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Early Childhood Teachers' Knowledge of Environmental Influences on Learners' Active Involvement, Ghana

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Abstract: *This study investigated early childhood education (ECE) teachers' knowledge of classroom environmental factors that influence learners' active involvement in the Lower Manya Krobo District of Ghana. Using a descriptive survey design and census sampling procedure, data were collected from 122 ECE teachers through structured questionnaires, based on two research questions. Descriptive statistics and regression analyses were employed to examine their knowledge of the environmental factors and their knowledge of those factors that influence learners' active involvement in the classroom. Findings from the study revealed that the ECE teachers recognized the importance of teaching and learning materials, ventilation, and teacher-learner interactions as sustaining leaners' focus and involvement. Despite strong knowledge levels, regression results showed no statistically significant relationship between age, educational qualification and teacher knowledge of the environmental factors and their knowledge of factors that influence learners' active involvement, while years of experience had a negative effect. These findings underscore the need for targeted professional development that bridges the gap between theoretical knowledge and practical implementation of the knowledge.*

Keywords: early childhood education, teachers' knowledge, environmental influences, early childhood learners, active learner involvement

INTRODUCTION

There is worldwide consensus on the importance of early years' development and of Early Childhood Education (ECE) in that regard. ECE is seen as the bedrock upon which a child must build a meaningful experience with formal schooling, lifelong learning and development. As stated by UNESCO (2021), ECE aims to support the totality of cognitive, emotional, physical, and social development in a safe, stimulating, and developmentally appropriate learning environment. Neuroplasticity is enhanced in early years and young children are especially responsive to environmental stimuli and signals (UNESCO, 2021; OECD, 2023). One of the

most relevant of these factors, among those that influence learning during this phase, is active involvement, which in this study is explained as children's ability to sustain their attention, interest, or interaction with instructional material and general classroom activities. The classroom space is integral to this, therefore, as it provides the space for the physical and mental conditions for concentrated involvement and learning.

A broader conception of the classroom space incorporates the actual space, vents, lighting, teaching materials, and the interaction between the teacher and learners, all of which can affect levels of active participation (Trawick-Smith et al., 2019; van den Berg et al., 2022; Oppong Frimpong, 2022). Even minor variations in the use of color, furniture setup, and lighting in the classroom can influence learners' involvement and motivation to learn. According to Barrett et al. (2015), these factors play an important role especially in the context of early childhood in which learners have low capacities for self-regulation and shorter attention span (Mashburn, 2018; La Paro et al., 2021).

It is also believed that the learning environment impacts learners' attention and active engagement in learning activities (Berti, Cigala, & Sharmahd, 2019; Oppong Frimpong 2019). These environmental conditions are determinant of whether a learner in the early years can concentrate on activities, react to the teacher's prompts, and engage in participatory learning experiences. Given the short attention spans of young children, the classroom space must be designed to limit distraction and promote active involvement.

At the centre of this structuring are teachers who are critically influential in the formation of these spaces. This knowledge and understanding as to what classroom related elements influence highly active involvement is important to foster optimal learning environments. It is the teacher's knowledge and understanding of, and intention to, manipulate the classroom environment that dictates the degree to which learners stay active, motivated and engaged (Agyeman et al., 2023). The role is even more pronounced in low-resource settings like most areas in Ghana, where teachers are expected to make up for the lack of infrastructure through well-organized lessons in the classroom and environmental adaptation (Oppong Frimpong, 2019).

Theoretical framework

This study theoretically aligns with Jean Piaget's constructivist theory from 1952. According to Piaget, learning is an active and constructive process in which the environment has an important role in stimulating children's curiosity and attention. He argues that the instructional environments created affects learning. Extraneous load should, therefore, be minimized to foster involvement and learning. According to a constructivist (Piaget), teachers must demonstrate knowledge in what way the environment will shape the active involvement of learners, in order to mediate an effective classroom experience. This theory assists in providing understanding of the active involvement of learners as a result of teachers' choices of design of the classroom. This theory has been selected for the study because, while Piaget clearly states the role of external stimuli to engage learners cognitively, the study emphasizes the way in which teachers perceive and mediate environmental considerations in order to cognitively involve learners in their classroom activities.

A corollary from the theory suggests some themes that are worth considering for the study. This includes contents of teachers' knowledge of environmental factors in classrooms; teacher-

learner interaction as a factor which informs involvement; and the role of teaching and learning materials in motivating and helping improve involvement.

Teachers' knowledge of classroom environmental factors

In this regard, Bergen (2015) states the importance of good play activity and organized classrooms in keeping learners involved. Teachers with a firm grasp of classroom design, emotional climate, and instructional strategies are better positioned to sustain young learners' involvement and focus. Thus, among other things, teachers should know their classrooms in terms of seating, ventilation, lighting, classroom aesthetics, and interactive learning spaces. They should be skillful in recognizing and controlling aspects of the environment like seating arrangements, lighting, and learning areas in ways that promote attention from learners. From Tonge et al. (2022), teachers who demonstrate understanding of sensory integration and spatial dynamics are more capable of detecting and maintaining focus to ensure involvement. As Smith & Johnson (2017) point out, the appropriate use of visual support dramatically improves involvement. Additionally, aesthetics, including colours and displays, of the classrooms are part of factors that enhance concentration and focus (La Paro et al, 2021). This means that in an environment where they are not properly established, learners get distracted and unfocused on classroom activities.

Without a strong theoretical and practical understanding, even well-intentioned teachers may fail to optimize their classroom settings. If ECE teachers don't possess sufficient understanding of how classroom layout, teacher-learner interactions, visual aids, and other environmental factors influence active involvement, learners are at risk of disengagement and poor learning outcomes.

Teacher-learner interactions

Teachers' interpersonal behaviour is related to the classroom climate (Oppong Frimpong, 2022). It is important for teachers to know the ways in which verbal and non-verbal communication maintains attention in the classroom. Knowledge of the emotional space created through activity, warmth and scaffolding can maintain levels of involvement even in deprived environments (Hamre & Pianta, 2001; Mashburn, 2018). Bergen (2015) notes that classroom routines and expected transitions allow, or train, younger learners to focus and be engaged for longer periods of time. What must be stressed here is that this kind of interaction in the classroom is not achieved in a vacuum. This is known by the teacher through training and experience, and a willingness to apply it, which is a significant factor for learner involvement.

Use of teaching and learning materials

Charts, pictures, models and other instructional aids are resources that teachers can use to engage and hold learners' attention. Those teachers who knew what age-appropriate and relevant materials were would be able to design more engaging lessons as opposed to others who didn't (Oppong Frimpong, 2021; Smith & Johnson, 2017). Barrett et al. (2015) suggest that factors such as lighting, acoustics and color can explain 16% of the variation in academic progress. The rest are more of the use of varied TL M. In addition to involvement, the impact of environmental features on emotional wellbeing would also be an important consideration within early childhood classrooms, as found by van den Berg et al. (2022).

In under-resourced contexts, teachers may not have had opportunities for training that highlighted the role of environmental factors in interpreting active involvement (Oppong Frimpong, 2019). While Ghana is continually working towards better ECE service delivery, there are still weaknesses in the design of the ECE classroom environment and teacher consciousness, especially in places such as the Lower Manya Krobo District.

Statement of the problem

Despite the recognized importance of the learning environment in ECE, anecdotal and empirical evidence suggests that some classrooms in the Lower Manya Krobo District did not meet the standards needed to support learners' active involvement. A casual classroom observation in the study area revealed that some early learners displayed frequent signs of inactive involvement, roaming, off-task behavior, and lack of engagement, during lessons. These behavioral patterns are often attributed to poorly ventilated classrooms, inadequate lighting, adequate seating, unstimulating learning materials, lack of structured learning centres, and insufficient use of instructional materials (Save the Children, 2019; Oppong Frimpong, 2019). These shortcomings likely impede active involvement, especially among younger learners.

While the Early Childhood Care and Development (ECCD) policy (MoE, 2020) outlines standards for classroom design and teacher competencies, implementation remains inconsistent, in some districts like Lower Manya Krobo. However, anecdotal evidence suggests that teachers are aware of these issues. Yet, the depth and application of their knowledge regarding classroom environmental influences on active involvement remain unclear. As such, understanding what ECE teachers know about classroom environmental factors and how they apply this knowledge in practice is vital for improving attention and involvement-related outcomes and overall educational quality.

Moreover, while previous studies have explored the state of classroom environments in Ghana, few have focused specifically on early childhood classrooms and the degree of teachers' knowledge about environmental factors that influence involvement. Such studies have also not been carried out in the current study area. Methodologically, this study employs purely quantitative approach where hypotheses are tested.

The lack of targeted research in this domain raises questions about the capacity of ECE teachers to create environments that actively promote learners' focus and involvement. This study seeks to explore the extent of teachers' knowledge and how this translates into classroom strategies, addressing a crucial gap in the literature on early childhood education in the district. Anticipatedly, this will inform teacher training and classroom management strategies to improve quality ECE delivery in the district.

Research questions and hypotheses

The study was guided by these research questions and hypotheses:

1. What knowledge do early childhood teachers possess regarding the classroom environmental factors that influence learners' active involvement in the Lower Manya Krobo District?

2. What specific environmental factors do teachers perceive as most important for sustaining learners' active involvement Lower Manya Krobo District?

Hypotheses:

$H_0$1: There is no statistically significant influence of teachers' knowledge of classroom environmental factors and environmental factors that influence learners' active involvement in the Lower Manya Krobo District.

$H_0$2: Age, educational level, and years of teaching experience do not significantly predict the knowledge ECE teachers possess about the classroom environmental factors and those factors that influence learners' active involvement in the Lower Manya Krobo District.

METHODOLOGY

Research design

This study adopted a Descriptive survey design is a quantitative research design employed to collect data that describes the characteristics, behaviours, opinions, or attitudes of respondents (i.e. ECE teachers in the Lower Manya Krobo District). It involved systematic collection and analysis of data to obtain an accurate portrayal of teachers' knowledge of the environmental factors that influenced learners' active involvement, as it naturally occurred in the ECE classroom, without manipulating variables. Babbie (2021) explains that surveys are among the most frequently used methods in the social sciences and it was employed in this study because of its ability to produce generalized, empirical data about all the ECE teachers in the study area. The chosen design was effective in assessing current status of those educational phenomena (Creswell, 2014). In particular, it was useful for establishing the "what is" questions this study sought answers to (Fraenkel, Wallen, & Hyun, 2012).

Sample and sampling procedures

Census sampling procedure also known as "complete enumeration" was adopted for this study. With this method, every single ECE teacher in the district was included in the sample. Unlike other sampling techniques that rely on selecting a subset of the population, this sampling procedure involved gathering data from every individual within the district's entire population. The decision to use census stemmed from the fact that the target population was not too large (178) for a descriptive survey design. Thus, it was feasible to obtain data from every member of the population (Babbie, 2021).

Data collection procedures

The district had 46 ECE centres so after permission was sought and granted, the schools were subsequently contacted. When the ECE teachers were identified with assistance from the headteachers, the intention for the study was declared to the potential respondents. Strict ethical protocols of inform consent, anonymity, confidentiality and free participation and or withdrawal from the study at any point were observed. Face to face contact as well as on the phone contact were used based on availability and readiness of respondents. With this, structured questionnaire was administered to the 148 respondents who finally agreed to take

part in the study. The respondents were given one two weeks to respond to the questionnaire. At the end of the period, 122 out of the 148 questionnaires were collected and analyzed.

Data analysis procedures

The collected data were analyzed using descriptive statistics (frequencies, means and standard deviation) for the biographic data and simple linear regression and multiple linear regression were used to test hypotheses 1 and 2 respectively.

RESULTS

Biographic distribution of the teachers

The demographic profile of respondents provides the foundational context for understanding the perspectives presented in Table 2. Table 1 presents three variables: age group, educational level, and years of ECE teaching experience.

Table 1. **Participants' biographic data**

Category	Levels/Range	Frequency	%
Age Group	20-30 Years	40	32.8
	31-40 Years	41	33.6
	41-50 Years	14	11.5
	Above 50 years	27	22.1
	Total	**122**	**100.0**
Educational Level	SHS	3	2.5
	Diploma	32	26.2
	Bachelor's degree	83	68
	Master's degree	4	3.3
	Total	**122**	**100.0**
Teaching Experience	Less than a year	10	8.2
	1-5 years	42	34.4
	6-10 years	35	28.7
	11-15years	17	13.9
	16-20 years	18	14.8
	Total	**122**	**100.0**

Age Group: The distribution suggests that the majority of respondents were at the beginning or midpoint of their careers. The age distribution may also reflect a relatively "young" and possibly "dynamic" or more "open" workforce that may be more willing to innovate their practice and modify the classroom environment. As Trawick-Smith et al. (2019) describe, younger teachers tend to have a new set of pedagogical ideas and are more likely to use best practices in stimulating involvement through classroom design.

Educational Level: In terms of education, the responses indicate that the majority of the teachers had formal training, at least, at the level of undergraduate. Agyeman et. al. (2023) validates that teachers with more advanced academic qualification have a more detailed knowledge and application of strategies within the classroom, especially related to engagement and attention of the learners.

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Years of Kindergarten Teaching Experience: Table 1 shows a relatively experienced teachers corps, whose majority have had more than 5 years of experience in practice. As concluded by van den Berg et al. (2022), teachers with average experience levels (5-15 years) are theoretical and practical types of adaptors with the potential to value classroom environmental strategies and assess their utility. Analysis of the research questions and the hypotheses follow.

Analysis of research questions

To address the research questions, the researcher examined teachers' knowledge of environmental factors that influence learners' active involvement and how teachers rated the importance of various classroom environmental factors by considering both the mean scores (M) and standard deviations (SD), along with the frequency of agreement (%). Standard deviation values provide insight into the consistency of these views among teachers, with lower SDs pointing to areas of consensus and higher SDs signaling variability in perception or application. This allowed for understanding not just with what factors were recognized, but how strongly and consistently they were perceived and valued among the teachers.

Research question 1: Teachers' Knowledge of Classroom Factors Influencing Learners' active involvement

Table 2 directly responds to Research Question 1 and examines teachers' knowledge of various environmental factors and their perceived impact on learners' involvement.

Table 2. **Teachers' knowledge of classroom factors influencing learners' attentiveness**

S/N	Items	Frequency N (%)		Total	M	SD
		Agree	Disagree			
1	Classroom layouts disrupt learners' active involvement.	76 (63)	46 (37)	122	2.71	0.94
2	Seating arrangements interrupts learners' involvement.	81 (66)	41 (34)	122	2.72	0.88
3	The furniture in the classroom contributes to learners' involvement.	111 (91)	11 (9)	122	3.21	0.73
4	Good ventilation in the classroom promotes learners' concentration.	119 (98)	3 (2)	122	3.47	0.58
5	Classroom colours and aesthetics disrupt active involvement.	47 (39)	75 (61)	122	2.35	1.02
6	Adequate lighting, classroom climate control and acoustical materials improve learners' focus.	113 (93)	9 (7)	122	3.32	0.73
7	Large class size disrupts learners' attentions.	`95 (78)	27 (22)	122	3.04	0.90
8	Teacher-learner interaction enhances learners' active involvement.	114 (93)	8 (7)	122	3.45	0.69

9	Learner-learner interaction contributes to learners' involvement in the classroom	108 (89)	14 (11)	122	3.15	0.71
10	Teaching approaches affect learners' involvement in class.	98 (80)	24 (20)	122	3.19	0.81
11	Teaching and learning materials promote learners' attention and focus during lessons.	117 (96)	5 (4)	122	3.53	0.55

Classroom layout: The classroom lighting, ventilation, seating, furniture and color were combined and analyzed as classroom layout under the classroom environmental factors. With that, nearly all teachers (98%) agreed that ventilation is critical. This was reflected in a high mean of 3.47 and a low SD of 0.58. This strong consensus underscores the essential role of fresh air and air circulation in sustaining focus, particularly in hot and humid climates in Ghana. The response on lighting and acoustics saw 93% (mean = 3.32, SD = 0.73), indicating that environmental comfort factors such as lighting and temperature are strongly perceived to impact involvement. Teachers understanding could have been that a well-lit and acoustics optimized classrooms reduce distraction and sensory overload, especially in young learners who are still developing self-regulatory capacities.

Teacher agreement about the role of furniture on involvement was significantly high (91%, Mean= .74 and SD=3.21). The mean shows a high level of agreement, and the low SD indicates it was somewhat clustered around the mean. Classroom layout had 63% of teachers agreeing that the physical classroom layout could disrupt involvement. However, the average score of 2.71 with a high standard deviation of 0.94 indicates disagreement among respondents. This could reflect some uncertainty as to what constitutes the ideal classroom layout, or it could signal different degrees of exposure to those ideas. Seating was also perceived as a factor for 66% of the learners' participation, with a mean of 2.72 and SD of 0.88, like that of the layout. Even though the agreement is moderate, some variation in responses may be attributed to size of the classrooms, resources, and training. Possibly to some of the teachers, to be able to engage in eye contact, be mobile, and interact with peers requires effective seating configurations to support these activities.

Classroom color had the lowest agreement of 39% and the highest SD of 1.02 of all the items on Table 2. This result suggests limited awareness or undervaluing of color psychology in classroom design in spite of the fact that stimulating colours can activate interest and focus in children, and overly bright or clashing colours can become sources of distraction. The finding points to a possible professional development gap in understanding the cognitive-emotional implications of classroom aesthetics.

Large Class Size: With 78% agreement, a mean of 3.04, and SD of 0.90, teachers acknowledge the negative impact of overcrowded classrooms. Although infrastructural limitations may restrict class size adjustments, the result shows that teachers were aware that high learner-teacher ratios reduce active learner involvement in an ongoing classroom activity.

Interaction: Teacher-learner and learner-learner interaction also witnessed a high agreement of (93% mean = 3.45, SD = 0.69) and (89%, mean = 3.15, SD = 0.71) respectively. This result suggests broad awareness of cooperative learning principles and confirms the fundamental role

of relational dynamics in supporting involvement. Perhaps, the teachers perceived emotionally responsive teacher behaviours such as praise, proximity, and dialogue, as facilitating attention regulation, and group work, role-play, and collaborative problem-solving, among learners which have been shown to reinforce cognitive focus, especially in constructivist classrooms.

TLMs and teaching approaches: The item on TLMs had the highest mean score (3.53), with 96% agreement and a low SD of 0.55, indicating a nearly unanimous recognition of the value of instructional materials in enhancing learner active involvement. The responses demonstrate a near agreement of how age-appropriate TLMs stimulate curiosity and help anchor learners' focus and involvement in the ECE classroom activities. With respect to teaching strategies, a mean of 3.19, with 80% agreement and SD of 0.81, indicates that while most teachers understand the influence of pedagogical strategies on involvement, there is some divergence in opinion or practice. This implies that differences exist among the teachers with respect to the potency of differentiated instruction, storytelling, and inquiry-based learning as being particularly effective in ECE settings to improve learners' involvement in the classroom.

In sum, the analysis for research question 1 demonstrates that early childhood teachers in the Lower Manya Krobo District possess a robust understanding of key environmental factors that influence learner attentiveness. The highest-rated factors were teaching and learning materials, ventilation and lighting, and teacher-learner interaction. This indicates a firm grasp of foundational classroom dynamics. However, lower awareness concerning classroom aesthetics and spatial organization reveals critical areas for professional development.

Research Question 2: What specific environmental factors do teachers perceive as most important for sustaining learners' attentiveness?

This research question sought responses to how respondents assigned importance to the environmental factors they had already identified as influencing leaners' active involvement in the classroom. Respondents ranked TLMs, good ventilation, interaction, and adequate lighting as the most important in influencing learners' involvement.

Table 3. **Ranked classroom environmental factors**

Rank	Statement	Mean	SD	Level of Agreement %
1	Teaching and learning materials promote learners' attention and focus during lessons.	3.53	0.55	96%
2	Good ventilation in the classroom promotes learners' concentration.	3.47	0.58	98%
3	Teacher-learner interaction enhances learners' active involvement.	3.45	0.69	93%
4	Adequate lighting, classroom climate control and acoustic materials improve learners' focus.	3.32	0.73	93%
5	Teaching approaches affect learners' involvement in class.	3.19	0.81	80%
6	Learner-learner interaction contributes to learners' involvement in the classroom	3.15	0.71	89%

7	The furniture in the classroom contributes to learners' involvement.	3.21	0.73	91%
8	Large class size disrupts learners' attentions.	3.04	0.90	78%
9	Seating arrangements interrupts learners' involvement.	2.72	0.88	66%
10	Classroom layouts disrupt learners' active involvement.	2.71	0.94	63%
11	Classroom colours and aesthetics disrupt active involvement.	2.35	1.02	39%

Teaching and Learning Materials: Teaching and Learning Materials (TLMs) emerged as the most influential factor perceived by the ECE teachers. With a mean of 3.53; 96% agreement, and an SD of 0.55, this factor stands out as the most highly rated among all items in Table 3. The standard deviation reflects strong consensus. This overwhelming perception of TLMs as central to sustaining attention confirms their perceived relevance and impact. To the teachers, TLMs, particularly those that are tactile and age-appropriate, possibly anchor learners' focus, attention and make abstract concepts more concrete thereby stimulating cognitive engagement. In early childhood settings where engagement is fleeting, visually stimulating and manipulable materials help learners remain on task and develop concentration. Given the short attention span of early learners, this consensus reflects an important strength in teacher knowledge.

Good Ventilation in the Classroom: Teachers ranked ventilation nearly as high, with a mean score of 3.47, 98% agreement, and a low SD of 0.58. This indicates near-general recognition of its importance. Air quality, temperature regulation, and freshness of space are integral to children's cognitive stamina. Ventilation and thermal comfort are environmental inputs that significantly influence learning outcomes. In the Ghanaian context, where overcrowded and poorly ventilated classrooms are common, teachers' sensitivity to this factor suggests both awareness and a call for infrastructural investment at the ECE level in the study area.

Teacher-Learner Interaction: Interpersonal relationships, particularly teacher-learner interaction, were also widely acknowledged among the respondents. This factor achieved a mean score of 3.45, 93% agreement, and an SD of 0.69. These results highlight that teachers view interaction as not only relational but also motivational, sustaining children's involvement through eye contact, questioning, emotional support, and encouragement. Possibly to the teachers, the emotional climate of the classroom is a key determinant of sustained learner engagement and focus. Teacher-learner interaction, especially in early years, provides scaffolding that supports the development of executive functions such as attention control.

Adequate lighting and acoustical materials (93%, M= 3.32, and SD=0.73); teaching approaches (80%, M=, 3.19 and SD=0.81); learner-learner interaction (93%, M= 3.45, and SD=0.69); furniture in the classroom (91%, M=3.21, and SD=0.73); and large class size (78%, M=3.04, and SD=0.90) were ranked as the fifth, sixth, seventh, and eighth influential factors respectively.

Classroom layout was considered to the last but one influential factor (63%, Mean=2.71, SD=0.94) with classroom colours being the last ranked factor (39%, M=2.35, SD=1.02. The

variation in the classroom layout suggests that many teachers either do not see layout as a major issue or lack knowledge. Yet, the classroom layout such as the placement of learning centres, shelves, and open space, can greatly influence how easily children can navigate the room. They can equally reduce distraction and promote self-regulated engagement. The classroom color and aesthetics received the lowest agreement, lowest mean, and the highest variability signaling that the classroom colours are not widely perceived as significant to attract learners' attention and get them actively involved, possibly due to limited professional exposure to environmental psychology. This suggests a professional gap in understanding how design psychology can influence attention.

In conclusion, the overall ranking of environmental factors based on mean scores and agreement percentages reveal that teachers perceive teaching and learning materials, ventilation, teacher-learner interaction, and lighting and acoustics as the most critical for sustaining active learner involvement. These are followed by pedagogical strategies and peer interactions, which highlight the multifaceted nature of focus, rooted in both physical environment and social-emotional dynamics.

Conversely, classroom aesthetics (colours, layout) and seating arrangements were less strongly perceived, indicating a need for capacity-building in more nuanced areas of classroom design. The standard deviation values show a clear distinction: high consensus exists around TLMs and ventilation, while greater variability exists for classroom layout, seating, and color.

The findings strongly affirm that ECE teachers in the Lower Manya Krobo District not only value core instructional materials and interpersonal engagement but are also attuned to the physical and psychological comfort of their learners. However, the limited perception of spatial and aesthetic elements points to possible professional development gaps that should be addressed in teacher training and support programs. With the varying responses and the seemingly positive demographic information of the respondents, these hypotheses were formulated to ascertain whether they are translated into practice and had a statistically significant influence in terms of the responses to the research questions.

$H_0$1: There is no statistically significant influence of teachers' knowledge of classroom environmental factors and environmental factors that influence learners' active involvement in the Lower Manya Krobo District.

This hypothesis aimed to determine ECE teachers' knowledge of classroom environmental factors that significantly influence learners' active involvement in the Lower Manya Krobo District. The central premise behind this hypothesis is grounded in constructivism (Piaget 1952), which suggests that the physical learning environment when designed or used effectively, can either facilitate or hinder children's focus and cognitive engagement.

To assess this relationship, a simple linear regression analysis was performed. This statistical method was suitable for examining the predictive effect of one independent variable (teachers' knowledge of classroom environmental factors) on a single dependent variable (teachers' knowledge of the classroom environmental factors that influence learners' involvement). The strength and significance of this influence were interpreted using the R^2 value (indicating the proportion of variance explained), the beta coefficient (β), and the p-value ($p < 0.05$ indicating

significance). Prior to running the regression analysis, Levene's Test for homogeneity of variances was conducted to verify whether the assumption of equal variances held was true.

The test results, as shown in Table A1, indicate that all p-values are greater than 0.05. This confirms that the assumption of homogeneity of variances was not violated, thereby supporting the suitability of conducting parametric tests such as regression analysis.

Table A1. **Test of homogeneity of variance**

Levene Statistic	Levene statistics	df1	df2	Sig
Based on Mean	4.458	2	119	.064
Based on Median	2.982	2	119	.055
Median with adjusted df	2.982	2	114.202	.055
Based on Trimmed Mean	5.009	2	119	.108

The descriptive statistics of the key variables, in Table A2, show that the mean score for the teachers' knowledge of the classroom environment that support involvement (M = 3.09) was slightly lower than their mean score on knowledge of environmental factors (M = 3.14).

Table A2. **Descriptive statistics**

	N	Mean	Std. Deviation
Use of classroom environment	122	3.09	0.50
Knowledge of classroom environment	122	3.14	0.49

This difference suggests that the teachers knew of the environmental factors, but same level of knowledge was not demonstrated for how they influence learners' active involvement.

Table A3. **Model summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.156[a]	.024	.016	.482

From Regression Model Summary, the R^2 value was 0.024, indicating that only 2.4% of the variance in teachers' knowledge of the environmental factors that influence learners' active involvement is explained by their knowledge of classroom environmental factors. This low R^2 suggests a weak explanatory power, meaning the majority of variation in influencing factors is accounted for by other factors not captured by this model.

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Table A4. **ANOVA results**

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.700	1	0.700	3.008	.085
Residual	27.931	120	0.233		
Total	**28.631**	**121**			

The results from ANOVA from Table A4 show that the regression model was not statistically significant, F(1, 120) = 3.008, p = .085. Since the p- value exceeds the .05 threshold, it implies that teachers' knowledge of the environmental factors does not significantly predict their knowledge of those factors that influence learner involvement. The coefficient results are also aligned with the results from the ANOVA table.

Table A5. **Coefficients results**

Predictor	B	Std. Error	Beta	t	Sig.
(Constant)	2.665	0.277		9.616	.000
Knowledge of classroom environment	0.151	0.087	0.156	1.734	.085

The coefficient table shows that for each one-unit increase in teachers' knowledge of classroom environmental factors, their knowledge of those factors that support involvement increases by 0.151 units. However, the p-value (.085) exceeds the 0.05 significance threshold, confirming that this increase is not statistically significant. Despite the direction of influence being positive, the strength of the effect is weak and not robust enough to make definitive inferences.

The analysis of hypothesis 1 underscores that although knowledge levels were generally high, this did not translate into knowledge of factors that influenced learner involvement. Based on the evidence from the regression analysis, the null hypothesis is not rejected. That is, teachers' knowledge of classroom environmental factors does not significantly influence their knowledge of those factors that enhance learners' active involvement. Having established this, the researcher went on further to ascertain whether age, educational level and years of ECE teaching experience of teachers predicted the knowledge they possessed about classroom environmental factors and those factors that influenced learners' involvement. The hypothesis tested and the inferential statistics performed is presented in the subsequent paragraphs.

$H_0$2: Age, educational level, and years of ECE teaching experience do not significantly predict the knowledge ECE teachers possess about the classroom environmental factors and those factors that influence learners' active involvement in the Lower Manya Krobo District.

The assumption underpinning this hypothesis is that teachers' demographic backgrounds may influence their exposure to and understanding of critical aspects of classroom design and its pedagogical implications. To assess the extent to which these demographic variables predict knowledge, a multiple linear regression analysis was employed. This statistical technique was ideal for evaluating how multiple independent variables simultaneously influence a single continuous dependent variable—in this case, teachers' knowledge of classroom environmental factors that influence involvement. Prior to regression analysis, Levene's Test for Homogeneity

of Variance was conducted to ensure that the error variance across groups was consistent. Table A6 shows the results.

Table A6. **Test of homogeneity of variance**

	Levene Statistic	df1	df2	Sig
Based on Mean	5.540	21	92	.710
Based on Median	1.877	21	92	.082
Median with adj. df	1.877	21	59.074	.082
Based on Trimmed Mean	4.860	21	92	.064

Table A6 shows that the p-values across all tests are greater than 0.05, suggesting that the assumption of homogeneity of variances has not been dishonored, implying that the parametric testing such as multiple linear regression is appropriate. Table A7 displays the descriptive statistics of the variables involved in the regression analysis.

Table A7. **Descriptive statistics**

Variable	N	Mean	Standard Deviation
Knowledge of classroom environmental factors	122	3.14	0.50
Age category	122	2.23	1.13
Highest qualification	122	2.72	0.56
Years of teaching in ECE	122	2.93	1.19

The mean score of 3.14 for teachers' knowledge indicates a relatively good level of understanding of classroom environmental factors that influenced learners' involvement. However, the variability across the demographic indicators warranted further investigation. In this hypothesis, the predictors were age category, highest qualification, and years of teaching at an early grade level. The dependent variable was knowledge of classroom environmental factors that influenced learners' involvement.

The model summary of the regression analysis yielded an R^2 of .047, meaning that only 4.7% of the variance in teachers' knowledge of classroom environmental factors is collectively explained by age, educational level, and ECE teaching experience. The adjusted R^2 which was (.022) further indicates a very limited explanatory power.

Table A8. **Regression model summary results**

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.216[a]	.047	.022	.497	.047	1.922	3	118	.130

a. Predictors: (Constant), Years of Teaching in KG, Highest Qualification of Teachers, Age Category of Teachers
b. Dependent Variable: Knowledge of classroom environmental factors

The model was not statistically significant, F(3, 118) = 1.922, p = .130, suggesting that the combined effect of these demographic variables does not significantly account for differences in knowledge levels. This is corroborated by the ANOVA table in Table A9.

Table A9. **ANOVA results**

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	1.427	3	0.476	1.922	.130
Residual	29.204	118	0.247		
Total	30.631	121			

The p-value of .130 far exceeds the 0.05 threshold, confirming that the regression model is not statistically significant. Thus, the null hypothesis is retained at the aggregate level. The individual predictors were further examined to determine if any of them had a statistically significant independent effect and these results are presented in Table A10.

Table A10. **Coefficient results**

Predictor	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	3.426	0.253	—	13.557	.000	—	—
Age Category	0.032	0.046	.072	0.702	.484	0.759	1.317
Highest Qualification	-0.023	0.080	–.025	–0.282	.778	0.993	1.007
Years of Teaching in KG	-0.101	0.044	–.239	–2.315	.022	0.761	1.314

Interestingly, years of teaching experience was found to have a statistically significant negative effect on knowledge of classroom environmental factors that influenced learners' involvement (B = –0.101, p = .022). This implies that, as teaching experience increases, teachers' knowledge of environmental factors that influenced learners' involvement tends to decrease slightly. On the other hand, age and educational qualification did not significantly predict knowledge levels (p = .484 and .778 respectively). This suggests that being older or more academically qualified does not necessarily translate into deeper knowledge of environment that influences learners' involvement. The model's Tolerance and VIF values fall within acceptable ranges (Tolerance > 0.1, VIF < 10), indicating no multicollinearity concerns among the predictors. This implies that the independent variables are sufficiently distinct.

The overall regression model was not statistically significant, and hence the null hypothesis is largely retained. However, years of teaching experience had a statistically significant negative effect on teachers' knowledge of classroom environmental factors that influenced learners' involvement. This suggests a potential decline in awareness or engagement with best practices as teaching years increase, potentially due to complacency or lack of continuous training or professional reinvigoration. This outcome emphasizes the need for sustained professional development and in-service training tailored to teachers at all career stages, not only novices

but also veterans, to ensure that knowledge of pedagogical innovations and environmental strategies is continuously updated.

DISCUSSION

This study sought to investigate ECE teachers' knowledge of classroom environmental factors that influence learners' involvement in the Lower Many Krobo District of Ghana. Drawing on constructivist theory and Piagetian principles, the research foregrounds the crucial role of environmental stimuli in shaping learners' cognitive engagement, particularly in the early years where neuroplasticity and responsiveness to external cues are at their peak (UNESCO, 2021; OECD, 2023).

Teachers' knowledge of classroom environmental factors

The findings indicate that the district's ECE teachers were generally well-informed about several classroom environmental factors that promote learners' involvement. TLMs, adequate ventilation, and teacher-student interaction were all widely acknowledged as having a significant impact on maintaining active involvement. According to earlier research by Oppong Frimpong (2021) and Tonge et al. (2022), tactile and visual instructional materials play a major role in sustaining attention and encouraging learner focus, particularly in the early childhood stage. These findings support those earlier ones.

The study also rated ventilation as almost universally important. Barrett et al. (2015) found that environmental factors have a direct impact on children's emotional and alertness, underscoring the importance of thermal comfort and air quality in Ghana's hot and muggy climate. According to sociocultural perspectives (e.g., Vygotsky, 1978; Hamre & Pianta, 2022), early learners benefit from warm, emotionally supportive, and responsive teacher behavior because it promotes attentional regulation and cognitive engagement. This is further supported by the high degree of agreement on teacher-learner interaction.

However, some elements were not as strongly regarded as influential, especially the colours, seating arrangements, and layout of the classroom. These items' comparatively low mean scores and higher standard deviations point to a professional knowledge gap regarding the more nuanced effects of classroom aesthetics and design on child development. This is consistent with research by Oppong Frimpong (2019), La Paro et al. (2021) and Bergen (2015), who highlighted the importance of color schemes, seating arrangements, and spatial zoning in reducing distractions and increasing learners' engagement.

According to these findings, teachers may not have a sophisticated grasp of concepts like visual design, spatial planning, and sensory integration, even though they exhibit a basic understanding of more obvious environmental elements (like ventilation and TLMs). The lack of continuous professional development centered on classroom environmental psychology or restrictions in pre-service training curricula could be the cause of this disparity (Oppong Frimpong, 2022).

Knowledge of environmental factors that influence learners' involvement

Testing whether the knowledge of the classroom environmental factors substantially translates into the teachers' knowledge of the classroom environment that influences learners' active involvement was a crucial component of this study. The findings did not support Hypothesis

1, which was tested using linear regression. The relationship was statistically non-significant and had a weak magnitude, despite having a positive direction. There appears to be a knowledge gap between teachers' awareness of the classroom environmental factors and those that can influence learners' active involvement in the classroom activities. The findings, especially shown from the analysis of Hypothesis 1, suggest that although teachers could identify those factors, they might not have been professionally inclined to determine their relevance. Otherwise, one would have expected that even the items that were ranked low like classroom color and aesthetics could have been given more prominence.

This causes for concern given that teachers awareness and knowledge of how classroom factors affect active involvement are essential for creating environments that promote optimal learning. The deliberate design of the classroom setting through teachers' knowledge primarily influences how learners will remain focused, encouraged and involved (Agyeman et al., 2023). In resource-constraint settings, as it may be in many parts of Ghana, this role becomes even more manifest when teachers are expected to improvise for infrastructural deficits through deliberate classroom management and environmental provision (Oppong Frimpong, 2019).

Shulman's (1986) idea that pedagogical content knowledge (PCK) needs to be operationalized through strategy, resource, and reflection is also supported by this finding. Nevertheless, how the teachers perceive the importance of the said environmental factors will determine how they will operationalize the environment to enhance learners' active involvement.

Demographic Factors' Effect on Teacher Knowledge

The second hypothesis examined the potential significance of demographic variables like years of ECE teaching experience, age, and educational attainment in predicting teachers' environmental factor knowledge. According to the regression results, these variables together only explained very limited predictive value.

It is interesting to note that years of teaching experience were found to significantly and negatively affect knowledge. This implies that unless actively re-engaged through professional development, more seasoned educators may grow complacent or disengaged from changing classroom design standards. This supports earlier worries by Fullan (2007) and Berliner (2001) that veteran teachers may rely on antiquated techniques in the absence of opportunities for ongoing learning, which could impair their responsiveness to contemporary pedagogical strategies.

Contrary to presumptions that older or more academically trained teachers inevitably possess superior insights into classroom environmental dynamics, neither age nor highest qualification significantly predicted knowledge in this study. This result might be the outcome of structural flaws in teacher preparation programs that even higher certification levels do not translate into classroom environmental practice.

CONCLUSION

The study concludes that, early childhood educators in the Lower Manya Krobo District are reasonably knowledgeable about the environmental elements that affect learners' involvement, especially ventilation, teaching and learning resources, and teacher-learner interaction. However, demographic factors do not predict knowledge levels, with the exception of years of teaching experience (negatively), and this knowledge does not translate significantly into

knowledge of environmental factors that influence learners' involvement. The results highlight the critical knowledge gap and the need for continual professional development centered on environmental management in early learning settings. The teachers need to be supported in both learning new material and applying it successfully in their classroom environment if they are to see a meaningful improvement in learners' focus and engagement.

RECOMMENDATION

Based on the findings, the following recommendations are proposed.

1. The District Education Directorate should design an ECE-specific in-service training modules that integrate evidence-based strategies for classroom environmental optimization. This should include layout, lighting, ventilation, and use of color psychology. There can also be integration of practical simulations and model classroom sessions during workshops so that teachers can visualize and test effective spatial and design modifications.
2. The education directorate should establish teacher learning communities to share best practices in environmental design and classroom management. With this, the more experienced teachers (not necessarily long service) will demonstrate success and share experience and knowledge with the less experienced ones.
3. There should be the creation of district-level classroom audit to ensure alignment with learner involvement principles. This classroom audit framework will be based on national ECCD standards to help teachers assess and improve their classroom environments.
4. Since ECE teachers may be expected to improve on their teaching through some of these avenues, the District Education Directorate should institutionalize feedback mechanisms, where school heads and district supervisors offer constructive classroom environment evaluations as part of routine supervision and provide timely, detailed and well-informed feedback to teachers.

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