practices. The findings of the study emphasize the need for inclusive, context-sensitive interventions targeting home learning environments.

ARTICLE HISTORY

Received 16 December 2025

Accepted 29 April 2026

KEYWORDS

Early grade education; academic performance; home learning environments; Ghana; moderated mediation; caregiver engagement

Introduction

Childhood is a critical period for cognitive, emotional, and social development, laying the foundation for lifelong learning and well-being (Black et al., 2017; Britto & Pérez-Escamilla, 2013; Knauer et al., 2019). However, in low- and middle-income countries (LMICs), the role of early grade education in shaping children's long-term academic trajectories is often constrained by systemic challenges. These include limited access to quality learning programmes, under-resourced schools, and inadequate support within the home environment, which, beyond formal classroom settings, has emerged as a critical contributor to students' academic performance (Bayat & Madyibi, 2022; Chen & Wolf, 2021; McCoy et al., 2018; Penn, 2023).

The home learning environment (HLE), which encompasses the quality of caregiver-child interactions, availability of learning materials, and children's engagement in educational activities, is positively associated with academic achievement (Lehrl et al., 2020; Wilder, 2023).

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Numerous studies have shown that children from higher socioeconomic status (SES) backgrounds tend to achieve better academic outcomes than their lower-SES peers (Liu et al., 2022; Suna et al., 2020). This relationship is often associated with enriched home environments characterized by emotional support, access to learning resources, structured routines, and parental involvement.

In Ghana, although approximately 71% of students complete primary school, only about 35% continue to upper secondary education, with children from the lowest income quintiles and rural communities being disproportionately affected (MICS-EAGLE, 2020). Alarming, even among those who complete primary school, foundational learning remains weak. By Primary 4 (P4), 62% of learners demonstrate below-basic proficiency in mathematics, while 50% fall below the minimum competency levels in English (Ministry of Education, 2021).

Given these disparities in educational attainment, studies highlighting the persistence of academic underperformance over time have informed a growing emphasis on early childhood interventions as a strategy for reversing negative achievement trajectories (Carter et al., 2020; Cortázar et al., 2020; Peng & Kievit, 2020; Wolf & McCoy, 2019). In the Ghanaian context, the role of home environments in early grade learning offers a promising avenue for augmenting school-based efforts to reduce literacy and numeracy gaps and improve academic outcomes.

Beyond caregiver engagement, family structure has also been linked to the academic performance of children. Research shows that children from single-parent households are more likely to underperform compared to those from two-parent households (Adeyeye, 2023; Zhang, 2020). Although a study conducted in Ghana among junior high school students found similar results (Azumah et al., 2018), the influence of family structure on early grade academic outcomes in Ghana remains underexplored.

A longitudinal study by Cross (2020) found that African American children from single-parent households in the United States were less negatively affected in their educational outcomes than their White peers, suggesting that for children already facing significant socioeconomic disadvantages, the absence of one or both parents may be less independently impactful. The study also found that African American children benefited from the social capital of having extended family members present in their daily lives, which appeared to buffer the effects of not living in a conventional nuclear household structure. Although not yet examined in early grade academic contexts in Ghana, this finding may reflect similar patterns in Ghanaian culture, where extended family systems are deeply embedded and continue to play a vital role in child-rearing and support (Ackah et al., 2025; Lloyd & Blanc, 1996).

Another HLE variable linked to academic achievement is bilingualism. Bilingual exposure has been shown to yield positive effects across multiple domains, including cognitive development, enhanced creativity, and improved academic performance (Fox et al., 2019; Gunnerud et al., 2020; van den Noort et al., 2019). In Ghana, English is the official language and has historically been the primary medium of instruction at all educational levels. However, a policy shift in 2012 introduced Ghanaian languages (L1), the child's first language, as the medium of instruction from Kindergarten through Primary 3 in all public schools, with English (L2) being gradually phased in. A recent study by Win-Tamakloe and Addai-Amoah (2024) found that students who used both L1 and L2 at home performed better

academically than those who used only L1, highlighting bilingual home environments as an additional factor supporting the academic development of early-grade learners.

The present study

Despite the growing recognition of the importance of early grade education, few studies in Ghana have systematically examined how home-based factors interact with child characteristics to influence academic performance in the earliest grades. This study seeks to address this gap by applying ecological (Bronfenbrenner & Morris, 2007) and sociocultural (Vgotsky, 1978) lenses to explore these relationships.

Bronfenbrenner and Morris (2007) emphasized that children grow up within multiple interrelated systems, each influencing and interacting with the others to shape developmental outcomes. Three of these systems are particularly relevant to this cross-sectional study: the microsystem, such as the home or school, which encompasses the immediate environment where children directly interact with caregivers, teachers, and peers; the exosystem, which indirectly influences the child, for example, through local policies or community factors affecting schools; and the macrosystem, representing broader cultural and societal contexts, including values such as extended family networks as sources of social capital. Biological characteristics of the child also interact with these environmental layers, highlighting the bioecological perspective.

Within this framework, ecological system variables such as caregiver engagement in children's education, the primary language spoken at home (and whether it differs from the language of instruction at school), family structure, and household socioeconomic status influence both cognitive stimulation and emotional safety, thereby shaping early academic outcomes (Bartoli et al., 2022; Ntim, 2024; Wolf & McCoy, 2019). In the present study, caregiver engagement and home resources represent proximal influences on early academic performance, while family structure serves as a contextual factor that may moderate these associations. For example, low rates of reading in Ghanaian homes have been highlighted as problematic for both children and national development (Kyei & Nyarko, 2024; Lee & Moussa, 2024; McCoy et al., 2016; Wolf et al., 2019), as they can instil long-lasting habits of deprioritizing reading. These observations underscore the importance of examining home resources and caregiver engagement as key microsystem factors that may support or hinder children's early academic outcomes within the broader cultural and socioeconomic context.

Vgotsky's (1978) concept of the zone of proximal development, which emphasizes supporting a child to progress from their current level of ability toward their potential level through social interactions with a more knowledgeable other, such as a teacher or peer, can be readily applied to the home environment, where caregivers can assume the role of the knowledgeable other. In home environments, adult guidance on academically related tasks can facilitate children's abilities to accomplish tasks that they cannot complete independently. Beyond reading to children, caregiver involvement in homework can also play a critical role in shaping academic outcomes. Studies in Ghana, for example, have shown that when parents actively support their children's homework, particularly in mathematics, using locally available materials embedded in culturally familiar contexts (e.g. stones, sticks, cans), children demonstrate improved performance, greater confidence, and

increased persistence in learning tasks (Avevor, 2024; Tackie-Ofosu & Vandyk, 2016). These findings align with Vygotsky's concept of the zone of proximal development.

Moreover, caregiver engagement has been linked to motivational strategies such as reward systems, which foster positive learning behaviours and enhance participation in school activities (Ackah-Jnr, 2021). In Ghanaian households, where educational resources may be limited, such involvement becomes even more significant by offering a scaffolded learning experience that bridges formal education and everyday life.

These factors highlight the need for a comprehensive investigation into how home environments influence early grade academic outcomes in Ghana. Therefore, this study sought to examine the influence of home environments (i.e. family structure, home resources as a proxy for socioeconomic status, caregiver engagement, defined as caregivers reading to early grade learners at home and helping them with their homework, and language spoken at home) and their interaction with child characteristics (i.e. sex, age, and grade level) in determining academic performance in early grade learners (Kindergarten 1 and 2 through Primary 1). By establishing a clearer understanding of these dynamics, stakeholders can design targeted interventions to strengthen home-school partnerships and enhance early learning outcomes.

The specific objectives of this study are as follows:

1. To examine the extent to which the home environment and student characteristics predict early grade academic performance.
2. To assess whether caregiver engagement interacts with children's grade levels in predicting academic performance.
3. To investigate whether the interaction between home resources and caregiver engagement differs depending on family structure.

The conceptual framework for these analyses is depicted in Figure 1.

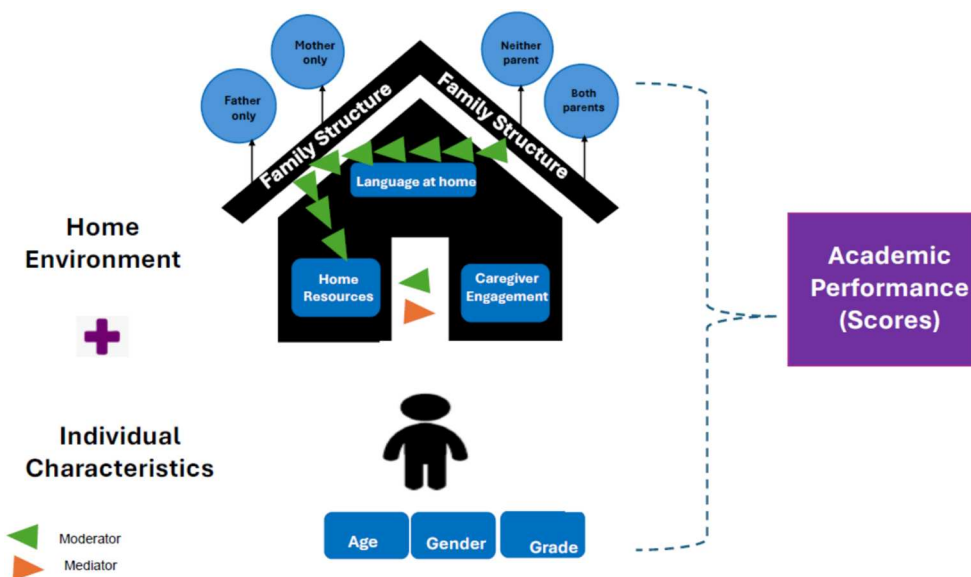


Figure 1. Conceptual framework.

Methods

Setting

The survey was conducted in the Greater Accra and Central regions of Ghana, a lower-middle-income country in West Africa. National data from the 2017/18 Multiple Indicator Cluster Survey (Ghana Statistical Service, 2018) indicate that foundational learning outcomes remain uneven with only about 21 % of children aged 7–14 years demonstrating foundational reading skills. The same survey shows that a substantial proportion of children — approximately seven in ten children aged 36–59 months – attend early childhood education programmes. The Greater Accra Region, which includes the nation's capital, Accra, is the most urbanized and densely populated region with a population of 5.5 million, representing 17.7 % of the national total. It is a socioeconomic hub with relatively higher literacy and school participation rates. The Central Region has a population of 2.9 million and covers a larger land area, encompassing both urban and rural districts. It is historically renowned for its educational institutions and cultural heritage sites but exhibits greater variation in socioeconomic and educational access than Greater Accra. Together, these two regions provide a diverse context for studying early grade learning outcomes.

Participants and procedures

A total of 4,827 children from Kindergarten (KG) 1 and 2, and Primary (P) 1 participated in the study. Data were collected across three districts selected from the Greater Accra and Central Regions of Ghana from May to June 2016. These districts were chosen based on public school kindergarten student–teacher ratios: one with above-average ratios, one with average ratios, and one with below-average ratios, to ensure a representative sample of children from diverse school-quality settings.

Public schools were randomly selected from the Education Management Information Systems (EMIS) school census listing, while private schools were conveniently sampled based on their proximity to the selected public schools. Data were collected from 62 schools, with one KG1, KG2, and P1 classroom randomly sampled per school. Within each selected classroom, all children whose caregivers provided informed consent and assented to participation were included in the study. The study was conducted in the middle of the third term of the academic year; therefore, all questions in the workbook covered areas that should have been covered by the end of the second term. The workbooks contained questions that tested students' literacy, numeracy, and reasoning skills.

Approval for conducting the survey in schools was obtained from the Basic Education Division of the Ghana Education Service, followed by clearance from the respective District Directorates of Education and individual schools.

Prior to data collection, all fieldworkers underwent a rigorous three-day training programme designed to ensure consistency, accuracy, and ethical compliance in study procedures. The training covered the research objectives, a detailed review of the data collection instruments, standardized interviewing techniques, and protocols for participant recruitment and informed consent. Fieldworkers were also trained in ethical considerations, including confidentiality and respectful engagement with participants. Practical sessions, including role-playing and mock interviews, were conducted to

reinforce understanding and ensure adherence to standardized procedures. Only field-workers who successfully demonstrated competence during training and pilot exercises were recruited to participate in the data collection process.

Given the normative age range for these grades, only students aged 4–8 years ($n = 3,742$; 51% male, mean age = 6.1, $SD = 1.2$); were included in the study's analyses.¹ Full sample characteristics are presented in Table 1.

Ethical considerations

Ethical approval for this study was granted by the University of Ghana Ethics Committee for the Humanities (ECH 082/14-15). Prior to data collection, informed consent was obtained from all parents or guardians, and assent was obtained from all participating children.

To ensure confidentiality, all participant data were anonymized, and participants were clearly informed that their answers would be used exclusively for research purposes. These procedures were designed to uphold ethical standards and protect the rights and privacy of all participants.

Measures

Grade-specific student workbooks were developed based on the Ghana Education Service (GES) curriculum and designed to assess literacy, numeracy, and reasoning skills. Before the main data collection, a pilot study was conducted involving 470 students from eight out of ten randomly selected schools (two private schools declined to participate)

Table 1. Sample descriptive characteristics ($N = 3,742$).

	<i>N</i>	%
<i>Sex:</i>		
Boy	1,920	51.3
Girl	1,822	48.7
<i>Grade:</i>		
KG1	1,361	36.4
KG2	1,196	32.0
P1	1,185	31.6
<i>Home Resource Index:</i>		
Low	1,416	37.8
Medium	1,254	33.5
High	1,072	28.6
<i>Family Structure:</i>		
One parent (father)	94	2.5
One parent (mother)	430	11.5
Two parent	3,138	83.9
Not living with either parent	80	2.1
<i>Caregiver Engagement:</i>		
Neither reads to child nor helps with homework	772	20.6
Only reads to child	352	9.4
Helps with homework only	674	18
Both reads to child and helps with homework	1,944	52
<i>Household Language:</i>		
English	273	7.3
Ga	246	6.6
Twi	1,204	32.2
Ewe	598	16.0
Other (English & ≥ 1 Local)	1,421	38.0

in the school districts and two regions where the study was undertaken. This pilot study was instrumental in refining the assessment instruments and making minor adjustments to the study design. The pilot study was undertaken in January 2016, the same academic year as the main survey. The schools selected for the pilot study were in a district different from the main fieldwork to pre-test and refine the study procedures without influencing the actual study population. Conducting the pilot in a separate district with similar socio-demographic characteristics allowed the research team to assess the clarity, relevance, and cultural appropriateness of the data collection instruments while minimizing the risk of contamination or response bias among participants who would later be included in the main survey.

The pilot study highlighted the importance of including reasoning tasks alongside reading and math, as students performed significantly better on literacy and numeracy questions than on reasoning questions, mirroring trends observed in international assessments such as TIMSS, which show stronger performance on basic skills than higher-order thinking tasks.

Following the pilot, two sets of questions were dropped: a word search puzzle for all grades and a word problem set for first graders. Students struggled to understand the instructions and locate words in the puzzle, and many first graders found the word problems too difficult to read and comprehend. A sub-sample of class teachers reviewed the test booklets post-assessment and confirmed that the reading level of their students was insufficient for the word problems. Teachers also noted that some topics in the assessment were scheduled to be taught in the coming weeks, emphasizing the need for alignment with the curriculum, specifically, limiting content to topics expected to be covered by the end of the previous term.

The final KG1 workbook consisted of 16 matching-type questions: matching two halves to form a circle, matching shapes, matching animals to their homes, and matching capital letters to their corresponding lowercase letters.

The final KG2 workbook consisted of 29 questions: matching tasks; joining left and right halves to form a circle; circling the odd one out from four items; counting objects and selecting the correct number from three options; and identifying the next item in a sequence from two options.

The final P1 workbook consisted of 60 questions: joining circle halves; matching wild baby animals to their mothers; identifying and circling (from four differently oriented options) the shape that matched a given stimulus; solving addition and subtraction problems; rearranging letters to name a pictured animal; sequencing four-picture sets to tell a story; circling the non-living item from three options; and colouring according to a number guide.

For each grade, raw scores were computed based on the total number of correct responses across the test items. To ensure fair comparisons across grades, given the varying workbook lengths, students' total scores were then converted into log scores.

Fieldworkers were trained to administer the questionnaire to obtain students demographic and household information, and to administer the workbook to students. Students were interviewed one-on-one in a designated area provided by the school. Workbooks were administered to the class at the same time. At least two fieldworkers administered the workbooks: one explained the examples provided for each section to the children, while the others monitored classroom behaviour, including potential cheating. Before giving students the workbooks to begin working independently, fieldworkers displayed A3-sized

cards with the workbook pages at the front of the class and reviewed the examples provided for each section with the class to ensure students understood what was expected from them.

The workbooks demonstrated strong internal consistency reliability, with Cronbach's alpha values of .77, .76, and .85 for KG1, KG2, and P1 subsamples, respectively. Additionally, the pilot confirmed consistency in the observational data on the physical classroom environment; the responses from the three fieldworkers showed no significant differences (Figure 2).

Home resources

To approximate children's household socioeconomic status (SES), this study constructed a Home Resource Index using self-reported data on the following family possessions: car, motorcycle, computer, cell phone, television, radio, adult books, children's books, and children's toys which were summarized into the index. While this index does not capture all dimensions of SES, such as parental education or household income, it reflects material resources that are directly relevant to children's everyday learning environments. Households were then categorized into low, medium, and high resource groups based on percentile cut-off points.

Caregiver engagement

In this study, caregiver engagement was defined as the extent to which caregivers participated in their children's learning at home, specifically through reading to them or helping them with homework. The homework assistance measure referred to help with any school-related homework and was not restricted to a specific subject area such as reading or mathematics, reflecting general caregiver support for the child's learning activities at home. These activities were measured using binary (yes/no) questions assessing whether caregivers regularly engaged in either or both behaviours, providing a useful snapshot of whether children receive any direct educational support at home.

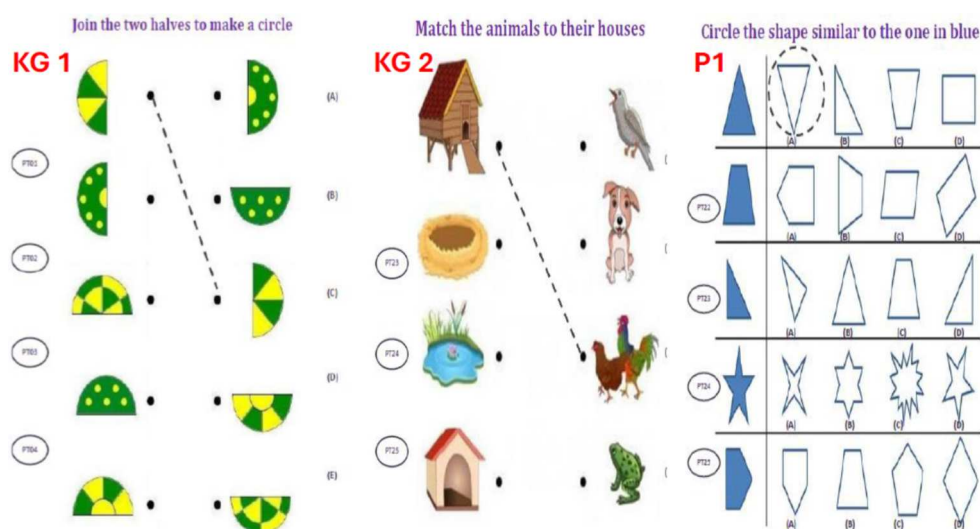


Figure 2. Sample items from test books.

Analytic strategy

Data were analyzed using SPSS Version 25 and PROCESS Version 4.2 (Hayes, 2022). Descriptive statistics were computed to summarize the sociodemographic characteristics of the sample. A hierarchical multiple linear regression analysis was conducted to examine the extent to which student characteristics – namely age, sex, and grade level – together with home environment factors (family structure, home resources, caregiver engagement, and language spoken at home) predicted early-grade academic performance, operationalized as students' workbook scores. In Step 1, all predictor variables were entered simultaneously. In Step 2, the interaction term between caregiver engagement and grade level was added to assess whether the association between caregiver engagement and academic performance varied by grade level.

Multicollinearity was examined using variance inflation factors (VIFs). All predictors in Steps 1 and 2 had VIFs below 2, indicating minimal concern. In Step 3, higher VIFs were observed for grade (5.48), parental engagement (6.49), and their interaction term (12.09), which is expected when including interaction terms in regression models and does not compromise coefficient interpretability (Akinwande et al., 2015; Hsieh et al., 2003). All other predictors had VIFs below 2.

A moderated mediation analysis was conducted using the PROCESS macro for SPSS (Model 7) to examine whether the association between home resources and academic performance was mediated by caregiver engagement, and whether this mediation pathway varied by family structure. Model 7 specifies moderation on the path from the independent variable (home resources) to the mediator (parental engagement), representing first-stage moderated mediation. Age, sex, and language spoken at home were included as covariates in all regression equations. Continuous predictors were mean-centered prior to analysis. Indirect effects were estimated using bias-corrected bootstrapping with 5,000 resamples and 95% confidence intervals.

Because family structure was a four-category variable (two-parent, father-only, mother-only, and neither-parent households), two-parent households were treated as the reference group and three dummy variables were created to represent father-only, mother-only, and neither-parent households. Each dummy variable was entered separately as the moderator in PROCESS Model 7, resulting in three moderated mediation analyses that compared each family structure category with two-parent households.

Due to fieldworkers collecting the home and student variables directly from students, no data were missing for the variables included in the analyses. Accordingly, missing data procedures (such as listwise deletion, or Little's MCAR test) were not applicable.

Results

Predicting academic performance from student characteristics and home environments

Table 2 shows the results of the hierarchical multiple regression predicting academic performance from student characteristics and home environment variables.

In the first step, the model was significant, $F(6, 3741) = 1194.61$, $p < .001$, and accounted for 66% of the variance in children's academic performance. Holding all other variables constant, age, grade level, and home resources were significant

Table 2. Final regression model for predicting academic performance.

Independent Variables	β	T
Age	.14	11.06***
Sex	.02	1.82
Grade	.78	34.65***
Family Structure	-.00	-.43
Home Resources	.04	3.88***
Caregiver Engagement	.09	3.55***
Language at home	-.01	-1.41
Caregiver Engagement x Grade Level Interaction	-.12	-3.47**

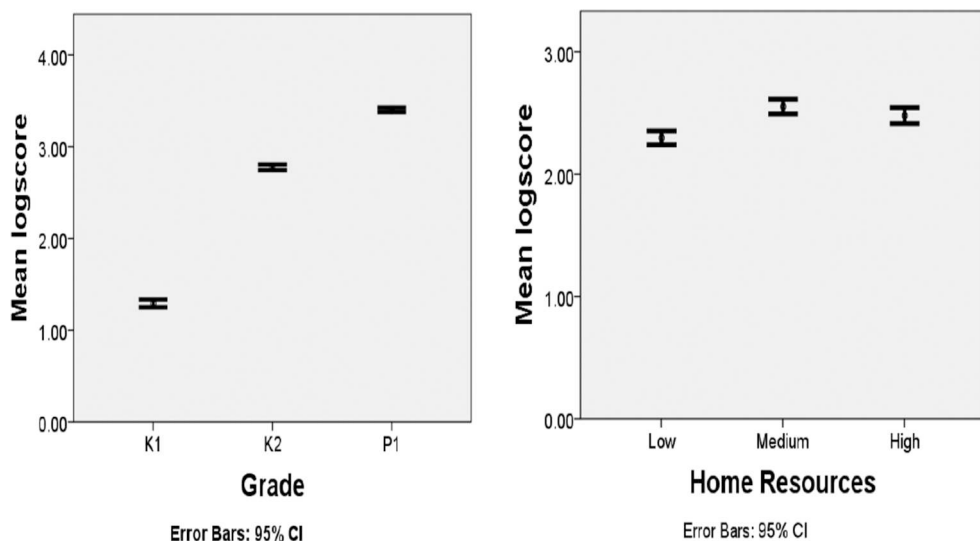
Note: ** $p < .01$; *** $p < .001$

predictors. Specifically, each additional year of a child's age was associated with higher performance. In regard to grade level, Tukey post hoc comparisons showed all pairwise differences to be statistically significant [$F(2, 3741) = 3949, p < .001$], with performance increasing sharply across all grades ($KG1_{\text{Mean logscore}} = 1.29$, $KG2_{\text{Mean logscore}} = 2.77$, $KG3_{\text{Mean logscore}} = 3.40$).

While the 'home resources' variable was entered as a continuous one in the model, for descriptive purposes children were grouped into low, medium, and high resource categories based on percentiles. The analysis indicated that children from low-resource homes ($M = 2.30$) scored significantly lower than those from medium-resource ($M = 2.55$) and high-resource homes ($M = 2.48$). No significant difference was observed between the medium- and high-resource groups, as the 95% confidence interval for their mean difference included zero.

The mean logscore by grade level and the means for the home resources categories are shown in Figure 3.

In the second step of the model, caregiver engagement (reading to children and helping with homework) was added. This step was non-significant and did not contribute significantly to explaining additional variance in academic performance.

**Figure 3.** Mean log scores by grade level and by home resources.

In the third step, the interaction between grade level and caregiver engagement was added to the model. This interaction was statistically significant, $F(8, 3741) = 900.19$, $p < .001$, and revealed that the positive effect of grade level on academic performance was amplified when caregiver engagement was present. The strongest interaction effect occurred when caregivers were involved in both reading and homework activities. A visual representation of these effects is shown in Figure 4. While reading only ($\beta = .05$, $t = 2.03$, $p = .04$) across all grades appears to have the most visually apparent positive effect on academic performance in the graph, this suggests that reading may be especially beneficial in the early grades. However, the combination of reading and homework ($\beta = .10$, $t = 3.02$, $p = .001$) shows the most significant impact on academic performance as children progress to higher grades.

Examining the moderating role of family structure in the home resources/caregiver engagement relationship

The conceptual model for the moderated mediation analysis using PROCESS Model 7 is presented in Figure 5. This model examined whether caregiver engagement mediated the association between home resources and academic performance and whether this pathway was moderated by family structure.

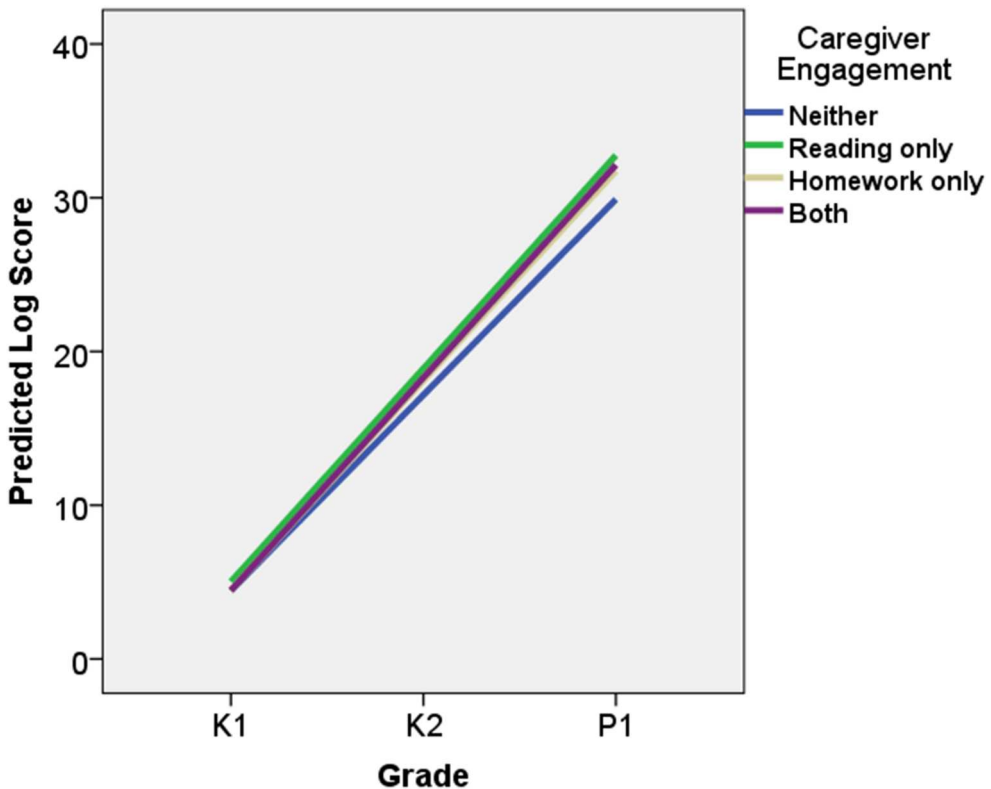


Figure 4. The simple slopes between grade level and predicted academic performance at different levels of caregiver engagement.

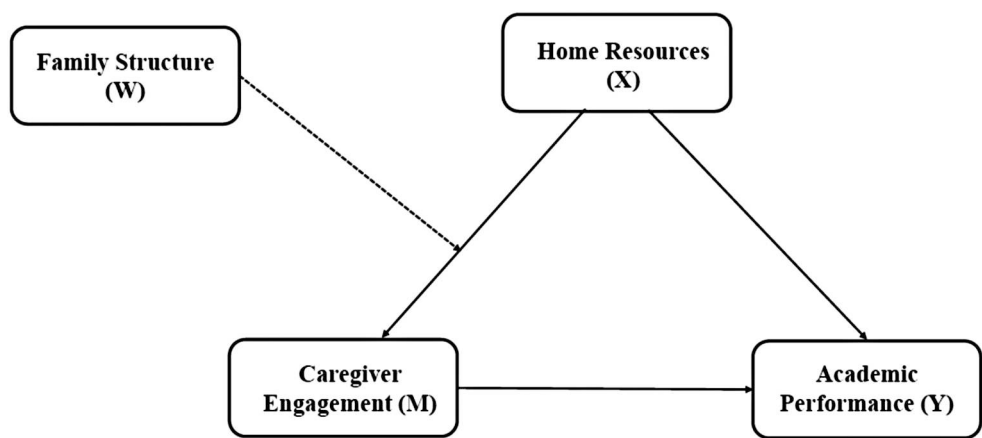


Figure 5. Conceptual model of the moderated mediation analysis. Home resources (X) predict academic performance (Y), mediated by caregiver engagement (M). Family structure (W) moderates the path from home resources to caregiver engagement, indicated by the dashed arrow; solid arrows represent direct and mediated effects.

Across all three models, home resources significantly predicted caregiver engagement ($bs \approx 0.073$, $ps < .001$), and caregiver engagement was positively associated with academic performance ($b = 0.150$, $SE = 0.024$, $p < .001$). Home resources also retained a significant direct association with academic performance ($b = 0.058$, $SE = 0.009$, $p < .001$), indicating partial mediation. Bootstrapped estimates indicated a significant indirect effect of home resources on academic performance through caregiver engagement for two-parent households (effect = 0.0110, 95% CI [0.0069, 0.0156]) and mother-only households (effect = 0.0124, 95% CI [0.0057, 0.0206]). Tests of the interaction between home resources and family structure in predicting caregiver engagement were non-significant for all groups. Consistent with this, the indices of moderated mediation were not significant, indicating that the indirect effect of home resources on academic performance through caregiver engagement did not differ across family structures. Although mother-only households reported slightly higher caregiver engagement and neither-parent households reported lower engagement, family structure did not moderate the mediation pathway. The results of the moderated mediation analysis are presented in Table 3.

Table 3. Regression model testing the moderated mediation effect of home resources on caregiver engagement and academic performance by family structure.

Family Structure	Indirect Effect	Boot SE	95% CI	Moderated Mediation Index	95% CI
Both parents (ref)	0.0110	0.0022	[0.0069, 0.0156]	–	–
Father only	0.0080	0.0099	[–0.0097, 0.0299]	–0.0029	[–0.0216, 0.0181]
Mother only	0.0124	0.0037	[0.0057, 0.0206]	0.0013	[–0.0053, 0.0084]
Neither-parent	0.0010	0.0076	[–0.0139, 0.0162]	–0.0100	[–0.0261, 0.0049]

Note: Indirect effects in bold indicate confidence intervals that are statistically significant. BootSE = bootstrapped standard error; CI = confidence interval.

Discussion

This study examined how household and student characteristics influence early grade learning outcomes in Ghana using a large sample of children in grades K1 through P1. The results indicate that both home resources and caregiver engagement are significant predictors of academic performance, while family structure does not independently predict outcomes. Caregiver engagement significantly mediates the association between home resources and academic performance in two-parent and mother-only households.

Our findings align with prior research showing that children's academic performance is shaped by both household resources and caregiver engagement across diverse contexts. At a regional level, data from West and Central Africa countries, including Ghana, show that cognitively stimulating caregiver–child interactions, such as reading and storytelling, are positively associated with early literacy and numeracy development (Kyei & Nyarko, 2024). Similarly, evidence from low-income communities in Cape Town, South Africa shows that limited household resources and low parental involvement constrain early learning opportunities (Bayat & Madyibi, 2022). A wider study of 51 low-and-middle income countries also reported an association between cognitive caregiving practices and early child development (Bornstein et al., 2026).

With respect to family structure, household composition did not independently influence academic outcomes, consistent with Ghanaian evidence reporting no significant differences across family types (e.g. Azumah et al., 2018), but contrasting with Boadu (2021), who found variation in educational attainment by living arrangement. However, Bretuo (2021) also shows that these differences are largely attenuated once household wealth is considered, suggesting that socioeconomic conditions may better explain observed disparities than family structure alone. Cross-context evidence also varies. In China and Nigeria for example, family structure is associated with academic outcomes, though the nature of these relationships differs by household type and socioeconomic conditions (Adeyeye, 2023; Zhang, 2020).

By contrast, our multivariate and moderated mediation analyses indicated that caregiver engagement is the key pathway linking home resources to academic outcomes, regardless of family structure. This finding may reflect protective effects of social parenting and extended family social capital (Addae & Kühner, 2022; Buchmann & Hannum, 2001; Cross, 2020; Lloyd & Blanc, 1996; Mawusi, 2013), which buffer disadvantage in Ghana, consistent with Bronfenbrenner's (1979) ecological systems theory.

Notably, limited home resources were associated with lower academic performance, indicating that relational support alone cannot fully offset material deprivation. Caregiver engagement mediates this relationship in two-parent and mother-only households, but not in father-only or neither-parent households. This aligns with evidence that socioeconomic status influences achievement partly through cognitively stimulating home environments (Lurie et al., 2021; Yeung & Chen, 2023). However, the strength of this mediation does not differ significantly across household types, suggesting that interventions targeting caregiver engagement may be broadly effective.

These emphasize the role of adult guidance in transforming learning potential into achievement. This is consistent with Vygotsky's (1978) zone of proximal development and Bronfenbrenner's concept of proximal processes linking caregiver engagement and resource environments to child development.

With respect to student characteristics, both age and grade level significantly predicted academic performance, reflecting the joint influence of developmental maturity and formal schooling exposure. Grade level was the strongest predictor, consistent with the cumulative nature of schooling, where each grade introduces more advanced instruction and learning demands.

Age also independently predicted performance, indicating that chronological maturity contributes beyond grade placement, with older children within the same grade tending to perform better academically. These findings underscore the importance of age–grade alignment in Ghana, where evidence indicates patterns of delayed school entry and age-for-grade mismatch in some groups, particularly boys and children in rural and poorer households (Seshie-Nasser & Oduro, 2016).

In contrast, the study found no evidence that language spoken at home significantly predicts academic performance in the early grades. This may reflect Ghana’s multilingual context, where children navigate multiple languages across home and school environments, particularly in urban settings, reducing the independent effect of home language exposure.

Nevertheless, this finding should not be interpreted as diminishing the value of mother-tongue instruction. Evidence shows that early learning is strengthened when children are taught in a language they understand (UNESCO, 2021), as this improves comprehension and reduces cognitive load. The non-significant effect may reflect the transitional nature of early grade classrooms in Ghana, where L1 and L2 are often used interchangeably. In such contexts, instructional quality and caregiver engagement may outweigh home language alone, reinforcing the importance of effective bilingual pedagogy that scaffolds learning across languages (Bretuo, 2021; Nkrumah & Erinosh, 2024).

Study strengths and limitations

This study is limited by its cross-sectional design, which prevents causal inference and reliance on self-reported measures, a narrow operationalization of caregiver engagement, and the absence of parental education and occupation data. These factors may limit generalizability and leave aspects of the home learning environment unmeasured.

Students outside the normative age range for these grades (i.e. 4–8 years) were excluded from this analysis because their older age could confer a cognitive maturational advantage that may influence performance on the study measures. While this approach helped maintain comparability within the sample and reduced the potential confounding effect of age-related developmental differences, it introduces certain limitations. Specifically, excluding over-age students may reduce the representativeness of the sample in contexts where delayed school entry or grade repetition is common. As a result, the findings may not fully capture the experiences or outcomes of all students within the broader school population, particularly those who are older than the typical age for their grade. Consequently, the generalizability of the results may be limited to children within the normative age range.

Despite these limitations, the paper fills an important evidence gap and advances understanding of the role of the home environment in shaping early learning outcomes in the sub-Saharan African context, where studies exploring the impact of household and caregiver factors on early academic achievement are relatively scarce. This study contributes to the understanding of early grade learning in this context by demonstrating the combined influence of caregiver engagement, home resources, and student characteristics.

Policy and practice implications

The findings highlight the pivotal role of in-home caregiver engagement. Interventions should equip caregivers, including extended family members and guardians, with strategies to support reading and homework, which were most strongly associated with academic performance. Material deprivation remains a barrier; providing learning resources such as books, writing supplies, or digital devices is essential to bridging the gap in academic outcomes across for children from lower-resourced homes. The findings of the present study underscore the importance of developmentally appropriate school entry policies to ensure children are aligned with grade-level expectations.

Future research

Future studies should explore broader indices of caregiver engagement, including play-based learning and other activities. There is also opportunity for future studies to assess the quality and consistency of bilingual instruction, and employ longitudinal designs to track academic trajectories. Examining interactions between same sex child/caregiver engagement outcomes, and language exposure across grades could further clarify influences on early learning outcomes.

Conclusion

This study has provided evidence on the interaction between young children and their learning and structural and relational dimensions of home environments in Ghana, an underrepresented area in the literature. The findings of the study indicate that while household resources are important for early academic performance, their influence operates primarily through caregiver engagement, and that family structure itself does not independently predict outcomes.

Taken together, the findings underscore that strengthening caregiver engagement alongside improving access to basic household learning resources may be a more effective strategy for supporting equitable learning progress and academic achievement among early grade learners in Ghana.

Note

1. Students outside of the normative age range were excluded from this analysis, as their older age may provide cognitive maturational advantage.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the International Growth Centre [grant number 1-VCC-VGHA-VXXXX-3300].

Data availability statement

The data that support the findings of this study are available from the corresponding author, [JJK], upon reasonable request.

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