

EVALUATING THE PHYSICAL CONDITIONS OF PRIMARY SCHOOL LANDSCAPES IN BAUCHI METROPOLIS: A FRAMEWORK FOR ENHANCED LEARNING ENVIRONMENT

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Abstract

The physical and design conditions of school grounds significantly influence pupils' educational outcomes, well-being, and social development. This study investigates the design conditions of the landscape of primary school grounds in Bauchi metropolis, Nigeria, with a view to proposing a framework for optimizing their functionality. Drawing on a mixed-methods approach, data were collected through observational checklists, questionnaires administered to pupils and teachers, and photographic documentation across selected public and private primary schools. The findings reveal significant design inadequacies, including limited interactive play areas, poor integration of natural elements, lack of designated outdoor learning spaces, and insufficient safety and aesthetic features. Teachers and pupils consistently reported dissatisfaction with the spatial quality and usability of their school grounds. The study highlights the need for strategic landscape redesign emphasizing accessibility, flexibility, environmental sustainability, and participatory planning. A conceptual framework is proposed to guide future interventions aimed at improving school landscape design in hot-dry urban climates. The paper contributes to the discourse on school infrastructure development in Sub-Saharan Africa, advocating for policies that integrate environmental design principles into educational planning.

Keywords: Educational infrastructure, Landscape design, Learning environment, Physical Conditions, Primary school grounds

INTRODUCTION

Primary school environments encompass more than just classrooms; the surrounding landscape plays a vital role in shaping children's physical, cognitive, and socio-emotional development. School grounds, when appropriately designed, provide a holistic educational setting that fosters creativity, exploration, socialization, and environmental awareness. In regions like Bauchi metropolis in Nigeria—characterized by a hot-dry climate, rapid urbanization, and infrastructural challenges—the condition of outdoor learning spaces is particularly critical.

Recent global research underscores the significance of outdoor environments in supporting children's development and learning outcomes (Bjorklund, 2022; Aminpour, Bishop, & Corkery, 2020). Specifically, design elements such as vegetation, seating, shelter, play structures, and learning gardens contribute to pupils' physical activity, attention restoration, and environmental engagement (Kaplan & Kaplan, 1989; Gibson, 1979; Sirmik et al., 2023). In contrast, poorly designed or neglected school landscapes can hinder these outcomes, limiting opportunities for experiential learning and inclusive education (Graham et al., 2022).

In the Nigerian context, particularly in Bauchi State, studies have highlighted deficiencies in educational infrastructure, especially in public schools where issues of overcrowding, poor maintenance, and inadequate outdoor facilities are prevalent (Ogunode & Adanna, 2022; Adamu, Tsiga & Zuilkowski, 2022). However, there remains a paucity of research focused specifically on the design aspects of school landscapes and how they contribute to or detract from the overall learning experience.

This study seeks to fill this gap by evaluating the design conditions of primary school landscapes in Bauchi metropolis. By assessing the spatial configuration, aesthetic quality, functional adaptability, and user perceptions of these landscapes, the study aims to propose evidence-based strategies for enhancing the learning environment through effective landscape utilization. The research aligns with the broader goal of optimizing primary school grounds as dynamic and inclusive educational spaces. It also supports Nigeria's commitments to improving basic education infrastructure under the Sustainable Development Goal 4 (Quality Education), with a particular focus on environmental and spatial equity.

LITERATURE REVIEW

School grounds are more than just recreational spaces; they play a central role in creating a conducive learning environment. A well-designed school landscape integrates aesthetics, functionality, safety, accessibility, and connection to nature. This section reviews existing literature and empirical findings on the design condition of primary school landscapes, with emphasis on the context of Bauchi Metropolis, Nigeria.

Theoretical Foundations

Bronfenbrenner's Ecological Systems Theory (1979), employed in the study, emphasizes how environmental factors, such as school design, influence children's development. Mishra, Bell, and Mishra (2020) affirm that design features like greenery, flexible spaces, and play areas stimulate interaction and cognitive engagement. The learning environment must thus address emotional, social, and physical needs (Goodyear, 2020; Aminpour et al., 2020).

The design condition of primary school landscapes plays a vital role in shaping learning environments and fostering holistic child development. A well-designed school ground incorporates physical, functional, and aesthetic elements that support cognitive, physical, social, and emotional learning (Gomez & Derr, 2021). The condition of these designs—ranging from layout, safety, visual appeal, to accessibility—determines the usability and educational value of school grounds.

Principles and Components of School Ground Design

Effective landscape design in schools embraces core principles such as safety, accessibility, inclusivity, variety, and connection with nature. Goodyear (2020) emphasized that design condition refers not just to the physical layout but also to how the space supports varied pedagogical needs. Features such as outdoor classrooms, sensory gardens, flexible play areas, shaded seating, and interactive spaces are central to a stimulating school landscape (Bjorklund, 2022).

According to Mishra, Bell, and Mishra (2020), effective design ensures that school grounds provide designated zones for formal and informal learning activities, recreation, and exploration. They recommend spatial zoning that caters to different age groups and activity levels to prevent overcrowding and promote age-appropriate engagement. Likewise, Karakas and Yildiz (2020) highlighted that school designs with integrated natural features such as trees, water elements, and biodiversity zones promote creativity, stress reduction, and attention restoration.

Biophilic Design and Cognitive Benefits

Biophilic design—incorporating natural forms and materials—is increasingly regarded as essential in school landscape planning. Studies by Kaplan and Kaplan (1989) show that children who engage with natural environments benefit from cognitive restoration, emotional regulation, and improved concentration. Adams and Savahl (2017) add that outdoor designs that offer exposure to green elements foster a sense of well-being and encourage self-guided learning through play and discovery.

In line with this, Gomez and Derr (2021) affirm that primary school designs must transcend conventional playgrounds and incorporate learning gardens, nature trails, and interactive ecological zones. These features support constructivist pedagogies where children learn by doing, observing, and collaborating.

Inclusivity, Flexibility, and Accessibility

Inclusivity is a key indicator of good design. Inclusive school grounds accommodate children of all abilities, ensuring full participation in outdoor activities. According to Cook et al. (2019), inclusive design includes wheelchair-accessible pathways, sensory play elements, and multi-surface play zones.

Flexibility in design is also critical. Outdoor areas must serve multiple purposes—structured classes, spontaneous play, and group collaboration. French, Imms, and Mahat (2020) found that schools with adaptable grounds witnessed higher engagement levels, as learners could freely transition between activity zones.

Impact of Poor Design Conditions

Poorly designed or neglected school grounds inhibit learning. Onojah and Adewole (2022) documented how lack of planning in Nigerian public schools results in overcrowded, unsafe, and unattractive grounds. Similarly, Ogunode and Adanna (2022) argue that insufficiently designed outdoor spaces discourage effective use, leading to reduced physical activity, increased behavioral issues, and diminished academic performance.

In Bauchi metropolis, Adamu, Tsiga, and Zuilkowski (2022) noted that many school grounds are either underutilized or unplanned, often lacking shade, structured play zones, or defined learning spaces. These shortcomings affect not only the functionality but also the safety and well-being of pupils.

Best Practices for Landscape Design in Schools

Research has consistently affirmed that well-designed school landscapes can be transformational. A study by Isfat and Raihan (2022) concluded that school grounds designed using participatory approaches—engaging pupils, staff, and communities—tend to be more effective and sustainable.

Furthermore, Van Dijk-Wesselius et al. (2020) recommend integrating outdoor learning into school curricula, supported by purposeful spatial designs. Features like nature-based classrooms, amphitheaters, and shaded reading corners serve both educational and recreational purposes.

Comparative Literature from Other Contexts

Cohen et al. (2023) emphasize that neglect of outdoor spaces in African schools often correlates with poor learning outcomes and physical health. Ogunode (2020) similarly found that many Nigerian schools lack basic landscape infrastructure. Studies in Europe and Asia (Gill, 2021; Sadrizadeh et al., 2022) support that school design influences cognitive performance and student engagement.

The design condition of school grounds is a critical determinant of how effectively pupils use outdoor spaces. Elements such as natural integration, safety, flexibility, and inclusivity must be considered to ensure landscapes are both functional and stimulating. In Bauchi metropolis, addressing the identified design gaps can promote enriched educational experiences and improved pupil outcomes. According to Mishra, Bell, and Mishra (2020), landscape designs should

accommodate diverse pupil needs and learning styles. The presence of natural vegetation, shaded zones, and designated play areas encourages inclusive and exploratory learning experiences (Gomez & Derr, 2021).

METHODOLOGY

Research Design

This study adopted a mixed-methods approach, combining both quantitative and qualitative techniques to assess the design condition of primary school landscapes in Bauchi metropolis. The mixed-methods design provided a comprehensive understanding by integrating observational evidence, survey data, and stakeholder perceptions. The pragmatist philosophy guided the research, enabling the combination of numerical trends and narrative insights for triangulated validity.

Study Area

Bauchi metropolis, the capital of Bauchi State in northeastern Nigeria, served as the study location as indicated in Figures 1, 2, and 3, and Table 1. The region experiences a hot-dry climate and faces infrastructure challenges in its public education sector. The metropolis includes a variety of both public and private primary schools, providing an appropriate sample to assess landscape design conditions across different administrative and funding structures.

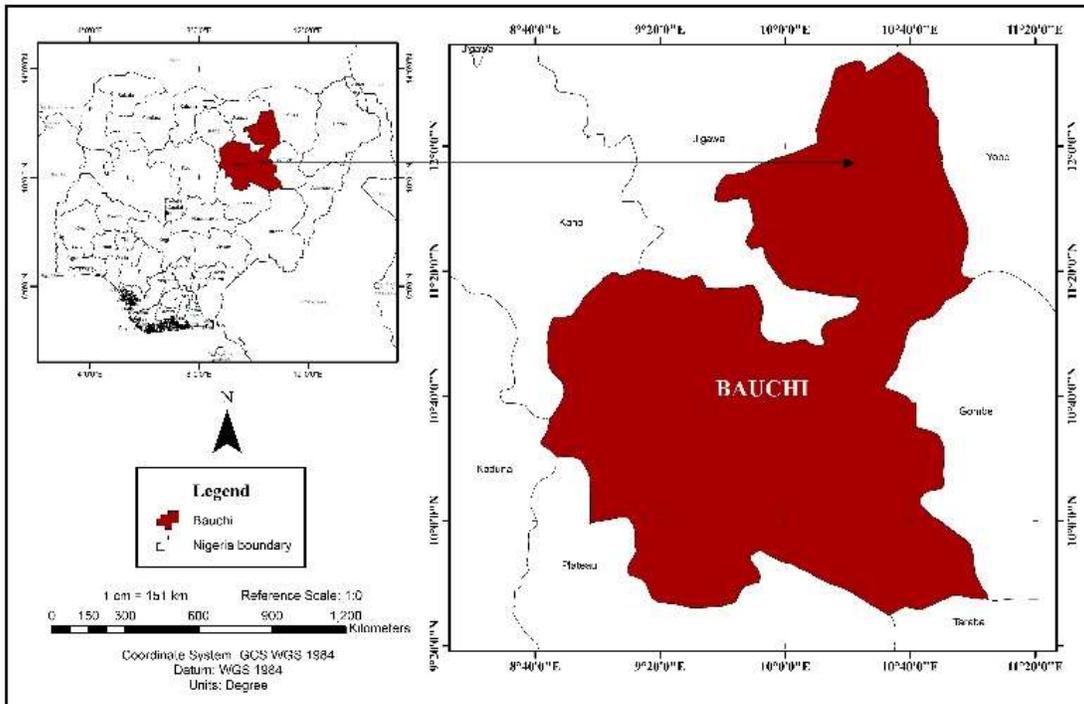


Figure 2: Map of Nigeria Showing Bauchi State.
Source: University of Jos GIS Laboratory (2025)

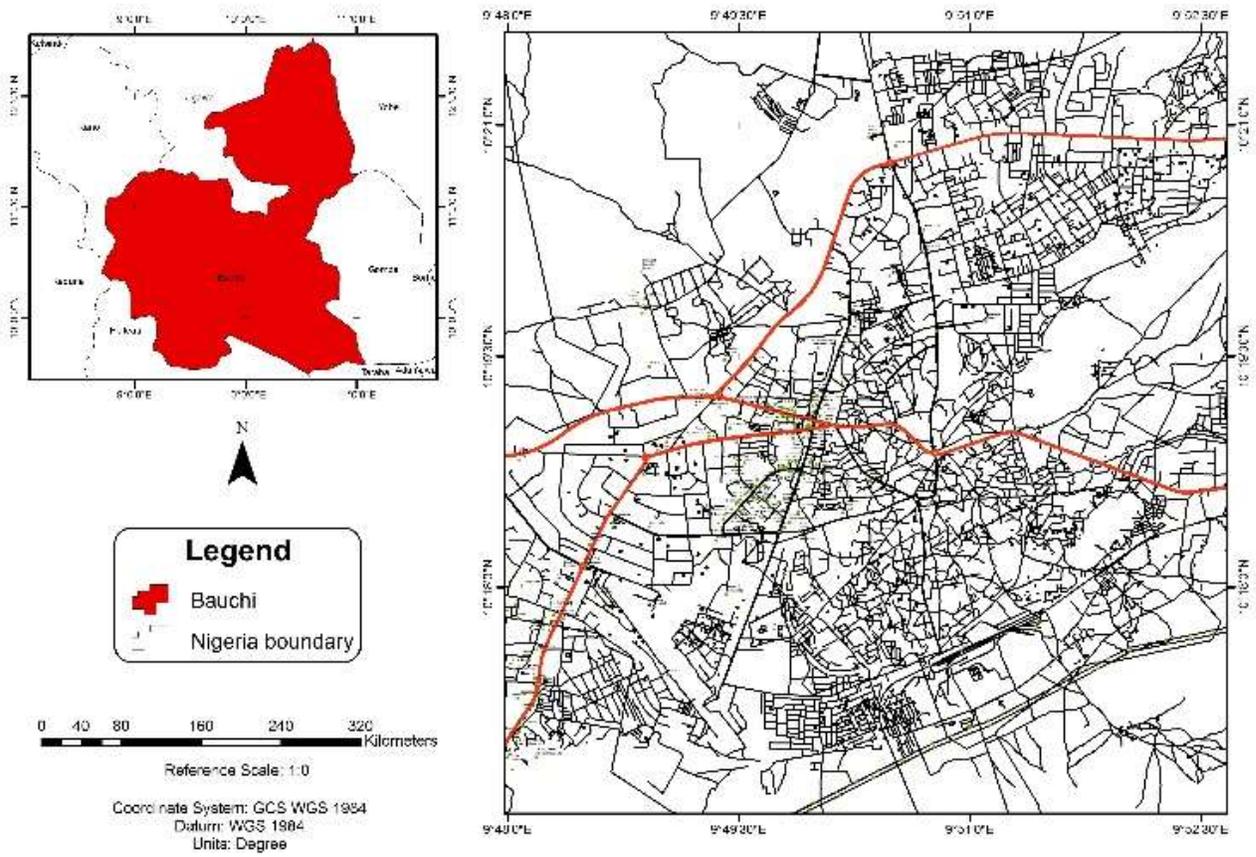


Figure 2: Map of Bauchi Showing Bauchi Metropolis.
Source: University of Jos GIS Laboratory (2025)

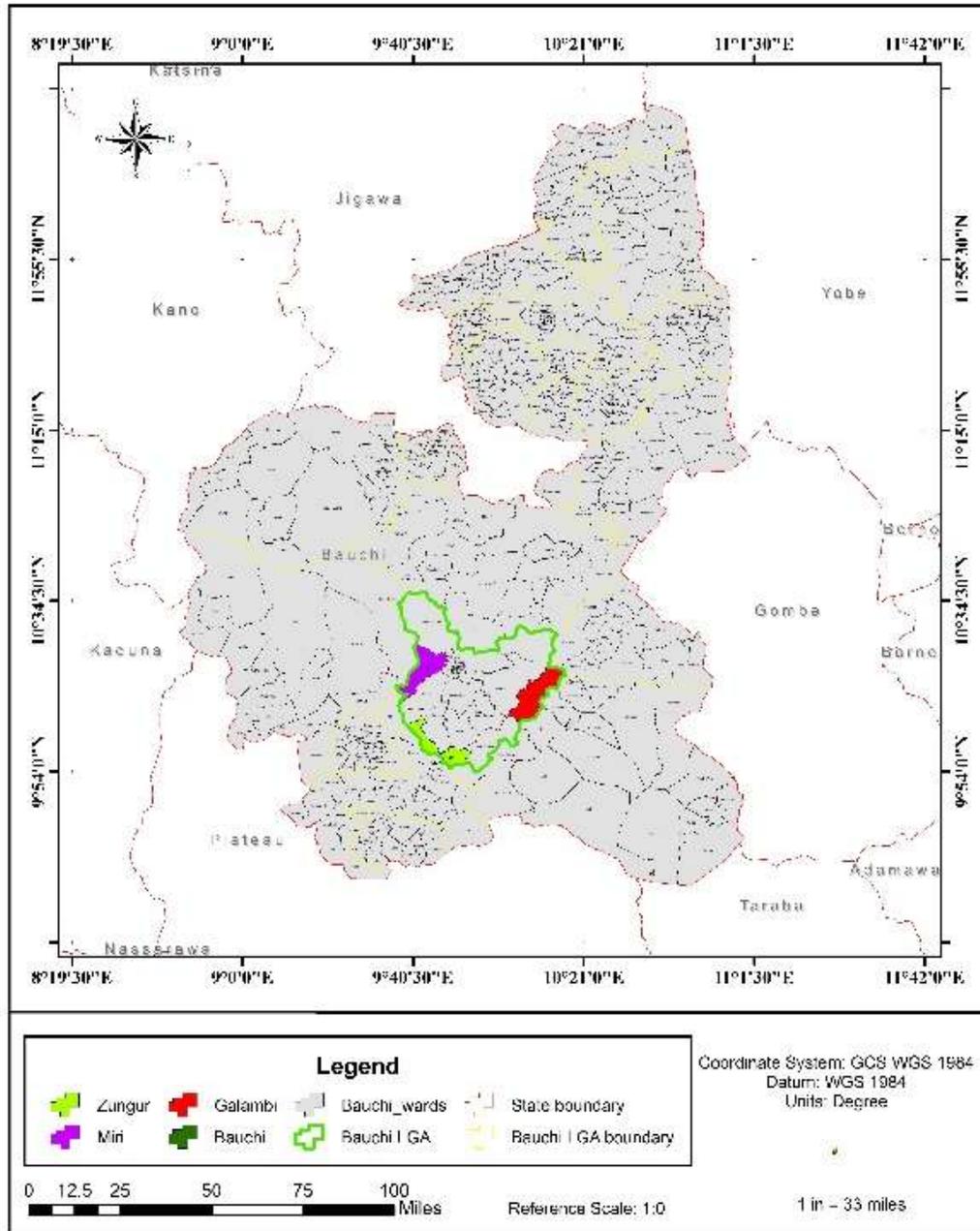


Figure 3: Map of Bauchi showing Study Area.

Source: University of Jos GIS Laboratory (2025)

Table 1: Public and Private Primary Schools in Bauchi Metropolis

S/N	District	Wards	Public Primary School	Private Primary School
1	Bauchi	Majidadi A	3	2
		Dan iya	11	91
		Majidadi B	2	6
		Dankade	4	16
		Dawaki	2	7
		Hardo	2	11
		Makama A	4	27
		Makama B	6	20
		Tirwun	1	1
2	Galambi	Tirwun	22	14
		Galambi	40	4
		Kangere	31	7
		Gwaskwaram	8	
3	Miri	Birshi	22	45
		Miri	29	11
		Dan danko	12	4
		Kundum	19	4
		durum	1	10
		Liman		
4	Zungur	katagum		
		Liman	16	1
		katagum	27	2
		Yamrat	19	2
		Zungur	25	3
	Mummunsal			
TOTAL		4	617	288

Population and Sampling

The target population consisted of: (i) Primary six (6) pupils from selected schools, considered mature enough to reflect on their school environment; (ii) Teachers and administrative staff from the same schools, selected for their role in managing and maintaining the school environment.

Sampling Frame

Using purposive sampling, a total of 8 schools were selected - 4 public and 4 private - to ensure diversity across ownership and funding types.

Sample Size: The sample included (i) Pupils: 241 respondents and (ii) Teachers: 178 respondents

This sample ensured proportional representation and robust statistical analysis.

Data Collection Instruments

Observational Checklist: A structured checklist was used to evaluate observable design conditions in school grounds, including: (i) Aesthetic elements (e.g., colour, layout, lighting), (ii) Functional spaces (e.g., outdoor classrooms, play areas), (iii) Safety measures, (iv) Integration with nature, (v) Flexibility and adaptability of spaces

Questionnaire Survey: Standardized questionnaires (Likert-scale and multiple choice) were administered to both pupils and teachers, covering (i) Their perceptions of the design adequacy of various landscape features, (ii) Frequency of use of different school ground elements, (iii) Satisfaction with current conditions

Visual Documentation: Photographic evidence of landscape elements was captured to supplement textual and statistical data.

Data Analysis

Quantitative Data (from questionnaires) were analyzed using descriptive statistics (means, frequencies, percentages) and inferential statistics (t-tests, ANOVA) using SPSS v26. Qualitative Data (from open-ended responses and observational notes) were thematically coded and analyzed using NVivo 12, focusing on recurring themes like aesthetics, usability, safety, and environmental harmony.

Validity and Reliability

To ensure instrument validity, pilot testing was conducted in two non-sampled schools, and the tools were reviewed by experts in landscape architecture and educational planning. Reliability was confirmed using Cronbach's Alpha, with values above 0.70 indicating acceptable internal consistency across all questionnaire sections.

Ethical Considerations

Informed consent was obtained from all participants (pupils' guardians and teachers). Respondents were assured of anonymity and data confidentiality. Ethical clearance was granted by the Department of Architecture, Abubakar Tafawa Balewa University, Bauchi.

RESULTS AND DISCUSSION

This section presents the key findings regarding the design condition of the landscape of primary school grounds in Bauchi metropolis, based on the analysis of observational checklists, pupil and

teacher questionnaires, and field photographs. The results were organized into thematic subsections reflecting core design indicators: aesthetics and ambiance, functionality, natural integration, safety, and user satisfaction.

Summary of Observational Checklist Results

The observational assessment focused on design features such as visual appeal, flexibility of space, integration with nature, outdoor learning areas, signage, and creative play structures across ten sampled schools as shown in Table 2.

Table 2: Summary of Observational Checklist on Design Conditions

Design Feature	Adequate (n)	Moderate (n)	Inadequate (n)	Comments
Visual aesthetics (color, layout)	2	4	4	Most schools lack deliberate color and spatial organization
Outdoor learning spaces	1	3	6	Only one school had designated outdoor classrooms
Green space integration	2	3	5	Green elements were sparse in public schools
Functional zoning	3	5	2	Most private schools had better zoning for play/learning
Safety design elements	4	3	3	Fencing, pathways, and traffic demarcations were inconsistent
Creativity in play spaces	1	3	6	Most grounds lacked interactive and imaginative play areas

Pupil Perceptions of Landscape Design

Pupils were asked about their satisfaction with various elements of their school's outdoor environment. From the Table 3, more than half of the pupils expressed dissatisfaction with outdoor classrooms and design appeal, suggesting a disconnect between design intent and student needs.

Table 3: Pupil Satisfaction with School Landscape Design (% of responses)

Design Element	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Play Areas	14%	26%	18%	24%	18%
Outdoor Classrooms	10%	15%	20%	25%	30%
Green Spaces	18%	21%	20%	23%	18%
Overall Design Appeal	12%	22%	26%	28%	12%

Teacher Evaluations of Design Features

Teachers offered expert insights on the usability and design quality of school grounds. Table 4 indicates a significant proportion of teachers disagreed that the landscape supports learning, underlining poor alignment between educational goals and design.

Table 4: Teachers' Responses on Landscape Design (n = 178)

Design Factor	Agree (%)	Neutral (%)	Disagree (%)
The landscape encourages learning	28%	16%	56%
Grounds accommodate multiple activities	34%	20%	46%
Presence of shade and shelter	36%	18%	46%
Safety and accessibility features	42%	20%	38%

Photographic Evidence (Descriptive Plates)

Plate 1: Dilapidated play zone



Dilapidated play zone with no grass or shading; pupils exposed to heat and dust.

Plate 2: A well-zoned private school



A well-zoned private school with trees, seats, and small garden beds for outdoor learning.

Plate 3: Unfenced public school ground



Unfenced public school ground adjacent to a road—posing safety risks.

These images (Plates 1-3) corroborate the disparities in design quality between private and public schools design inadequacies, including limited interactive play areas, poor integration of natural elements, lack of designated outdoor learning spaces, and insufficient safety and aesthetic features especially visible in Public Primary schools within the study area.

DISCUSSION

The results reveal considerable variation in design conditions between public and private primary schools. Private schools generally had more visually appealing, functionally zoned, and safety-conscious landscapes. In contrast, many public schools suffered from poor spatial organization, lack of green infrastructure, and inadequate outdoor learning spaces as shown in Table 2.

This echoes findings by Aminpour et al. (2020) and Graham et al. (2022), who argued that landscape design correlates strongly with pupil engagement and environmental behavior. The lack of design coherence, shaded spaces, and stimulating zones in Bauchi public schools undermines their potential as environments conducive to learning (Karakas & Yildiz, 2020).

From an ecological and psychological standpoint, as informed by Kaplan's Attention Restoration Theory, the absence of restorative outdoor features like trees and quiet spaces hinders focus and stress recovery among children. Similarly, the Behavioral Setting Theory (Barker, 1968) suggests that such poorly defined and under-resourced settings fail to activate desired learning and play behaviors.

CONCLUSION

This study evaluated the design condition of primary school landscapes in Bauchi metropolis to determine their effectiveness in supporting outdoor learning and development. Utilizing observational checklists, questionnaires, and photographs, the study compared both public and private school grounds.

The results revealed wide disparities in design standards. Many public schools had minimal or no landscape planning, lacked designated outdoor learning areas, and demonstrated poor integration with nature. Private schools fared better in terms of zoning, aesthetics, and safety but still showed limitations in offering creative and flexible learning spaces.

The study also found that both pupils and teachers expressed dissatisfaction with the design conditions, particularly regarding outdoor classrooms, green spaces, and visual appeal. These findings suggest a pressing need for policy and design reforms to transform primary school grounds into stimulating and functional educational environments.

The condition of the landscape in primary school environments in Bauchi metropolis reflects broader systemic issues of infrastructural neglect and poor design integration in public education settings. As highlighted in this study, well-designed school grounds are not a luxury but a fundamental component of quality education. The lack of appropriate landscape features—such as shaded outdoor learning areas, functional play spaces, and aesthetically pleasing environments—hinders cognitive development, attention restoration, and socio-emotional learning. The situation undermines both formal curriculum delivery and informal learning processes that occur in outdoor settings.

This research contributes to the growing body of evidence that underscores the educational value of designed outdoor environments and provides an empirical basis for developing context-sensitive landscape policies in Nigerian schools.

RECOMMENDATIONS

Based on the findings, the following recommendations are proposed:

- i. Incorporate landscape design in UBE infrastructure guidelines, emphasizing outdoor learning and play.
- ii. Enforce minimum standards for landscape design in both public and private primary schools in Nigeria.
- iii. Promote school greening programs through partnerships with environmental NGOs and community bodies.

Design and Planning Guidelines

- i. Design multifunctional spaces that support learning, play, relaxation, and environmental awareness.
- ii. Use indigenous plants and climatically appropriate vegetation to ensure sustainability and reduce maintenance costs.
- iii. Integrate child participation in school landscape planning, aligning with place-based and behavioral learning theories.

Capacity Building and Awareness

- i. Train school administrators and facility planners in landscape maintenance and utilization.
- ii. Encourage schools to involve pupils in gardening, outdoor learning, and environmental stewardship programs.

REFERENCES

- Adamu, A., Tsiga, A. U., & Zuilkowski, S. S. (2022). Teaching reading in Northern Nigeria: The challenges of large class size. *Pedagogy, Culture & Society*, 30(2), 225-242.
- Adams, S., & Savahl, S. (2017). Nature as children's space: A systematic review. *Children's Geographies*, 15(3), 311–331.

- Afshar, A., & Barrie, L. (2021). Socio-emotional development through outdoor education. *Journal of Experiential Education*, 44(1), 44–61.
- Aminpour, F., Bishop, K., & Corkery, L. (2020). The impact of schoolground design on children's learning and development. *Learning Environments Research*, 23(1), 67–88.
- Barker, R. G. (1968). *Ecological Psychology: Concepts and Methods for Studying the Environment of Human Behavior*. Stanford University Press.
- Bjorklund, D. F. (2022). *Children's Thinking: Cognitive Development and Individual Differences*. SAGE.
- Cohen, D. A., Talarowski, M. R., Han, B., Williamson, S. L., Galfond, E. C., Young, D. R., & McKenzie, T. L. (2023). Playground design and physical activity. *American journal of preventive medicine*, 64(3), 326-333.
- Crossan, A., & Salmoni, A. (2021). Designing restorative schoolgrounds. *Children, Youth and Environments*, 31(2), 30–46.
- Gill, T. (2021). *Urban playground: How child-friendly planning and design can save cities*. Riba Publishing.
- Gomez, T., & Derr, V. (2021). Landscapes as living laboratories for sustainable campus planning and stewardship: A scoping review of approaches and practices. *Landscape and Urban Planning*, 216, 104259.
- Goodyear, P. (2020). Design and co-configuration for hybrid learning: Theorizing the practices of learning space design. *British Journal of Educational Technology*, 51(4), 1045-1060.
- Graham, D., Dixon, C., Azevedo, A., Wright, S., & Innerd, A. (2022). Schoolgrounds and children's physical activity: Evidence from the UK. *Health & Place*, 74, 102752.
- Isfat, M., & Raihan, A. (2022). *Current practices, challenges, and future directions of climate change adaptation in Bangladesh*. Journal homepage: www.ijrpr.com ISSN, 2582, 7421.
- Karakas, G., & Yildiz, D. (2020). The effect of schoolyard greening on student well-being. *Environmental Education Research*, 26(8), 1143–1160.
- Kaplan, R., & Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*. Cambridge University Press.
- Kuo, M., Barnes, M., & Jordan, C. (2019). Do experiences with nature promote learning? Converging evidence of a cause-and-effect relationship. *Frontiers in Psychology*, 10, 305.
- Mishra, B., Bell, S., & Mishra, H. S. (2020). An exploration of how playground design affects the play behaviour of kindergarten children in Tartu, Estonia. In *Place, pedagogy and play* (pp. 41-62). Routledge.
- Ogunode, J. N. (2020). Administration of primary school education in Nigeria: challenges and the ways forward. *Intercathedra*, 45(4).

- Ogunode, N. J., & Adanna, C. M. (2022). An Analysis of Factors Responsible for High Out of School Children in Nigeria and Way Forward. *International Journal on Integrated Education*, 5(6), 194-202.
- Onojah, A., & Adewole, T. (2022). Infrastructure challenges in Nigerian primary schools. *African Journal of School Management*, 6(1), 45–53.
- Sadrizadeh, S., Yao, R., Yuan, F., Awbi, H., Bahnfleth, W., Bi, Y., ... & Li, B. (2022). Indoor air quality and health in schools: A critical review for developing the roadmap for the future school environment. *Journal of Building Engineering*, 57, 104908.
- Sirnik, I., Sluijsmans, J., Oudes, D., & Stremke, S. (2023). Circularity and landscape experience of agrivoltaics: A systematic review of literature and built systems. *Renewable and sustainable energy Reviews*, 178, 113250.
- Tapia-Fonllem, C., Fraijo-Sing, B., Corral-Verdugo, V., Garza-Terán, G., & Moreno-Barahona, M. (2020). The physical school environment and its relationship with student well-being. *Frontiers in Psychology*, 11, 276.
- van Dijk-Wesseliuss, J. E., Van den Berg, A. E., Maas, J., & Hovinga, D. (2020). Green schoolyards as outdoor learning environments: Barriers and solutions as experienced by primary school teachers. *Frontiers in Psychology*, 10, 484511.