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An Examination Of Spatial Configuration Variables Influencing Well-Being In Learning Spaces

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Abstract

Learning spaces play an important role in shaping the experiences and well-being of students within educational environments. Well-being has become an increasingly prominent concern since the COVID-19 pandemic, particularly for students, as there is growing scholarly attention on the influence of the role the built environment plays in aiding well-being. Existing studies on learning environments primarily focus on academic performance, while limited attention is given to the spatial configuration variables affecting well-being in learning spaces. This study aims to identify the spatial configuration variables that influence well-being in learning spaces from existing literature by addressing the following research questions: (1) what spatial configuration variables influencing well-being in learning spaces have been addressed in existing literature? (2) Which variables are most influential? (3) What gaps and future research directions characterise the field? A hybrid literature review combining a scoping review and bibliometric analysis was conducted to identify, map and synthesize relevant literature using Google Scholar as the database. Findings indicate that interconnected spatial dimensions influence well-being, and environmental quality variables emerged as the most influential factors. Key gaps identified include a paucity of longitudinal and multi-variable research, and under representation of tropical learning environments such as Nigeria

Keywords: Spatial Configuration, Well-Being, Learning Spaces, Educational Environment, Scoping Review, Bibliometric Analysis

1.0 INTRODUCTION

As educational institutions evolve, the physical learning environment is increasingly being recognized as an active agent that significantly influences students' well-being (Ali et al., 2026; Bakbak, 2026; Zin1 et al., 2025). Scholars frequently describe the classroom space as the "third educator", noting the critical role this physical space plays in hindering or facilitating cognitive, social and emotional growth in students (Boudra et al., 2025; Whipple & Evans, 2022).

To illustrate, Wen et al., (2024) noted that when specific features such as ventilation, lighting and acoustic levels are poor in a learning space and when students do not have a sense of personal control over their physical settings, the direct result is an increase in anxiety levels and mental fatigue. Furthermore, the broader literature shows that spatial configuration often determines movement patterns and perceptions of inclusion within learning environments, with highly integrated layouts and circular/u-shaped seating arrangements reducing spatial hierarchy and improving confidence and collaborative engagement among students (Orhani, 2025; Smith, 2017; Wu et al., 2017).

Regardless of the outcomes in these studies, spatial configuration remains one of the most often debated aspects when it comes to student learning. Wannarka & Ruhl (2008), through a review of eight empirical studies, concluded that educators should not let the nature of the task dictate seating arrangements, noting that rows benefit individual work, thereby supporting the promotion of the traditional row seating. However, studies such as Falout, (2014) propose a counterargument, noting that circular-shaped arrangements expand the action zone to the whole classroom, promoting belonging and positive learning emotions. Similarly, crescent-shaped seating has also been found to produce significantly higher individual and group process performance scores compared to round arrangements, with video analysis showing more eye contact and greater efficiency as opposed to traditional row seating (Hayashi et al., 2023). Collectively, these studies indicate the effect the physical configuration of a space has on the students. Nonetheless, existing studies remain fragmented and heavily focused on isolated variables such as acoustics, lighting or thermal comfort rather than examining learning environments as integrated spatial systems. Further attention must be given to the relationship between the built environment and student well-being in educational spaces since it plays a significant role in the overall development of a student.

Therefore, this paper aims to examine the spatial configuration variables influencing well-being in learning spaces. Specifically, the study seeks to identify the various spatial configuration variables addressed within existing literature, determine their prominence and frequency across different educational environments and examine how these variables relate to different dimensions of well-being. The significance of this research lies in the growing psychological and social challenges facing contemporary society, particularly students within educational institutions. As global events continue to shape feelings of instability about the future, it becomes increasingly important for architects, educators and policymakers to design learning environments that support well-being. To guide the study, the following research questions (RQ) are addressed:

RQ1: What spatial configuration variables influencing well-being in learning spaces have been addressed in the existing literature?

RQ2: What are the most influential spatial configuration variables affecting well-being in learning spaces?

RQ3: What are the gaps and future research recommendations regarding spatial configuration and well-being in learning spaces?

2.0 LITERATURE REVIEW

2.1 Learning Spaces

In conventional discourse, the definition of a learning space is usually constrained to the classroom environment; however, contemporary research argues that learning extends beyond the classroom space into a broader "learning landscape" composed of both formal and informal environments. Cook, (2010) defines a learning space as any physical or virtual environment where educational activities take place. Over time this definition has further evolved as learning spaces have extended beyond physical boundaries (formal and informal) and now include the digital/virtual settings (online platforms and virtual reality environments) (Barua & Lockee, 2024; Papaioannou et al., 2023) Regardless of whether these learning environments are physical or virtual, they are often tailored to cater to differing pedagogical needs ranging from collaboration to reflection/focus to experimentation. (Papaioannou et al., 2023, 2023).

2.2 Formal vs Informal Learning Spaces

In practice, formal learning spaces are often designed for conventional teaching with specific technologies and layouts that support a rigid curriculum. These spaces are typically classrooms, lecture halls, laboratories, studios and auditoriums (Peng et al., 2022; Salih et al., 2024). Whereas informal learning spaces are spaces outside the classroom used for learning which included libraries, cafeterias, atriums, corridors, outdoor arenas, social hubs and hybrid learning centres (Cox, 2018; Salih et al., 2024; Wu et al., 2021) often ranging from private quiet rooms to semi private areas and public/outdoor spaces to comprehensive multifunctional spaces(Salih et al., 2024). However, in this study, "learning space" primarily refers to the physical environments where learning takes place.

2.3 Spatial Configuration of Learning Spaces

Spatial configuration refers to how spaces are arranged and connected, and how this affects the interactions between users in their environment and their overall spatial experiences (Hammadamin et al., 2024; Sharmin & Kamruzzaman, 2018). In learning environments, it determines how users navigate, encounter others, access facilities and perceive their surroundings, thereby influencing both learning outcomes and well-being. Within educational settings, spatial configuration is commonly examined through variables such as spatial layout and circulation patterns, accessibility and connectivity, visibility and openness, density and flexibility, environmental quality and wayfinding characteristics (Guo & Sui, 2025; Hammadamin et al., 2024; Sharmin & Kamruzzaman, 2018; Youssef & Youssef, 2022), which can be measured using key spatial configuration measures resulting from space syntax theory such as integration, connectivity, visibility and choice (Hillier & Hanson, 1984).

2.3.1 Integration

Integration describes how easily a space can be reached from all other spaces and is closely associated with movement patterns and social encounters (El-Darwish, 2022; Sharmin & Kamruzzaman, 2018; Youssef & Youssef, 2022);

2.3.2 Connectivity

Connectivity measures the number of directly linked spaces and reflects the potential for interaction and accessibility (Hammadamin et al., 2024; Youssef & Youssef, 2022);

2.3.2 Visibility Analysis

Visibility analysis evaluates what can be seen from different locations within an environment and is widely used to assess openness, surveillance and spatial legibility (Dai et al., 2025; Guo & Sui, 2025; L. Wang et al., 2022; Youssef & Youssef, 2022)

2.3.2 Visibility Analysis

Choice, also referred to as betweenness, indicates how frequently a space lies along the shortest routes between destinations and is considered a strong predictor of pedestrian movement and activity patterns (El-Darwish, 2022; Sharmin & Kamruzzaman, 2018).

2.4 Well-being in learning spaces

Well-being is multidimensional in nature; it is described as a state of feeling happy, coping with daily life, and functioning effectively, including emotional, psychological, and social aspects, and generally how they evaluate their lives overall (Jarden & Roache, 2023; Ruihua et al., 2025). Models such as PERMA (Positive Emotions, Engagement, Relationships, Meaning, Accomplishment) are often used to describe the idea of flourishing as it relates to well-being rather than the absence of illness (Li, 2025; Ruihua et al., 2025). In educational settings, studies have shown that well-being encompasses a student's emotional, psychological and social aspects (Hossain et al., 2023; Jiang et al., 2025; Li, 2025; Li et al., 2024; Murray et al., 2024; Ruihua et al., 2025), with some research frameworks including the academic, physical, financial and relational well-being as other aspects of well-being within the learning environment (Khatri et al., 2024; Murray et al., 2024; Norozi, 2023).

3.0 METHOD

This study employs a hybrid literature review approach, combining a structured scoping review with a bibliometric analysis. A scoping review was considered appropriate because the study sought to identify, map and synthesise the breadth of existing knowledge on the relationship between spatial configuration and well-being rather than evaluate the effectiveness of specific interventions, an approach well suited to the multidisciplinary literature spanning architecture, environmental psychology, education and space syntax (J. H. Lee et al., 2023).

3.1 Search Strategy

Google Scholar was used as the primary database due to its broad coverage of peer-reviewed literature across architecture, environmental psychology, education and well-being -related disciplines. Its broad multidisciplinary coverage makes it suitable for identifying omissions that may be missed by field-specific databases (Phelps et al., 2025). Searches were conducted using the string: (“spatial configuration” OR “space syntax” OR “spatial layout”) AND (“well-being” OR “well-being” OR “mental health”) AND (“learning space” OR “classroom” OR “educational environment”) and further refined to allintitle: spatial configuration of learning spaces. Forward and Backward citation searches of included studies were additionally conducted to identify records missed by the original search. All records were managed in Zotero and exported in RIS format for bibliometric analysis.

3.2 Eligibility Criteria

Studies were included if they were peer-reviewed journal articles published in English and examined spatial configuration variables within learning environments in relation to well-being outcomes. Studies focusing solely on academic performance, non-educational settings, conference abstracts, editorials, book reviews or non-English publications were excluded (Figure 1)

3.3 Study Selection

A total of 1093 records were initially identified and imported into Zotero. Following duplicate removal, 1,036 records remained; title and abstract screening reduced this to 338 records. Further application of the eligibility criteria with a specific focus on learning spaces resulted in 150 records for full-text assessment. Full-text screening yielded 40 studies included in the final study. A single researcher conducted screening.

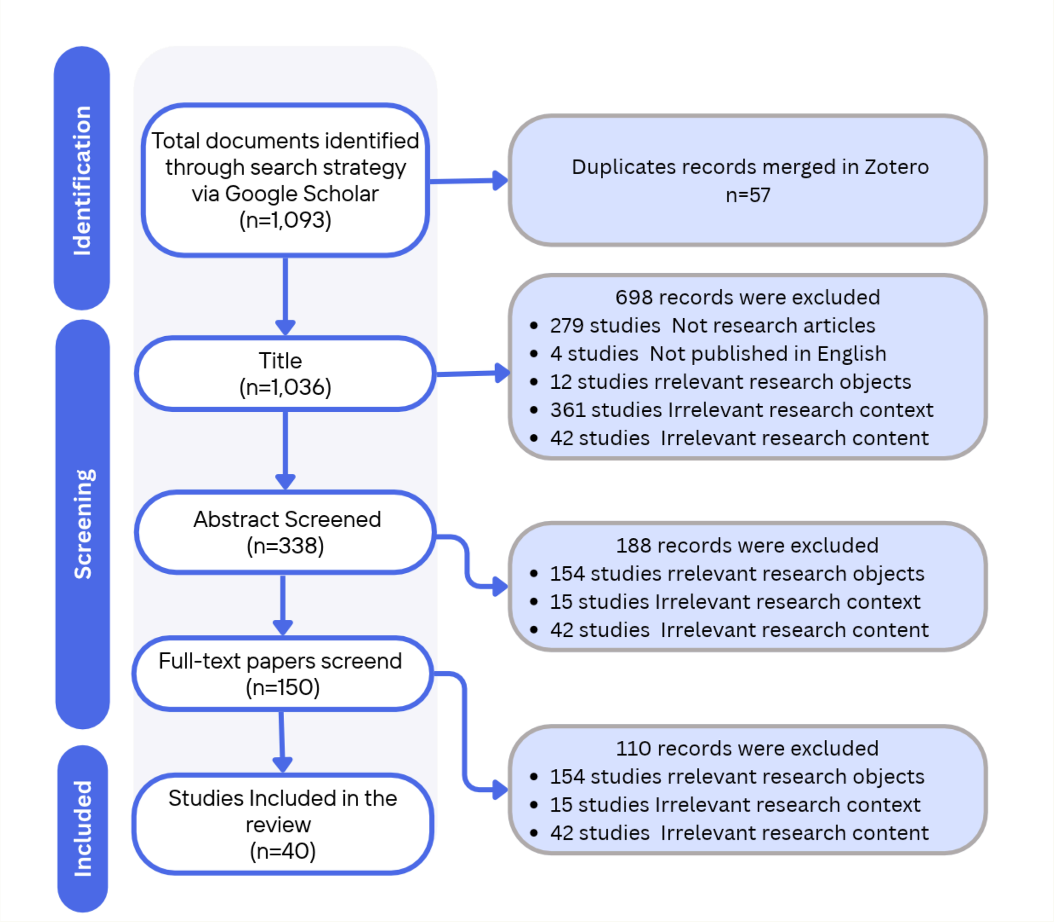

Figure 1: Flow Diagram Of Search And Selection Process

3.4 Data Extraction and Analysis

The following data items were extracted from each study: (1) Author and year; (2) study context/ learning environment; (3) spatial configuration variables examined; (4) well-being variables or outcomes measured; (5) summary of key findings. A single author extracted these, with the format illustrated in Figure….. During the analysis stage, bibliometric analysis was first undertaken to examine keyword co-occurrence networks, and then a thematic synthesis was conducted to identify recurring spatial configuration variables, well-being outcomes and knowledge gaps in the literature. The integration of these approaches provided a comprehensive understanding of the current state of research and emerging directions in the field. (Figure 2

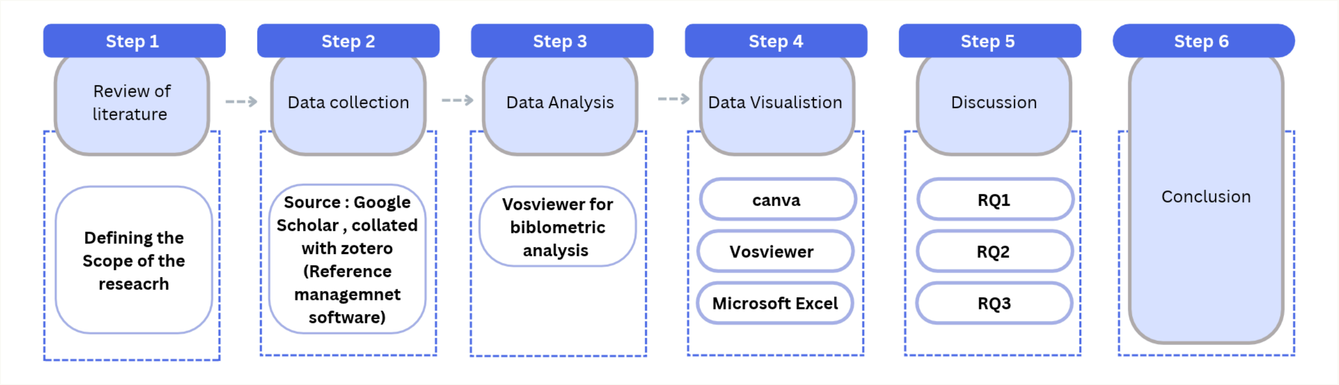

Figure 2: Schematic Illustration of the Workflow

4.0 RESULTS

A total of 40 studies were included in the final sample of this study; the resultant studies showing the variables obtained from these studies are as shown below.

Table 1: Result from study

s/n	Author(s) and Year	Learning Environment	Spatial Configuration Variables	Well-being Variables	Key Findings
1	(Poutanen, 2025)	informal space	Biophilic patterns , staircase width and natural light	Cognitive function and emotional well-being	Minimal use of natural materials limit restorative benefits in centers
2	(Zhao et al., 2026)	informal space	Perceived restorativeness and healing landscapes	Psychological restoration and campus belonging	Landscape perception predicts restoration and belonging.
3	(Hammad amin et al., 2024)	Formal Space	Global Integration, floor level and per capita area.	User satisfaction with facilities	Spatial integration not proportional with area occupancy rates.
4	(Upadhya ya & Uprety, 2026)	Informal Space	Spatial openness , hierarchy and furniture flexibility.	Sense of belonging , engagement and social awareness	Visual openness and flexible layout , enhance social awareness and emotional connection to space
5	(Abid & Arifuzzam an, 2026)	Informal Space	Versatility , physical planning, maintenance levels	User satisfaction, comfort in various weather and sense of safety.	Versatile spaces taht adapt to changing user needs achieve positive higher-ranking scores.
6	(Alhmoud et al., 2025)	Informal Space	Corridor width , layout and visual connectivity	User satisfaction , emotional response and perceived stress	High visual connectivity and appropriate width reduce stress and enhance interaction.

s/n	Author(s) and Year	Learning Environment	Spatial Configuration Variables	Well-being Variables	Key Findings
7	(Anwar et al., 2025)	Informal Space	Degree of enclosure and shape	Brainwave activity (Alpha/Theta). Representing relaxation/ concentration.	U shaped courtyards improve perceived comfort and restorativeness.
8	(Bay-Sahin & Shah, 2026)	Formal Space	Spatial Strategies , soft seating and daylight	Competence , autonomy and relatedness	Inadequate lighting and ventilation create a “depressing” atmosphere.
9	(Liu et al., 2025)	Informal space	Spatial scale, layout and natural elements	Psychological well-being metrics	Balance between collaborative and solitary modes is critical for equity.
10	(Akkurt & Akbulut, 2025)	Informal space	layout , Connectivity and visibility	Social interaction and psychosocial well-being	In-between spaces, corridors, and atriums are vital nodes of resilience and community
11	(Nguitragool, 2026.)	Informal space	Spatial typology , formal vs informal space	Relaxation , docs and stress reduction	Nature based vr gardens provide teh highest restorative value
12	(Hu et al., 2025)	Informal space	Actual vs perceived exposure on daily paths	Stress , anxiety and sleep quality	Perceived exposure has a stronger impact on mental health than actual exposure
13	(Zakari et al., 2025)	formal space	Spatial harmony, bounded and transitional spaces	Cognitive restoration , concentration and mental fatigue relief	Poorly organised classrooms with limited visual diversity lead to cognitive fatigue , transitional spaces are vital for momentary restoration

s/n	Author(s) and Year	Learning Environment	Spatial Configuration Variables	Well-being Variables	Key Findings
14	(Lwin et al., 2025)	Informal space	Furniture layout, cluttered vs minimalist	Perceived relaxation , mindfulness	Minimalist layouts with fewer distractions promoted higher levels of perceived relaxation and meditation effectiveness
15	(Tomlin et al., 2025)	Formal space	Background noise and spatial acoustics	Resilience	Speech in noise recognition ability is a strong predictor of student resilience
16	(Zhang et al., 2024)	Formal space	Spatial layout, connectivity and integration of outdoors.	Learning utility and psychological preference.	Outdoor integration and flexible seating enhance learning utility.
17	(Hammadamin et al., 2024)	formal space	Visual Integration, choice, connectivity.	Concentration and collaboration levels.	Visual integration and local clustering are the primary performance predictors.
18	(Makaremi et al., 2024)	formal space	Ieq, space quality, layout and furniture	Satisfaction , comfort and physical/ mental health	Poor IEQ impairs health ; flexible spaces are necessary for diverse learning styles
19	(Feng et al., 2025)	formal space	Seating location, peer network, spatial structure	Behavioral Academic related well-being metrics	Peer network dictates behavior
20	(Sun et al., 2024)	formal space	colors (cool vs warm colors)	Calmness, nervousness , cheerfulness , liveliness	Warm colored class rooms evoke liveliness and cool colors increase calmness

s/n	Author(s) and Year	Learning Environment	Spatial Configuration Variables	Well-being Variables	Key Findings
21	(McClain et al., 2024)	Formal space	Spatial layout and acoustics	Stress levels	Poor acoustics effects autistic youths negatively.
22	(Yaseen & Mustafa, 2023)	Formal space	Visibility , connectivity, integration	Connectedness and visual quality	Visual connectivity and entropy are higher in schools with internal courtyards.
23	(Rijken & Fraser, 2024)	Formal space	Spatial logic and variety	satisfaction , motivation and perceived productivity	Classroom layout variety is decisive in shaping student satisfaction and motivation
24	(Gao et al., 2022)	Formal space	Row / column position and proximity to instructor	Perceived engagement and satisfaction	Individual and group wise seating experiences differ in perceived engagement.
25	(Anteet, 2024; Binabid & Anteet, 2026)	Informal space	Visual mean depth, connectivity and isovist area	Recess behaviour patterns and spatial usage	Higher connectivity and expansive isovist support more balanced and divers social play
26	(Fouad & Sailer, 2022)	Formals & informal spaces	Spatial zoning , circulation paths and openness	Collaboration between peers and self-directed activity	A classroom that is open yet zoned facilitates collaboration while avoiding disruptions.
27	(Sitthiworachart et al., 2022)	Formal spaces	modular / flexible layouts	Participation , engagement , motivation	Flexible configuration enhance students motivation
28	(G. Wang et al., 2026)	Informal spaces	Spatial layout	Satisfaction	Spatial layout is the strongest predicator of satisfaction

s/n	Author(s) and Year	Learning Environment	Spatial Configuration Variables	Well-being Variables	Key Findings
29	(Zhang et al., 2019)	Formal spaces	Spatial proportions and ceiling height	Stress reduction	Ceiling height affects the psychological perception of space and cognitive processing.
30	(Y. Lee, 2019)	Formal spaces	Layout and indoor environmental quality (IEQ)	Satisfaction	Green certified layouts improve satisfaction levels
31	(Siramkaya & Aydin, 2017)	Formal space	integration , connectivity, and mean depth	Social interaction and frequency pattern	Integration corresponds to the diversity of students self motivation
32	(Amlani & Russo, 2016)	Formal space	Acoustic metrics	Cognitive fatigue	Improperly placed panels can have a negative effect on listing effort if spatial clarity is lost
33	Allen et al 2016	Formal spaces	Green vs conventional spatial environments	Cognitive performance	Green environments with optimized ventilation and layout support significantly higher cognitive scores.
34	(Barrett et al., 2017)	Formal space	flexibility , orientation and connection	Motivation	Physical design accounts for 16% variance in self-motivation and progress
35	(Mealings et al., 2025)	Formal space	Layout , acoustics	Satisfaction and motivation , stress	Higher noise related stress
36	(Taguchi & Kishimoto , 2012.)	Formal space	Step depth , integration	Motivation connection	Low step depth determines movement and level of connectivity and integration zones

s/n	Author(s) and Year	Learning Environment	Spatial Configuration Variables	Well-being Variables	Key Findings
37	(Mealings et al., 2023)	Formal space	Acoustics	interaction patter	Open plan classrooms promote connection among students
38	(Cuyvers et al., 2011)	Formal & informal space	Integration	Perceived well-being	Poor infrastructure correlates with lower well-being
39	(Pasalar, 2003)	Formal space	Spatial layout	interaction patter	Layout directly influences teh types of social behaviors and peer interactions observed.
40	(Arnold & Canning, 1999)	Formal space	Acoustics	Comprehensio n and stress	Classroom amplification improves comprehension and reduces cognitive brain stain and stress.

5.0 DISCUSSION

5.1 RQ1: What spatial configuration variables influencing well-being in learning spaces have been addressed in the existing literature?

The literature identifies a broad range of spatial configuration variables that influence well-being in learning environments. These variables can be grouped into four major categories as shown in *Figure 3* below

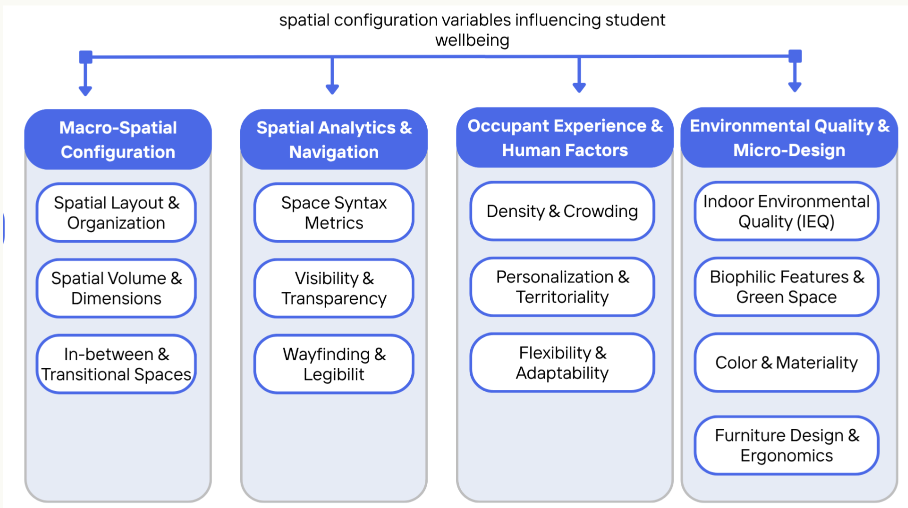

Figure 3: Categorization of spatial configuration variables influencing well-being(Source: authors work)

The first category is Micro-spatial configuration (**Morphological**) variables which comprises of layout typologies , modularity , spatial volume and ceiling height and transitional /in between space**s** , such as corridors , atriums , courtyards , cafes and study lounges, which support social interaction , community building and informal learning, all of which affect engagement , autonomy , concentration and spatial comfort; The second category is the Spatial Analytics & Navigation (**Syntactic**) variables which include ;spatial integration , connectivity , choice , step depth and visibility measures; which influence movement , social interaction , navigational clarity and perceived safety; the third is the occupant experience which include density and crowding and personalization and territoriality and flexibility and adaptability; the fourth is environmental quality and micro design which includes indoor environmental quality and biophilic and environmental variables include green and blue spaces , nature views , lighting , acoustic , thermal comfort and air quality , which are consistently associated with improved psychological well-being .

5.1.1 Network Analysis from Study

The Network diagram below shows a structural separation between objective spatial configuration terminology and subjective well-being terminology within the field's conceptual network. As shown below in *Figure 4*.

Figure y resolves into three larger clusters. The red cluster, learning environment, campus data, questionnaire, preference, survey, indicates a substantial survey-driven strand focused on characterising user needs at the campus scale. The blue cluster, well-being, student well-being, teaching and mental health review, reflects a more conceptual synthesis-oriented strand of the field. The green cluster, spatial configuration, space syntax, building, case study, methodology, with China at its edge, points to a methodologically rigorous but narrowly configurational strand concentrated in a specific national context. The clear separation between the green, configurational and blue, well-being clusters, bridged mainly through the red survey cluster, indicates that spatial configuration and well-being remain largely parallel rather than integrated lines of inquiry. This pattern suggests that although spatial configuration and well-being are frequently studied within the same broader body of literature, they are rarely integrated within the same conceptual or methodological frame. Whereas configurational research tends to remain oriented toward measurable, objective spatial properties, while well-being research clusters around subjective experiential and pedagogical concerns.

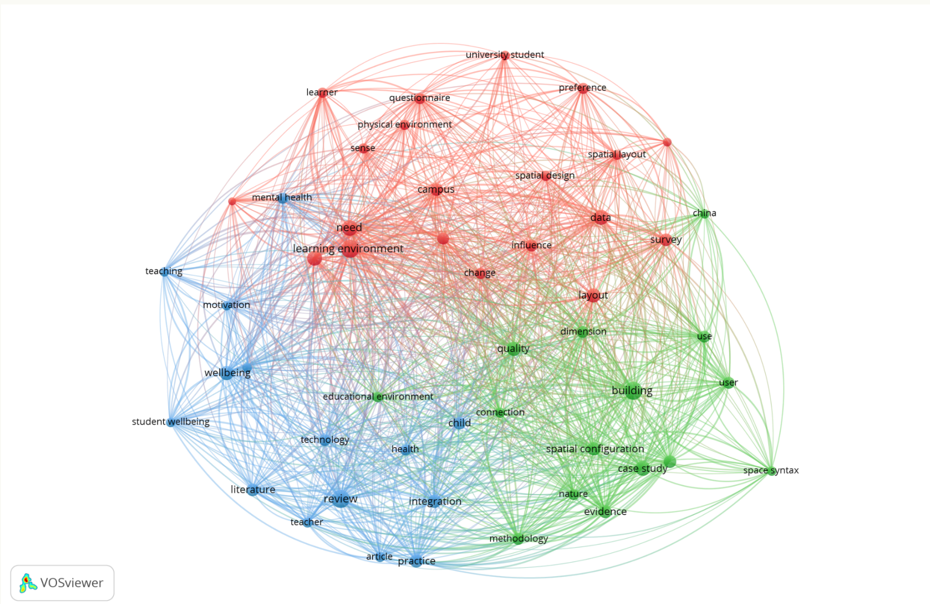

Figure 4: Network diagram from bibliometric analysis (Source: authors work)

5.1.2 Keyword Co- occurrence Diagram

Figure 5 resolves into five clusters. The green cluster, learning, well-being, classroom, classroom acoustics, lecture, children, indicates a tightly bounded focus on instructional and acoustic conditions at the classroom scale. The red cluster, education, neuroarchitecture, classroom design, built environment, reflects an emerging bridge between pedagogical theory and architectural/neuroscientific framing. The purple cluster, anchored by space syntax and linked to social interaction and campus design, shows configurational analysis applied mainly at the building/ campus scale, oriented toward circulation rather than well-being. The smaller blue cluster, student well-being, in-between space, informal learning, suggests transitional spaces form a distinct, still emerging research focus. The yellow cluster, machine learning, semantic segmentation, street view, connected only through space syntax, indicates computational methods have entered space syntax research but remain disconnected from well-being inquiry. The isolation of the machine learning cluster, connected only through space syntax and entirely disconnected from well-being terminology, further indicates that emerging computational methods have not yet been meaningfully applied to well-being outcomes.

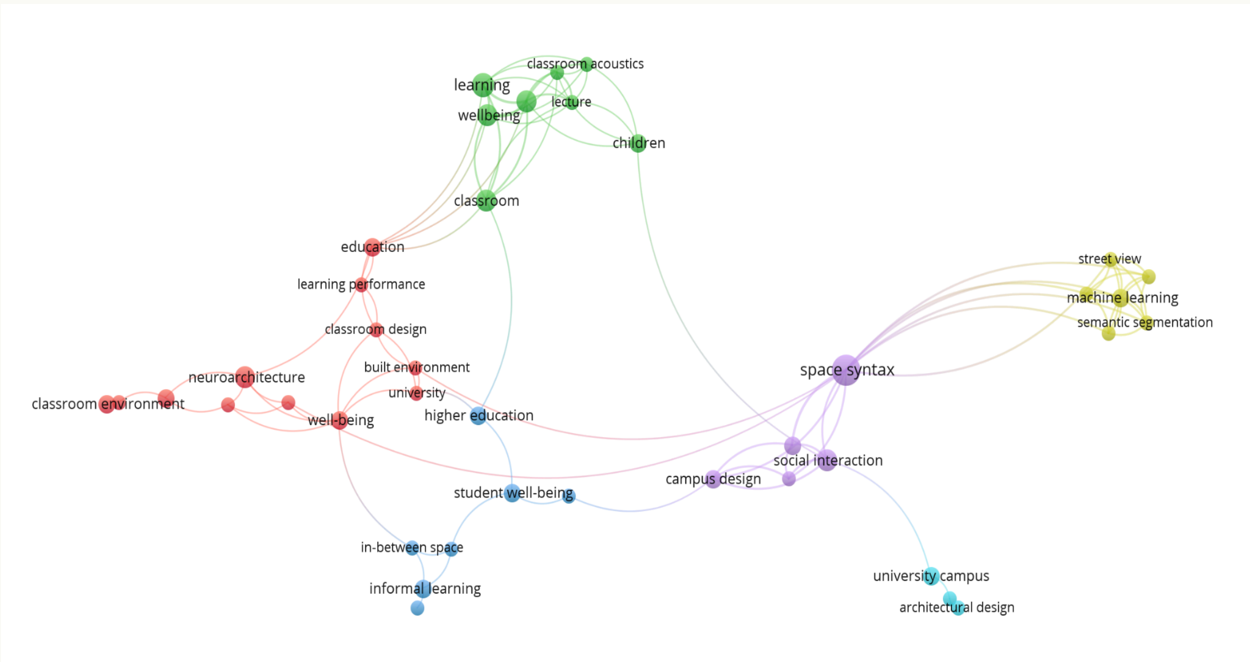

Figure 5: Keyword Co- occurrence Diagram (Source: authors work)

5.2 RQ 2: What are the most influential spatial configuration variables affecting well-being in learning spaces?

The study identifies eight interrelated domains shaping well-being in learning environments, which are as shown in *Figure 6* below

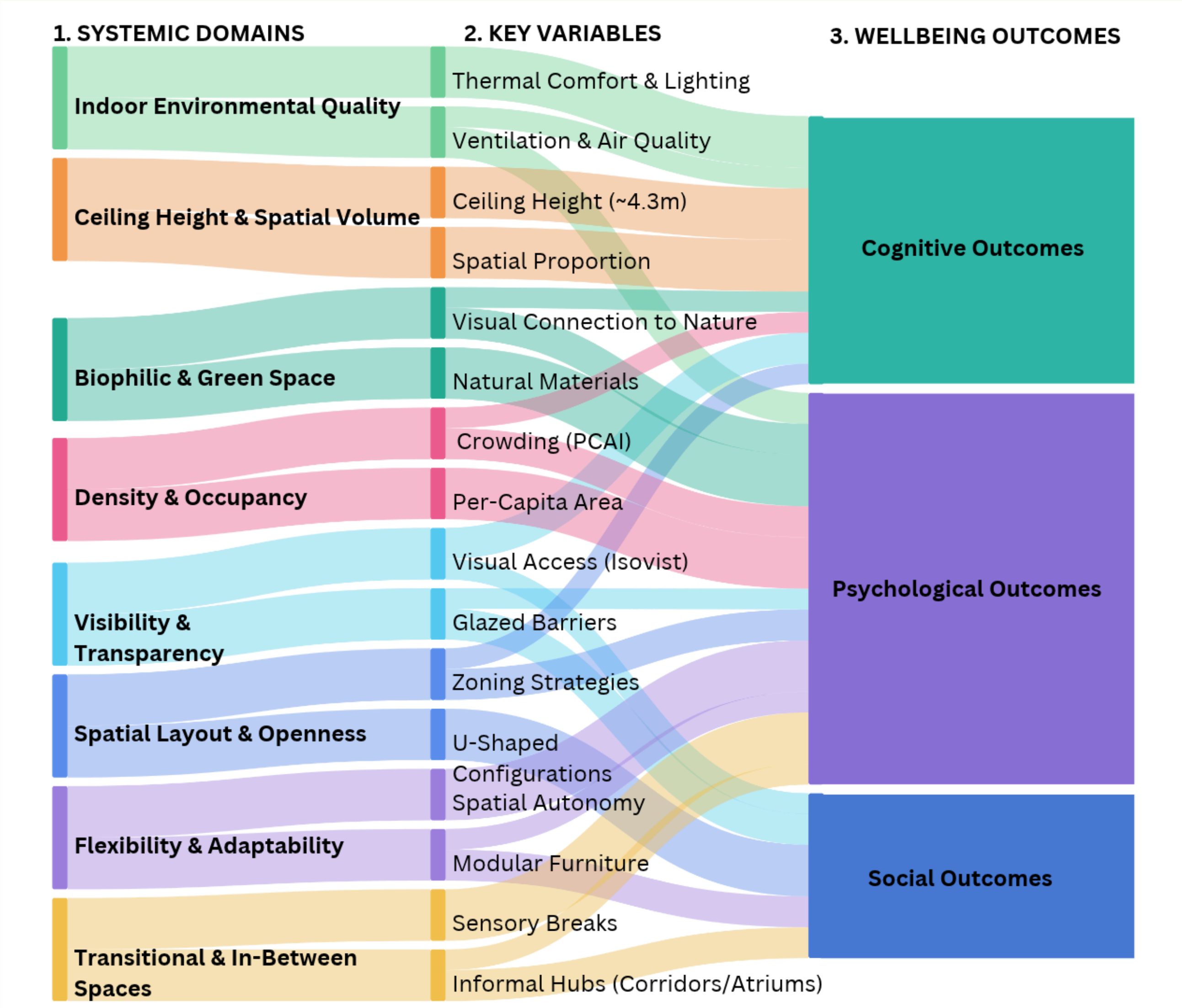

Figure 6: Sankey diagram showing most influential variables (source: authors work)

Indoor environmental quality (ventilation, thermal comfort and lighting) emerges as the strongest predictor of both environmental satisfaction and anxiety, with poor air quality, suboptimal temperatures and limited daylight access linked to reduced cognitive performance and fatigue (Barrett et al., 2017) Visibility and transparency, assessed through isovist analysis, show that greater visual access lowers cognitive load and improves supervision, while glazed barriers balance openness with acoustic control (Mealings & Buchholz, 2026; Papaioannou et al., 2023). Spatial layout and openness influence social interaction, with U-shaped configurations outperforming traditional configurations in fostering cohesion (Anwar et al 2025), while zoning strategies support varied learning modes (Barua & Lockee, 2024). Biophilic and green space variables link natural exposure to cognitive recovery, mood regulation and reduced fatigue (Zhao et al., 2026). Flexibility and adaptability, reflected in modular furniture and agile layouts, support autonomy and engagement (Poutanen, 2025), while in-between and transitional spaces such as corridors and atriums serve as informal hubs for interaction and restoration. (Akkurt & Akbulut, 2025). Ceiling height and spatial volume shape cognitive style, with higher ceilings associated with creativity and lower ceilings with focused, detail-oriented thinking (Sitthiworachart et al., 2022), while density and occupancy, measured via the per capita area index, show that crowding consistently predicts anxiety and diminished productivity (Hammadamin et al., 2024). Collectively, these domains demonstrate that well-being in learning environments is shaped by the interaction of multiple spatial, sensory and psychological factors rather than any single design variable.

5.3 RQ3: What are the gaps, limitations and future research recommendations regarding spatial configuration and well-being in learning spaces?

This body of research points to a persistent gap between how learning spaces measure up on paper and how students actually experience them. Studies like Hu et al., (2025) and Hammadamin et al., (2024) show that objectively good design comprising dense greenery, highly integrated classroom layouts, good lighting and acoustics does not reliably translate into better student well-being in all cases. Therefore, a clear gap remains in understanding how objective characteristics such as greenery, spatial integration, lighting and environmental performance are translated into subjective perceptions of well-being .

Furthermore, another major gap is that a substantial amount of the literature examined individual variables in isolation, despite growing evidence that well-being emerges from the interaction of multiple factors. Some studies employ multivariate approaches and emerge with more well-integrated results. Lin & Juan, (2025) found that combining large windows with green walls boosted attention and lowered stress, while higher ceilings helped auditory learners but stressed out more visually oriented or individual learners. Peng et al., (2022) similarly showed that visual comfort only translates into real satisfaction when acoustic and thermal conditions are also favourable. Findings like these are pushing the field toward frameworks such as multi-coupling theory and the SALIENT checklist, which treat well-being as something that emerges from the interaction of space, behaviour, technology and culture rather than from any single design feature.

Last but not least, a third prominent gap relates to the cross-sectional nature of many studies, as they only capture students' responses at a single moment in time rather than tracking how that relationship evolves across a semester or an entire academic career. There is also a shortage of real-time physiological data, e.g., heart rate and similar moment-to-moment signals that could be paired with spatial metrics to see how environments affect students as they actually move through them, rather than relying solely on retrospective surveys.

While these gaps are significant, the field is moving in a promising direction, as researchers like (Zhao et al., 2026) who combined structural equation modelling with XGBoost-SHAP, have shown that the relationship between objective design quality and well-being isn't linear, as improvements yield diminishing returns and can result in aesthetic fatigue once a space passes a certain threshold. Expanding this kind of machine learning and explainable artificial intelligence (AI) work alongside longitudinal and multivariate study designs would promote a shift from descriptive assessment towards more predictive tools that can evaluate how a learning space will affect students' well-being before it is even built.

5.4 Recommendations

Future research should bring together longitudinal studies and interactive labs to track how design changes affect student well-being and academic performance over time, while also strengthening methodological triangulation by combining spatial analysis tools such as Geographic Information Systems (GIS) with biometric and neurocognitive measures to better understand how people actually interact with space.

Future studies should also focus on combining and investigating the combined effects of multiple factors at once, and should extend this work across cross-cultural contexts given that well-being itself is not a universal constant but shaped by sociocultural conditions such as individualistic and collectivist cultures that understand spatial well-being differently or tropical climates like those in Nigeria and other African countries. Building on emerging work such as Ekpo & Johnson, (2025), culturally responsive studio model and Lagos-specific basophilic design proposals, future studies should prioritise African and other underrepresented content, incorporate co-creation with students to foster ownership and account for context-specific factors like gender based privacy norms and culturally distinct expectations around classroom and transitional spaces. Greater attention should also be given to inclusivity and universal design so that learning environments support diverse cognitive and physical needs, alongside stronger interdisciplinary collaboration among architects, psychologists, educators, sociologists and public health experts to build a more comprehensive research base. Finally, future studies should look beyond traditional classrooms to examine informal and digitally integrated learning spaces, with the shared goal of advancing both student well-being and educational outcomes.

6.0 CONCLUSION

This study demonstrates that spatial configuration plays a significant role in influencing well-being in learning environments and further shows that well-being results from the interaction of multiple factors rather than from isolated design variables.

In addressing the study objectives, the review identified and categorized the principal spatial configuration variables influencing well-being , then it identified the key spatial variables shaping well-being , establishing that these variables operate synergistically with indoor environmental quality as the most consistent determinant in the existing body of literature studied in this research. In synthesizing this knowledge and identifying these gaps, the study provides a robust foundation for future research, serving as guidance for architects, educators and policymakers working towards designing healthier, more inclusive learning spaces.

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