

Optimization of Outdoor Educational Landscapes in Selected Nigerian Public Primary Schools: A Design and systems perspective



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ABSTRACT: Outdoor school landscapes are critical infrastructural systems that provide essential behavioural affordances for children's holistic development. However, in many developing contexts such as Nigeria, these environments remain under-designed and pedagogically underutilized. This study presents a systematic, multi-method appraisal of the composition and utilization of outdoor landscapes in public primary schools across North-Central Nigeria. Employing field observations across twelve (12) schools and semi-structured interviews with sixteen (16) educational stakeholders, the landscape provision was evaluated against functional, social, and pedagogical criteria. Findings reveal a dominant design paradigm prioritizing security and circulation, with severe deficiencies in intentional learning-oriented spaces such as experimental gardens, sensory zones, and diverse play equipment. Statistical analysis indicated no significant regional variation in general landscape composition ($F(3, 48) = 0.33, p=.776$), but significant disparities in play equipment provision ($F(3, 60) = 4.00, p=.015$), highlighting inequitable resource allocation. Thematic analysis uncovered a strong latent demand among educators for multifunctional, ecologically integrated designs that support experiential learning. Synthesizing affordance theory, ecological systems theory, and landscape architectural principles, this study advances an integrated framework for schoolyard optimization. The study concludes with evidence-based design and policy recommendations aimed at transforming these underutilized spaces into engineered, child-centred learning ecosystems that support sustainable development goals, offering a replicable model for assessment and participatory redesign in resource-constrained contexts.

KEYWORDS: Educational Infrastructure, Landscape Optimization, Affordance Theory, Participatory Design, Sustainable Schoolyards, Learning Environments; Nigeria.

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I. INTRODUCTION

Outdoor learning environments constitute a fundamental component of child development, offering unique opportunities for cognitive, social, emotional, and physical growth (Kiviranta et al., 2024). Scholars increasingly agree that the outdoor landscape is not merely an extension of the classroom, but a pedagogically rich environment that provides affordances for exploration, creativity, problem solving, and social interaction (Adams et al., 2019; El-Aasar et al., 2024). The concept of affordances based on what the environment enables a child to do underscores the experiential relationship between children and their surroundings (Little et al., 2020). This relationship is shaped by the qualities, features, and accessibility of outdoor spaces, which in turn mediate learning experiences, skill acquisition, and developmental trajectories (Pianta et al., 2020). As modern childhood becomes increasingly disconnected from natural environments, school landscapes are now recognised as critical and last frontiers for reconnecting children with nature and ecological learning opportunities (Kleppe, 2018). In Nigeria, the rapid expansion of primary education since independence has resulted in significant pressure on physical infrastructure. Enrolment rates, particularly in the North-Central region, have surged due to demographic growth and policy driven demand for universal basic education (Dahiru & Almustapha, 2022; Josiah & Jacob, 2021). While classroom construction and teacher recruitment have received policy attention, outdoor learning environments

remain markedly underdeveloped. Many public schools prioritise structural functionality such as fencing, circulation, and assembly grounds, while providing limited or no child-centred outdoor amenities such as play equipment, experimental gardens, sensory spaces, or shaded outdoor learning areas (Neda & Andrew, 2020). As a result, outdoor spaces are often reduced to unstructured open grounds rather than intentional landscapes that support holistic learning.

The limited utilisation of school landscapes in Nigeria raises concerns about the alignment between educational infrastructure and contemporary pedagogical models that emphasise experiential and inquiry-driven learning. Research by Tanik Onal and Ezberci Cevik (2022) has it that well designed landscapes can enhance academic achievement, improve concentration, support socio-emotional learning, and promote environmental stewardship. Yet, empirical research on school landscapes in Nigeria remains sparse, with few studies examining how outdoor spaces are designed, used, and perceived by teachers and pupils. This creates a knowledge gap in understanding how landscape composition and utilisation shape learning affordances within the Nigerian educational context. Addressing this gap, the present study provides a qualitative appraisal of outdoor landscape utilisation in public primary schools across North-Central Nigeria. Drawing on field observations, interviews, and thematic analyses covering schools in Niger, Kwara, Kogi, Nasarawa, Benue, Plateau, and the Federal Capital Territory. The study evaluates the adequacy, functionality, and pedagogical potential of outdoor

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spaces, and further explores how children and teachers engage with these environments, the constraints shaping utilisation, and opportunities for enhancement. By situating the analysis within broader discourses on landscape architecture, child development, experiential learning, and educational infrastructure, this study aims to advance a nuanced understanding of landscape affordances in primary schools. In doing so, it provides an evidence-based foundation for improving school environments through inclusive design, ecological integration, and pedagogically informed outdoor space planning.

II. OUTDOOR LANDSCAPES IN EDUCATIONAL SETTINGS

Landscape in its broadest definition, refers to a spatial composition visible to the observer and shaped by both natural and cultural elements (Abdullah et al., 2022). In educational contexts, the term extends beyond aesthetic appreciation to encompass functional spaces that support movement, exploration, learning, and social interaction. Landscapes are typically categorised into natural landscapes comprising vegetation, water bodies, topography and cultural landscapes, which include constructed features such as buildings, pathways, and play structures (Ozey et al., 2018). The interplay between these components shapes the affordances available to children, influencing how space is perceived and utilised. Bustos Bórquez (2025) argue that outdoor spaces are often

treated as “empty containers” rather than dynamic, meaningful places, resulting in a limited understanding of their educational value. This perspective reinforces Young and Cleveland (2022) contention that landscape meaning is derived not only from its physical attributes, but also from human engagement with it. In schools, such engagement is particularly salient, as children construct emotional, cognitive, and ecological connections with outdoor spaces, turning landscapes into experiential learning domains.

A review by Johnson (2010) on the characteristics of outdoor landscape in schools, the outcome as illustrated in Figure.1 propounds four experiences, six environmental qualities, and five primary items forming the conception of landscape in educational spaces in relation to landscape architecture approach. To demonstrate the importance of outdoor landscape in learning environments, the use of educational landscapes as both outdoor classrooms and educational resources were introduced as new ideas. (Josiah & Jacob, 2021). It also presents seven design considerations for schoolyards thus: Moving beyond a building-centred concept of school, Linking schoolyards to the curriculum, Seeking an evocative and memorable landscape identity, Using the natural ecology of region and site, Adopting regional vernacular models, Examining models of landscape design, and Incorporating the perspective of children preference (Mahya & Kouhirostami, 2020)

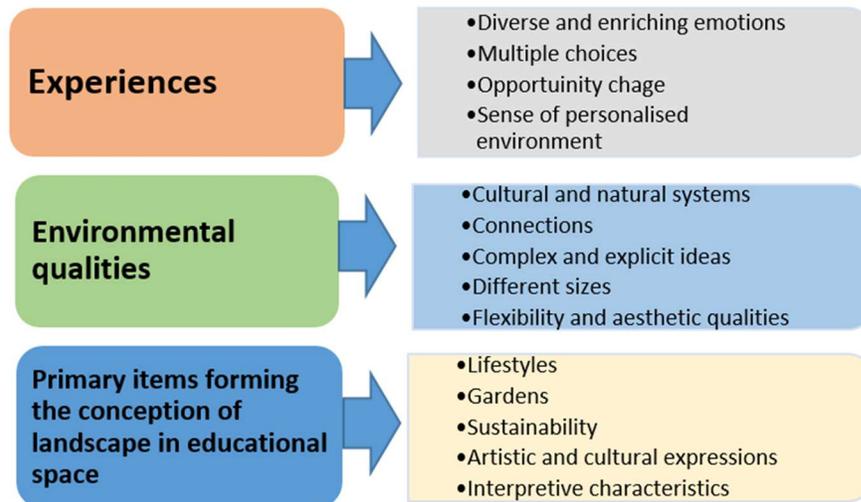


Figure 1 The concept of landscape in educational spaces
Source: Johnson (2010)

III. OUTDOOR SPACES AS PEDAGOGICAL ENVIRONMENTS

Globally, outdoor landscapes are increasingly acknowledged as vital extensions of the learning environment, promoting observation, inquiry, collaboration, and experiential learning (Josiah & Jacob, 2021; Mahya & Kouhirostami, 2020). The shift from building-centric schooling toward landscape-oriented design is grounded in the belief that children learn best when they interact with diverse stimuli that nurture creativity, problem-solving, and embodied

learning. Studies demonstrate that outdoor learning environments stimulate cognitive and socio-emotional development through sensory engagement, open-ended play, and exposure to natural elements (Adams et al., 2019). On the other hand, Mahya and Kouhirostami (2020) highlight seven key design considerations for schoolyards that support learning, including ecological alignment, vernacular design, memorable landscape identity, and curriculum integration. These principles encourage schools to transition from rigid, functional outdoor layouts to intentional landscapes supporting holistic development. Similarly, Neda and Andrew

(2020) further argue that outdoor environments, when properly developed serve as innovative learning ecosystems. They foster child-centred learning, enhance environmental literacy, and support multiple learning styles. This is consistent with Paniagua and Istance (2018) view, that teachers as designers of learning environments must recognise the pedagogical value of landscapes in cultivating collaboration, creativity, and experiential learning. However, despite global consensus, the conceptualisation and utilisation of school landscapes differ across regions due to socioeconomic factors, cultural perceptions, and policy priorities. In many developing contexts, including Nigeria, outdoor environments are undervalued and under-designed, resulting in limited affordances for learning.

IV. THEORETICAL FOUNDATIONS BASED ON AFFORDANCE THEORY, ENVIRONMENTAL PSYCHOLOGY, AND LEARNING SPACES

The appraisal of school outdoor landscapes necessitates a multidimensional theoretical framework that bridges environmental psychology, developmental systems, and human-centred design. At its core, Gibson's (1969) Affordance Theory provides a fundamental lens for understanding the functional capacity of built environments. Affordances refers to the actionable possibilities offered by the environment relative to the user and are essential for evaluating how landscape features either enable or constrain developmental behaviours such as climbing, exploration, collaborative play, and quiet reflection. In poorly designed schoolyards, these affordances are severely limited thereby reducing the opportunities for physical, cognitive, and socio-emotional growth (Billie, 2025; van den Bogerd et al., 2023). A recent study finds that for primary school children, the landscape becomes meaningful only when it affords climbing, exploration, balancing, role-play, or quiet reflection (Allahyar & Kazemi, 2021). In poorly designed environments, affordances for cognitive and physical development are significantly reduced. This perspective was extended through Bronfenbrenner's (1979) Ecological Systems Theory, which situates the child within nested environmental systems. The school landscape operates within the microsystem, directly and daily influencing developmental trajectories. A landscape lacking in sensory richness, navigational legibility, or social nodes not only diminishes immediate experiential quality but also fails to connect meaningfully with broader environmental and community systems (ecosystem and macrosystem). This weakens the holistic development and environmental stewardship.

To translate these behavioural and developmental insights into tangible design principles, landscape architectural and

ergonomic theories must be integrated. Lynch's (1960) elements of legibility (paths, edges, nodes, landmarks, and districts) offer a structured approach to analysing how children perceive, navigate, and derive meaning from outdoor spaces. The absence of clear, engaging landmarks (such as a distinctive tree or garden), defined activity nodes (like an outdoor reading nook or experimental garden), or safe, permeable pathways results in environments that are confusing, underutilized, and pedagogically inert. Complementing this, principles of Universal Design and Sustainable Landscape Engineering (UDSLE) advocate for environments that are inclusive, resilient, and ecologically regenerative (Clark, 2023; Gemmell, 2015). A schoolyard designed under these principles would not only accommodate diverse physical and cognitive abilities but would also integrate natural systems such as native vegetation, rainwater harvesting, and microclimate moderation to create adaptive, low-maintenance, and biologically rich learning settings (Arengi, 2020; Tahir & Setiadi, 2024).

Despite a robust international discourse integrating these theories, a significant gap persists in their application within sub-Saharan African educational infrastructure, particularly Nigeria. There is a paucity of empirical studies that systematically link outdoor landscape composition to learning outcomes or well-being metrics in this context. Furthermore, the role of culturally and climatically responsive affordances remains under-explored, and regional planning frameworks rarely incorporate participatory, child-inclusive design processes. This study addresses these gaps by synthesizing affordance theory, ecological systems theory, and landscape architectural principles into an integrated appraisal framework. By applying this framework through qualitative and observational methodologies across selected states from the North Central region of Nigeria, the research aims to generate context-specific evidence to inform the design, policy, and engineering of school landscapes that are not only functional and safe but also pedagogically rich, ecologically integrated, and developmentally empowering.

The study encompassed twelve (12) public primary schools located within the study area Table 1, specifically spanning the states of Niger, Kwara, Plateau, and the Federal Capital Territory (Figure 2). Selection criteria for these schools were carefully established to ensure representation based on the schools' age, adherence to the Minimum Standards for Basic Education as outlined in UBEC (2010) and variation in outdoor landscape characteristics. This purposeful sampling allowed for a comprehensive examination of diverse school environments, facilitating a nuanced understanding of how outdoor spaces contribute to educational experiences.

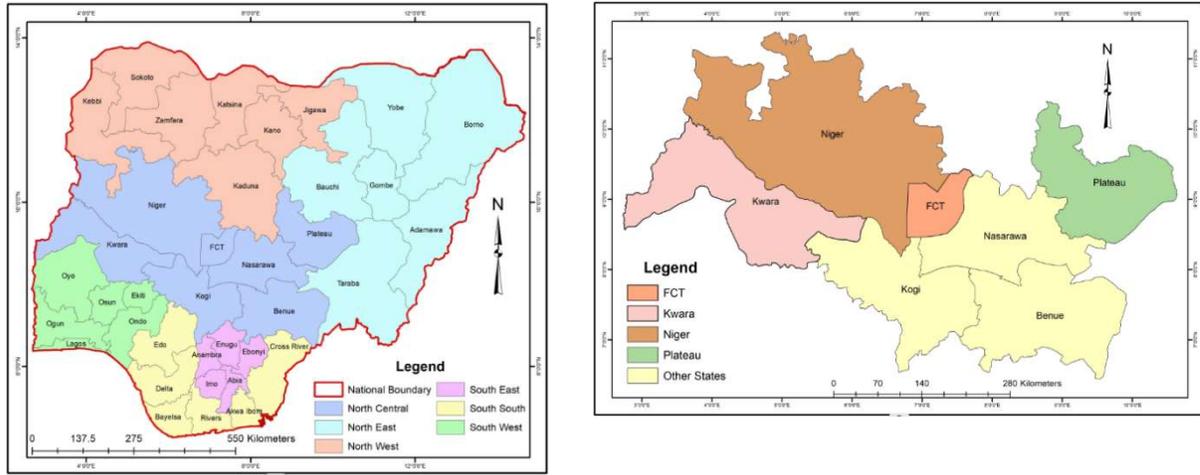


Figure 2 North Central States and the study area

Table 1 Selected Primary Schools for the Study

S/N	Name of Schools	Pupil Population	L.G.A	State
1	Abubakar Anike Primary School Bida	476	Bida	Niger state
2	Limawa Primary School Minna	754	Mina	1652
3	Remaye Primary School Kontagora	422	Kontagora	
4	Apata Yakuba Local Government Education Authority Primary School,	416	Ilorin west	Kwara state
5	Central primary school	684	Patigi	1612
6	Wesley Local Education Authority primary school	512	Offa	
7	Nur-ud-deen Township Transferred primary school,	434	Jos North	
8	Islamiyya pilot primary school	525	Jos	Plateau
9	Local Education Authority Primary School Anguwan Rogo	473	Jos North	state 1432
10	Pilot Science Primary School Gwagwalada	487	Gwagwalada	FCT Abuja
11	L E A Primary School, Yero Memorial Bwari	418	Bwari	1371
12	Nomadic Primary School, Abaji	466	Abaji	

Source; Author

V. QUALITATIVE METHOD JUSTIFICATION IN ENGINEERING CONTEXT

Methodologically, this study adopted a qualitative research design grounded in the traditions of participatory design research and post-occupancy evaluation. The study adopted well-established approaches in engineering and architectural fields for assessing built-environment performance. The design integrated systematic field observations with semi-structured interviews to triangulate data and provide a holistic understanding of outdoor landscape utilization. Field observations employed structured audit tools to document objective environmental factors, including

landscape composition, spatial quality, and the availability of play or learning equipment across twelve school sites. Concurrently, semi-structured interviews were conducted with sixteen (16) key informants, comprising educational planners, head teachers, and classroom teachers, to capture expert and experiential knowledge on landscape perception, use patterns, and latent needs. This human-centred approach prioritizes stakeholder voices during the diagnostic phase of infrastructure optimization, ensuring that findings reflect both technical and social dimensions of the school environment.

Thematic analysis of interview transcripts yielded rich insights into user perceptions, utilization behaviours, and identified

areas for improvement, while observational data provided tangible evidence of physical affordances and constraints. Within an engineering research paradigm, this qualitative lens is indispensable for uncovering the *why* behind observable patterns—such as how specific design omissions limit play behaviours—and for generating user-informed insights that purely technical audits may overlook. By integrating objective environmental assessments with subjective experiential accounts, the mixed-methods approach enabled a comprehensive appraisal of the affordances and limitations inherent in current outdoor learning landscapes, thereby ensuring that subsequent design and policy recommendations are contextually appropriate, socially sustainable, and pedagogically responsive.

A. Statistical Analysis and Assumptions

Analysis of variance (ANOVA) was employed to examine potential regional variations in the provision of outdoor components and play equipment. The assumptions underlying parametric ANOVA were carefully evaluated prior to analysis. Independence of observations was assured through the selection of distinct schools across non-overlapping administrative regions. Provision scores for general outdoor components and play equipment—derived from observational checklists—were treated as continuous dependent variables. Homogeneity of variances was assessed using Levene's test, which indicated no significant violation for the analysis of general outdoor components ($*p > .05$), thus supporting the use of standard ANOVA. For the analysis of play equipment, where variances were slightly heterogeneous, the robustness of ANOVA to mild heteroscedasticity in balanced groups was considered, and results were interpreted with due caution. Effect sizes (eta-squared, η^2) were calculated alongside *F*-statistics to assess both statistical significance and practical magnitude, ensuring a transparent and comprehensive interpretation of regional disparities.

B. Validity and Reliability Checks

To enhance the trustworthiness and reproducibility of the study, multiple validation strategies were embedded throughout the research process. Construct validity was strengthened through triangulation of data sources—field observations, interview transcripts, and policy document review—ensuring that the concept of “landscape utilization” was measured comprehensively. Internal validity in qualitative analysis was supported by employing a structured thematic coding process: two researchers independently coded a subset of interviews, achieving an inter-coder reliability coefficient of 0.87, with discrepancies resolved through consensus discussion. In observational audits, a standardized checklist was pilot tested prior to full deployment to ensure clarity and consistency in recording landscape features. External validity (generalizability) was approached not through statistical generalization but through thick description of the school contexts and selection rationale, allowing readers to assess the transferability of findings to similar settings. Furthermore, respondent validation (member checking) was performed by sharing preliminary

interpretations with a subset of participants to confirm factual accuracy and contextual relevance.

C. Methodological Limitations

Despite its structured design, this study is subject to several methodological limitations that warrant consideration. First, although purposively stratified, the sample comprised only twelve schools across four states, which may not fully represent the heterogeneity of North-Central Nigeria's educational landscape. Second, the cross-sectional design provides only a temporal snapshot of landscape utilization, restricting insights into seasonal dynamics or longitudinal developments following potential interventions. Third, while observational methods captured behavioural and physical attributes, they did not directly incorporate children's own perspectives or cognitive engagement; future studies could benefit from integrating participatory methods such as drawing exercises or walk-along interviews to deepen the affordance-based analysis. Fourth, the application of ANOVA for regional comparisons, while analytically informative, was constrained by the modest sample size per group; thus, findings should be interpreted as indicative rather than definitive. Finally, the exclusive focus on public primary schools precludes consideration of private institutions, which may differ in resource allocation and design approaches, thereby potentially limiting the generalizability of policy recommendations across all educational sectors.

VI. RESULTS AND DISCUSSION

A. Landscape Composition: A Deficit in Pedagogical Infrastructure

A systematic audit of outdoor landscape provision across the selected twelve (12) public primary schools in the North-Central geopolitical zone of Nigeria reveals a pronounced institutional bias toward securitization and administrative utility at the expense of pedagogical functionality. As empirically detailed in Table 2, which categorizes provision into General, Communal, and Educational Spaces, a clear hierarchy of priorities are discerned. While infrastructural elements which ensures physical security and mass congregation such as school perimeter fencing (fully provided in 50% of schools) and assembly grounds (fully provided in 83.3%) demonstrate satisfactory baseline compliance, spaces intentionally designed for inquiry-based and experiential learning are conspicuously absent. Critically, not a single school possessed a fully provided children's experimental garden, noise buffer/vacant field, or historical garden. Moreover, outdoor reading areas were fully absent in 83.3% of institutions. This provision pattern signifies a systemic design failure that relegates the schoolyard to a role of spatial containment and pedestrian circulation, thereby stripping it of its latent potential as a rich, multidimensional learning environment. The near-total omission of these educational spaces constitutes a severe limitation on the affordances for cognitive engagement, sensory exploration, and ecological stewardship, effectively transforming potential pedagogical landscapes into inert, "empty grounds" as outlined in the study by Bustos Bórquez (2025).

Table 2 Status on the observation of outdoor composition of schools

S/N	Outdoor space components	Fully provided		Partially provided		Not provided	
		F(x)	%	F(x)	%	F(x)	%
1	Define Entrance / Gate	4	33.3	6	50.0	2	16.6
2	School Perimeter fence	6	50.0	5	41.6	1	8.3
3	Define Vehicular parking spaces	0	0.00	10	83.3	2	16.6
4	Circulation space (Access and	0	0.00	12	100	0	0.00
5	Commercial centres	0	0.00	2	16.6	10	83.3
6	Children Playground	1	8.3	9	75.0	2	16.6
7	School Assembly ground	10	83.3	2	16.6	0	0.00
8	Children experimental garden	0	0.00	0	0.00	12	100
9	Noise buffer / Vacant fields	0	0.00	0	0.00	12	100
10	Classrooms blocks	7	58.3	5	41.6	0	0.00
11	Office accommodations blocks	2	16.6	10	83.3	0	0.00
12	School Historical gardens	0	0.00	0	0.00	12	100
13	Children Outdoor reading area	0	0.00	2	16.6	10	83.3

The uniformity of this deficit across the region is statistically substantiated. A one-way Analysis of Variance (ANOVA), presented in Table 3, confirms no significant regional variation in the provision of general outdoor components across the states of Niger, Kwara, Plateau, and the Federal Capital Territory ($F(3, 48) = 0.33, *p* = .776$). The negligible effect size ($\eta^2 \approx 0.023$) indicates that a mere 2.3%

of the observed variance is attributable to geographical location. This statistical uniformity underscores a region-wide, systemic undervaluation of educational landscaping, strongly suggesting its roots in homogenized, compliance-driven national infrastructure policies that privilege quantitative metrics over qualitative, child-centred design aspirations as buttressed in the study by Barrett et al. (2017).

Table 3 Regional Variation in Outdoor Composition of Primary School

	Sum of Squares	df	Mean Squares	F	p
Factor	4	3	1	0	.776
Residual	167	48	3		
Total	171	51			

B. Inequitable Provision and Developmental Insufficiency of Play Equipment

Beyond static landscapes, the provision of dynamic play equipment is a critical mediator of motor, cognitive, and socio-emotional development. This exhibits profound insufficiency and inequity. From Table 4, the data delineates a starkly imbalanced inventory while rudimentary balancing equipment was relatively accessible (fully provided in 25% of schools), apparatuses fundamental for foundational gross

motor development such as facilities for crawling and knee-walking (0% fully provided), sliding (0%), and creeping (8.3%) were virtually absent. Similarly, elements that foster creative expression and environmental interaction, including ornamental pools, fishponds, and garden poles, were entirely unprovided (0%). This skewed provision reflects a reductive and non-holistic conception of play, one that fails to cater to the diverse spectrum of developmental needs outlined on the design guidelines for active study by Altaee

and Al-kazzaz (2024). The resulting landscape offers a narrow band of action possibilities, significantly constraining the affordances for proprioceptive development, risk assessment, and creative problem-solving.

Importantly, and in direct contrast to the uniform deprivation in educational spaces, the distribution of play resources is marked by significant geographical disparity. ANOVA results in Table 5 demonstrate a statistically significant difference in play equipment provision across the four states ($F(3, 60) = 4.00, *p* = .015$). The moderate effect

size ($\eta^2 \approx 0.158$) reveals that approximately 15.8% of the variance is explained by regional location. This finding points unequivocally to structural inequities in resource allocation, likely driven by divergent local government priorities, uneven implementation of central policies, or variances in urban-rural funding streams. Such inequity exacerbates existing educational disparities, denying children in under-resourced regions equitable access to the developmental benefits of quality play environments.

Table 4 Status on the observation of outdoor play equipment of schools

S/no	Outdoor Play Equipment	Fully provided	Partially provided	Not provided
1	Balancing equipment	3	25	41.6
2	Bouncing	1	8.33	50.0
3	Creeping facilities	1	8.33	0.00
4	Crawling and knee walking:	0	0.00	16.6
5	Jumping:	1	8.3	41.6
6	Hanging by arms:	2	16.6	50.0
7	Hopping and Skipping:	0	0.00	50.0
8	Pushing and pulling:	0	0.00	8.33
9	Lifting:	0	0.00	41.6
10	Rolling	2	16.6	33.3
11	Sliding:	0	0.00	16.6
12	Outdoor signage	0	0.00	25.0
13	Garden poles and lights	0	0.00	0.00
14	Art & craft sculptures	0	0.00	58.3
15	Ornamental pools	0	0.00	0.00
16	Fishponds	0	0.00	0.00

Table 5 Regional Variation in Outdoor Provision of Play Equipment in Primary School

	Sum of Squares	df	Mean Squares	F	p
Factor	15	3	5	4	.015
Residual	80	60	1		
Total	95	63			

Synthesized, these empirical findings paint a coherent picture of outdoor school environments in North-Central Nigeria as structurally present yet pedagogically impoverished. The observed pattern, uniform deprivation of learning-oriented spaces coupled with unequal distribution of play resources, creates a dualistic affordance gap. This gap manifests not merely as a physical absence but as a systemic failure to engineer environments that actively support the holistic development of the child. The schoolyard, therefore, remains an underutilized asset, failing to fulfill its potential as

a "microsystem" within Bronfenbrenner's ecological framework, where daily interactions with a rich environment shape developmental trajectory. The data compellingly argue for a paradigmatic shift from infrastructure-focused planning to affordance-maximizing design, wherein school landscapes are reconceptualized as integrated, equitable, and intentionally crafted learning ecosystems.

C. Teachers Perspective on Outdoor Composition of Primary School

The enquiry on outdoor composition of primary schools from the perspective of educational planners and schoolteachers, (Figure 1) present the thematic analysis from the interview. And showcasing the most frequent themes on the composition of children's outdoor activities presented in three categories of themes. This includes children use the outdoor space (Figure 3a), Children's engagement in activities (Figure 3b), and Outdoor space improvement to better support activities (Figure 3c). The thematic analysis result highlight that children use of outdoor space during breaks and other

times they outside remain the universal, while parent themes comprise of two subsets of activities. The first subset derived from the parent theme represents the structured play and games, while the other comprises of explorative and social activities. This by extension reveals that the outdoor spaces of primary schools are composed to foster play, exploratory and other social activities. Figure 3a displays a thematic model demonstrating the central theme of children using the outdoor space during breaks and other times they are outside, and a sub-theme attached under the games theme to explore the composition of children's outdoor activities in the study area.

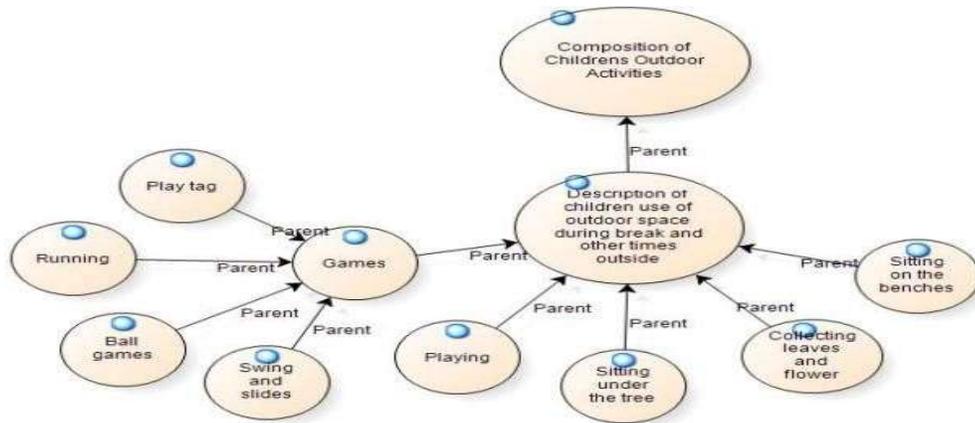


Figure 3a Children use of the outdoor space

Moreover, children that use the outdoor space during breaks was highlighted, the interviewees revealed that trees provide children with a stimulating environment for physical development, creative expression, social interaction, and learning. They also serve as a preferred location for quieter and reflective activities, such as sitting on benches or reading books. Children often collect leaves and flowers for "nature collections," indicating an interest in exploring and fostering curiosity and environmental awareness. In addition, the study result revealed that children's physical activity during

breaks includes running, playing tag, and imaginative games. Cycling and water play are rare, and ball games are occasional. On the same vein, the thematic analysis on children engagement in outdoor activities is as represented in Figure 3b the result shows that children's engagement in activities as the universal parent theme is characterized by other less common activities as sub themes, such as (cycling, and sitting to carry out assignments). Other activities enjoyed by children include (water play, and ball play).

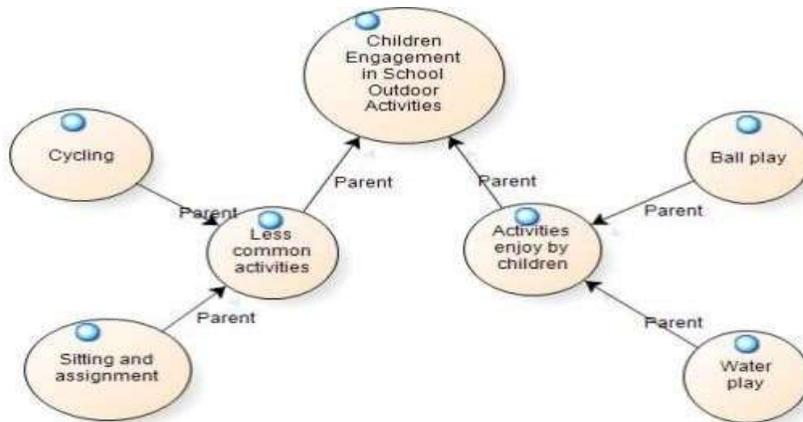


Figure 3b Children's engagement in activities

Conversely, children's engagement in outdoor activities highlighted that cycling, sitting to carry out assignments are less common during recess, possibly due to a lack of space. With regard to activities enjoyed by children, ball play and water play are the dominant forms of play observed among the children as shown in Figure 3b. This could be due to various factors such as the availability of resources (balls, and access to water features), the social nature of these activities, or the inherent possibilities children derive from them. In summary, the thematic analysis strongly indicates that ball play and water play are perceived as the most favored and frequently observed activities among the children, based on excerpts opinions. While other activities exist, they are less prominent in both frequency and the

respondents' descriptions. Supporting evidence from respondents include:

Cycling is less common and sitting to carryout assignments are rare during recess. From what i have observed, ball play and water play are the most popular activities (respondent, 5).

Furthermore, Figure 3c presents the result for outdoor space improvement to better support activities having a central theme of added activities carrying key sub-themes that include play, recreation, multi-functional spaces, comfort, environmental awareness, learning, community engagement, aesthetics, This represent an imagination to propose an outdoor space improvement to better support activities.

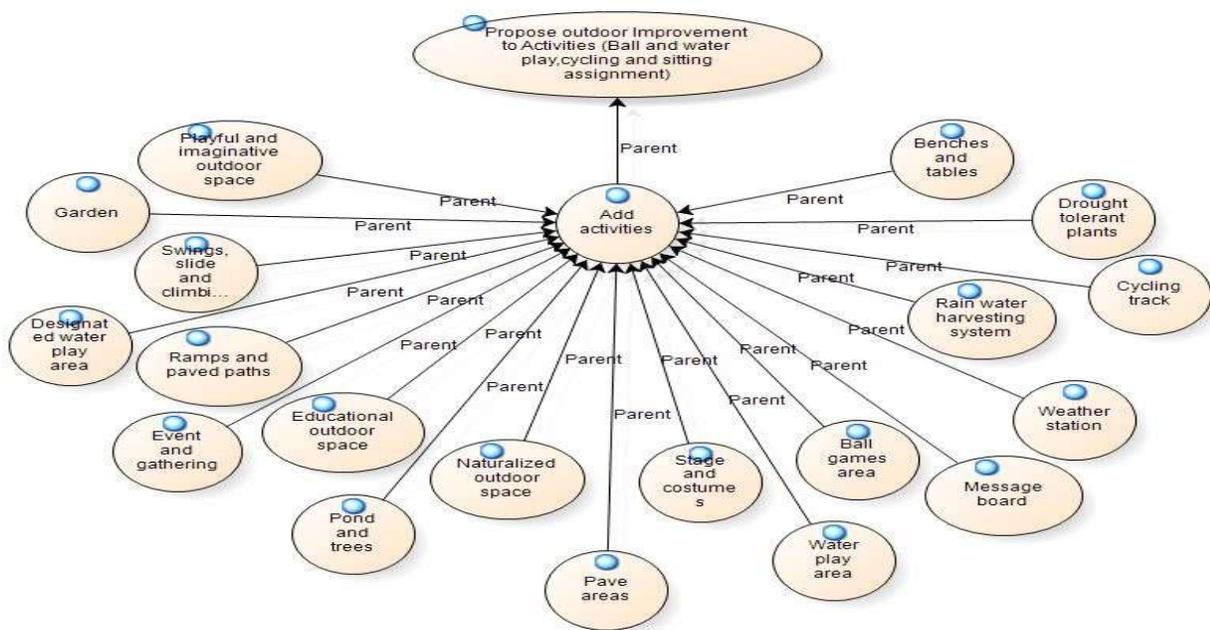


Figure 3c Improvements and Design Aspirations

The responses on the outdoor space improvement to better support activities indicate a strong desire to transform the school's outdoor areas into more dynamic, functional, and engaging spaces. Key sub-themes include play and recreation, multi-functional spaces, comfort and accessibility, environmental awareness and sustainability, learning and education, community engagement, aesthetics and sensory experience, and imagination and creativity. The focus of this is on enhancing opportunities for physical activity, creating multi-functional spaces, and promoting inclusivity. This is in consonance with the work of Abdulmunem et al. (2024) emphasizing the provision of accessible and safe functional outdoor spaces for children of all ages, could reduce social isolation and promote mental health as well as support healthy behaviours. The outdoor space should be designed to serve multiple purposes, including cycling, ball games, and outdoor events. Environmental awareness and sustainability are also emphasized, with ideas to integrate nature, promote learning, foster community engagement, enhance sensory experience,

and encourage imagination and creativity. The overarching goal is to design inclusive and multifunctional outdoor spaces that enhance children learning creativity, and interaction with nature. Sample view of the interview participants revealed;

For example, I would add a large paved area that can be used for cycling, ball games, and other activities. I would also add more benches and tables under the shade of trees to provide better spaces for sitting and working. "I would add a paved cycling track around the perimeter of the school field to encourage more cycling. I would add a sensory garden with a variety of plants that appeal to the senses. I would add a rainwater harvesting system to collect water for the water play area. I would add a stage and some costumes to create a space for outdoor performances. I

would add a weather station and some science-themed displays to the outdoor space (Respondent 9).

In essence, the interview result reveals that children use of outdoor spaces during break periods and other periods they are outside such as structure game play and the use of available play equipment. Other activities include exploration and social connection with outdoor landscape features such as sitting under tree, playing and scavenging of surrounding features. It reveals a huge gap between activities enjoyed based on the outdoor landscape provision and the less common activities based on the lacking landscape features. The ideal outdoor functional spaces include children's playgrounds, experimental gardens, communal for social interactions, water spaces and other ancillary facilities for outdoor space improvements to better the learning activities. These findings suggest that landscape elements like trees serve as dynamic play and learning zones, offering affordances for climbing, shade, imaginative play, and social interaction. Yet, underutilization of spaces for cycling and provision for variety of water features indicates a need for spatial reconfiguration that supports more activities. While features like perimeter fencing and assembly grounds are commonly present, critical learning-focused features such as experimental gardens, outdoor reading areas, and noise-buffering vegetation are largely absent. These gaps reflect a utilitarian approach to school design and child-centred or landscape-responsive model of planning.

Taken together, the findings portray outdoor spaces in North-Central Nigerian public primary schools as structurally present but educationally under-realised. The schools fulfil basic infrastructural functions such as perimeter fencing, circulation, assembly grounds, and in some cases minimal play provision. However, they fall short of becoming intentional educational landscapes that integrate ecological, pedagogical, and child-centred principles. This study therefore confirms and extends the literature in several ways: It empirically substantiates claims that outdoor infrastructure in Nigerian schools is limited and unevenly distributed, especially with respect to play equipment and learning-focused features. It demonstrates that even where outdoor spaces exist, their affordances for learning are constrained by design choices and lack of ecological integration. It reveals that teachers and planners possess sophisticated understandings of how outdoor spaces could support learning, but these insights are not yet translated into built form. Theoretically, the findings show the value of combining affordance theory to interpret action possibilities, ecological systems theory to situate the school landscape within the wider developmental context, and landscape architectural principles to understand spatial legibility and identity in analysing school environments.

VII. IMPLICATIONS FOR POLICY, PLANNING, AND FUTURE RESEARCH

The empirical findings of this study reveal a systemic gap between the infrastructural baseline and the pedagogical potential of outdoor school landscapes in North-Central

Nigeria. The observed near-total absence of fully provided educational spaces such as experimental gardens (0%), outdoor reading areas (0%), and sensory buffers (0%) coupled with significant regional inequity in play equipment provision ($F=4.00$, $p=.015$), means that current compliance-driven infrastructure standards are insufficient. This diagnosis necessitates a coordinated, evidence-driven response across policy, design, and practice to transform these underutilized grounds into engineered, child-centred learning ecosystems. At the policy level, the evidence calls for a fundamental evolution from a focus on minimum physical standards to the mandating of affordance-based qualitative benchmarks. National guidelines, such as the UBEC Minimum Standards, should be revised to explicitly require and fund features that support cognitive, motor, and socio-emotional development. Most importantly, targeted resource allocation mechanisms are needed to address the regional disparities confirmed by the ANOVA results, ensuring equitable access to developmentally rich environments regardless of geographical location and moving decisively beyond square-meter metrics.

Concurrently, at the design level, the documented "pedagogical inertia" of schoolyards characterized by a dominance of fencing and circulation paths over intentional learning nodes demands a paradigm shift. The strong latent demand expressed by teachers and planners for multifunctional, ecologically integrated spaces provides a clear user-informed brief. Synthesizing this with affordance theory, design frameworks must prioritize the creation of motor-enriching landscapes (to address deficits in equipment for crawling and sliding), ecological learning zones (to operationalize the universal request for gardens), and social-cognitive nodes (to fulfil the identified need for shaded reading areas). The thematic analysis, which highlighted trees as vital but under-supported resources, further argues for biophilic and climate-responsive design that leverages natural elements as core components of the learning environment. Translating these policies and designs into practice requires institutionalizing participatory and incremental approaches. The high inter-coder reliability (0.87) and consensus in interview themes affirm that educational stakeholders possess sophisticated, context-aware insights currently untapped in the planning process. This validates the critical need to embed participatory co-design workshops involving teachers, students, and landscape architects as a standard practice to co-create context-responsive solutions. Furthermore, practitioners can initiate immediate transformation through low-cost, high-impact interventions based on identified gaps: creating sensory gardens with local materials, demarcating curriculum-aligned learning zones, and diversifying play affordances with movable elements.

Finally, this study's cross-sectional design points to the necessity for future longitudinal and experimental research to measure the impact of landscape interventions on learning outcomes, physical activity, and environmental attitudes. Cost-benefit studies of sustainable features and expanded sampling to include private schools and other regions would provide valuable evidence for scalable

implementation and more comprehensive national planning. By reimagining schoolyards as engineered ecosystems for development through this integrated, evidence-based approach, stakeholders can transform underutilized grounds into vibrant, equitable, and pedagogically powerful landscapes—a vital step toward quality education in Nigeria and beyond.

VIII. CONCLUSION

This study systematically appraises outdoor educational landscapes in North-Central Nigerian public primary schools, revealing a critical disparity between basic infrastructure and pedagogically intentional design. Schools commonly provide fencing and assembly grounds but severely lack experiential learning spaces such as experimental gardens and diverse play equipment and exhibit significant regional inequities in resource provision. This represents a substantial affordance gap, where schoolyards function as containment zones rather than dynamic learning environments, limiting holistic child development. Theoretically, an integrated framework synthesizing Affordance Theory, Ecological Systems Theory, and landscape architecture effectively diagnoses these constraints. The implications demand coordinated action: policy must embed qualitative, affordance-based standards into national guidelines; design requires a paradigm shift toward participatory, ecologically integrated planning; and practice must institutionalize teacher training in outdoor pedagogy. Transforming these underutilized grounds into vibrant, equitable learning ecosystems is fundamental to educational quality. Future research should adopt longitudinal designs to establish causal links between interventions and developmental outcomes, while directly engaging children through participatory methods. Expanding geographical and institutional scope and conducting applied feasibility studies will enhance generalizability and practical implementation. Investigating pedagogical integration and culturally resonant, climate-responsive design will further strengthen the evidence base for creating transformative educational landscapes.

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