

Role Of Built Environment In Promoting Quality Of Higher Education – A Systematic Literature Review

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Abstract

The built campus of universities is one of the key factors in shaping educational experiences, yet its influence on the quality of higher education remains underexplored within Indian institutions. This study investigates how physical and spatial characteristics of campuses contribute to academic performance, student satisfaction, and institutional rankings. Guided by the Sustainable Development Goals (SDGs) and the National Education Policy (NEP) 2020, I have followed Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines and performed a systematic literature review using the Scopus database to identify peer-reviewed research published between 2000 and 2025. From an initial pool of 548 articles, 25 studies were selected for in-depth analysis, supplemented by manual reference checks. Key design parameters were categorized into six groups: pedestrian mobility, spatial layout, ecological significance, transportation, outdoor environmental quality, and social dynamics. These factors were examined in relation to parameters of student satisfaction such as student retention and graduation rates. Findings are expected to show that integrated green spaces, efficient connectivity, and supportive social areas correlate positively with academic outcomes. By offering evidence-based recommendations, this research informs campus planners and policymakers on enhancing higher education through via built environment. This literature review examines papers in global context.

These recommendations also suggest the possibility of incorporating certain key effective physical attributes in NIRF while rating Indian institutions.

Keywords: built environment; campus design; higher education quality; PRISMA.

1. INTRODUCTION

Firstly, under background and context, I have discussed the definitions of the built environment through the perspectives of various well-known organizations and groups. Secondly, I have explored the framework of SDGs within the context of campus planning, along with the quality of education. Finally, I have discussed the need for the study by mentioning the objectives and guidelines of the NEP 2020 on educational infrastructure and its quality. This section includes a structured literature review, conducted through a Systematic Literature Review (SLR) following the PRISMA methodology, to identify existing relevant research and highlight prevailing gaps. This review is accompanied by a critical discussion of published research aimed at understanding the built environment and its relationship with the quality of education. These researchers have extensively examined how the built environment influences users' mental health, cognitive ability, emotions, and behaviours. In educational settings, built environmental factors are particularly pertinent, as they can affect students' learning experiences and outcomes. Drawing on existing studies, the chapter further identifies several key parameters that significantly influence the planning and design of effective educational campuses. These factors were divided into groups of pedestrian mobility, land use distribution, ecological sustainability, transportation and accessibility, outdoor environmental quality, and social-behavioral dynamics. These groups are widely recognized as essential components in campus master planning and play a critical role in shaping educational experiences and outcomes,

as per the studied relevant pieces of literature. In implications chapter discusses the research gaps identified through SLR.

The chapter concludes with a discussion of the identified research gaps, laying the foundation for the study's objectives and methodological framework.

In the following sections, I have analysed the identified morphological factors influencing the design of the selected Indian institutions based on some latent variables and then examined their relationship with observed variables such as student retention rate and graduation rate, etc. This is followed by checking the efficacy of the model by performing certain tests. Finally, presenting the results in the form of correlations between the variables. Later, understanding the intensity of these correlations on the form of weights. The campus index/score will rank identified Indian institutions based on the physical attributes of the built environment and urban design.

2. BACKGROUND

The built environment refers to the human-made surroundings that include buildings, infrastructure, and open spaces. These buildings and infrastructure encompass residential, commercial, and industrial spaces, along with the systems that support them, such as utilities and transportation. This definition is provided by the United Nations Environment Programme (UNEP) (Wendy R. McClure, 2007). The World Health Organization (WHO) defines the built environment as all the physical surroundings where people live, work, and play. This includes houses, buildings, streets, open spaces, and supporting infrastructure. WHO also states that these physical elements influence people's physical activity, access to healthy food, and the quality of water and air, which in turn affect the overall quality of life (Built Environment – Collaborative for Health & Environment). The Commission for Architecture and Built Environment (CABE) defines the built environment as all the landscape elements of the natural environment and spaces between the buildings in a town or city (Simmons). As per the National Institute of Environmental Health and Sciences (NIEHS), emphasis is placed on the design and its impact on health and well-being. It defines the built environment as a physical surrounding where people live, work, and play, including homes, workplaces, parks, and transportation systems (Environmental Stewardship | National Institute of Environmental Health Sciences). Similarly, the U.S. Environmental Protection Agency (EPA) defines the built environment as all human-made or modified surroundings created to support living, working, and leisure activities. This includes recreational parks, infrastructure, buildings, and transit networks that shape how people interact with their environment (Basic Information about the Built Environment | US EPA). According to the Royal Institution of Chartered Surveyors (RICS), the built environment includes "all aspects of buildings and spaces that people create, modify, and use, including homes, workplaces, public spaces, and the infrastructure that connects them. As per the above definition, a built environment is a balanced blend of green or recreational spaces, transportation, and other physical infrastructure. Hence, it is clear that the term "built environment" is subsequently a combination of green spaces, transportation, social areas, and outdoor and indoor environments, which aims to offer overall improved well-being and quality of life.

To understand the Global ranking parameters, I have studied Quacquarelli Symonds (QS) World Ranking, which focuses on the ratio of international and local faculty and students, reputation in the academic world, faculty-to-student ratio, and quality of research publications. However, it does not explicitly rank/consider campus design and overall environment as an indicator or ranking. To understand the national ranking parameters for Indian institutions, I studied the Institutional Ranking Framework given by the Ministry of Education (MoE), Government of India (GoI). I realized that this ranking system includes teaching-learning, including digital and physical infrastructure. However, direct consideration of the physical or morphological indicators of campus planning and infrastructure facilities appears to be missing. Therefore, I looked into what the 2023 Sustainable Development Goal agenda is, and if it is crucial to consider it while framing such policies and plans. I found out that, particularly in the context of campus planning, SDG Goals 3, 4, 11, 13, and 15 are very relevant. These goals focus on creating an inclusive and sustainable environment, facilitating safety, and promoting inclusivity. (Agrawal and Yadav, 2021). These goals are discussed in detail below.

Table 1 Understanding the related Sustainable Development Goals.

S.No	Goals linked to university planning and design	Detailed understanding
1	Goal 3: Good Health & Wellbeing	Infrastructure and facilities like recreational and social spaces, counselling centres, open-air classrooms, sports facilities, and gathering areas.
2	Goal 4: Quality Education	Designing inclusive campuses and facilities, as well as academic curriculum, that accommodate students from varied socioeconomic statuses, ethnicities, and genders.
3	Goal 11: Sustainable Cities & Communities	Establishing urban spaces that are livable, green, connected, and sustainable. Green spaces, bike lanes, and public transportation induce mobility and reduce carbon emissions.
4	Goal 13: Climate action	Adoption of green practices reduces adverse effects on the climate and promotes effective waste management.
5	Goal 15: Life on land	Promoting land-mix policies helps biodiversity flourish in harmonious ecosystems.

The notion that factors of the built environment are correlated with the students' performance has a long history. These factors of the built environment may have been at both the micro and macro levels. In the past few decades, there has been increasing interest in the tangible and intangible literature about how these environments may have influences on a variety of learning outcomes, and evidence has shown that the tangible and intangible environments influence performance (Marchand et al., 2014a; Mansor et al., 2023). This research employs factors of the built environment to develop a framework that analyzes students' performance in selected colleges from the top 100 college list from the NIRF ranking, India. Despite the increasing popularity of academic research in the domain of the built environment as a determinant of academic excellence and mental health, very few studies have investigated the topic of educational built environments in the Indian context. However, there has been some research exploring this domain in the demographic of Southeast Asia (Mansor et al., 2023). National Education Policy (NEP) 2020 guidelines given by the Ministry of Human Resource Development, Government of India, aim to provide attractive spaces, recreational resources within educational institutes for the users to feel safe and inclusive. Also, under the Optimal Learning Environments head, NEP suggests that the built spaces like digital libraries, effective classrooms, discussion and gathering spaces, and dining spaces are a must to encourage learning environments. Hence, higher education is extremely important for students' social and educational development. High-quality teaching-learning process requires a "Vibrant campus life". A quality educational institution should have a "good physical infrastructure." (Government of India, 2020). This suggests that the domain of campus planning and design in the Indian context is partially explored. Research considering the quality of educational spaces at the physical planning level to achieve global trends in effective teaching and learning is very recent (Agrawal and Yadav, 2021). Therefore, to bridge this knowledge gap, this study explores the association between the built environment and university ranking systems.

3. METHODOLOGY OF SYSTEMATIC LITERATURE REVIEW

3.1 Overview of PRISMA based approach

SLR is used in collecting, evaluating, and summarizing published literature. Unlike traditional literature reviews, it has transparency, repeatability, and critical analysis. This review is conducted to explore existing knowledge on the topic of exploring the quality of higher education and campus planning, aiming to find insights, trends, and research gaps in the last 2 decades. Identification, screening, eligibility, and inclusion are the four main steps of

a systematic literature review, which are further described in detail below. This PRISMA based approach is used here as it provides better transparency at each step. Following the PRISMA checklist enhances the quality of reporting the published research, thereby increasing its reliability. It also facilitates other researchers in identifying and understanding the research gaps and the need for continuity in the same domain of knowledge. Its visual representation in the form of a flowchart is easy to comprehend, even for non-professionals. The PRISMA approach is widely recognized and follows a standard format, making it suitable for conducting meta-analyses and thus widely adopted. Hence, a PRISMA-based approach was adopted to ensure correct methodology and transparency throughout the review process.

3.2 Data Collection

This review evaluates existing studies in the same domain. By systematically analyzing literature published from the year 2000 onwards, this study uses a focused set of keywords aligned with the central research theme. The search terms included combinations such as ("*built environment*" OR "*campus design*" OR "*learning spaces*") AND ("*quality of education*" OR "*student performance*" OR "*student outcomes*" OR "*academic success*" OR "*learning outcomes*" OR "*university ranking*" OR "*campus score*"). These keywords were selected to capture research at the intersection of physical campus environments and educational quality metrics. Conference papers, book chapters, editorials, and other non-peer-reviewed or less substantiated sources were removed. Scopus was chosen as the only database, due to its comprehensive coverage, rigorous indexing criteria, and strong relevance across interdisciplinary fields such as planning, architecture, urban design, and education. As the world's largest abstract and indexing database, with approximately 81 million records, Scopus offers a high-quality dataset ideal for literature related to urban design and planning research topics.

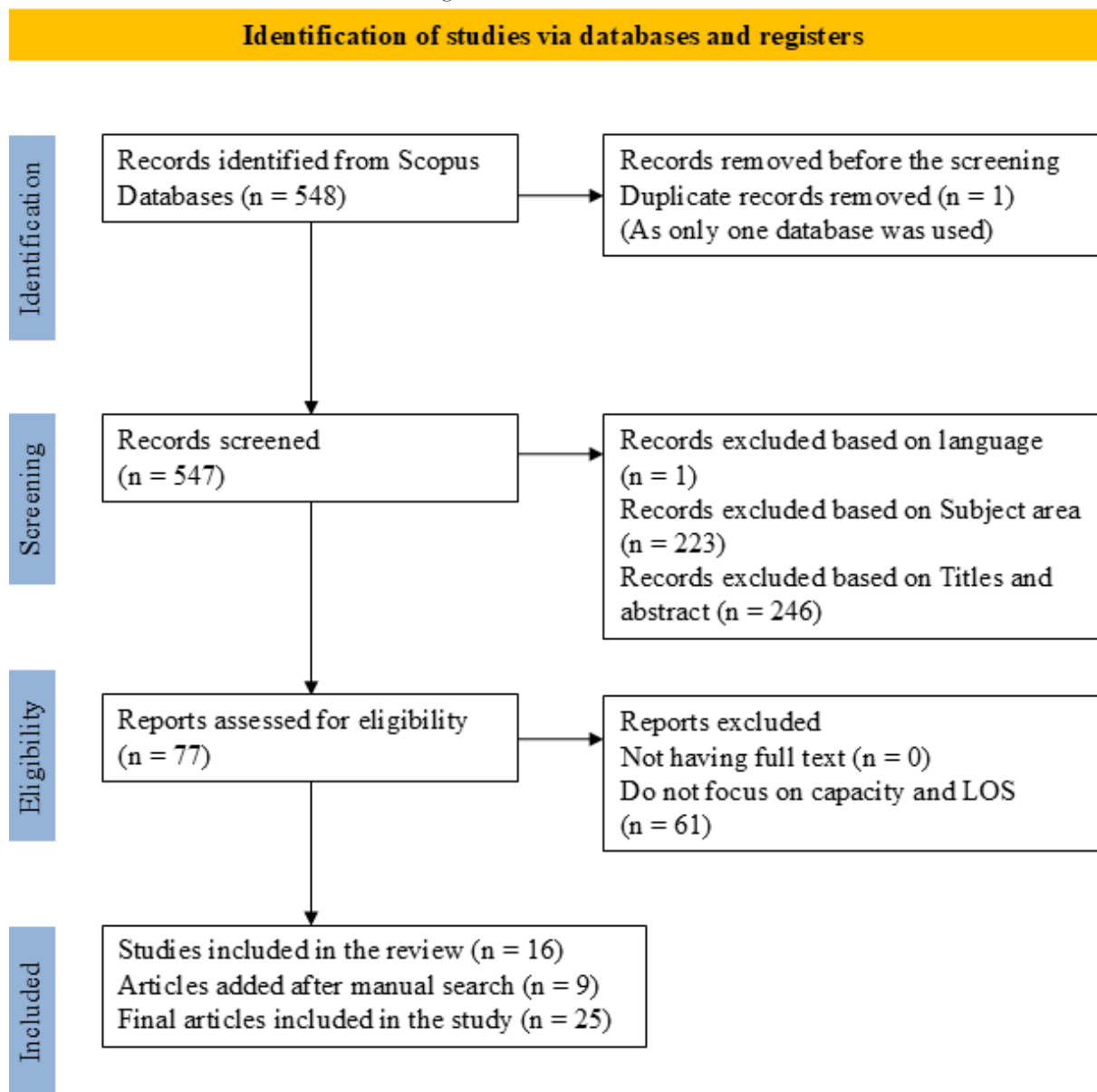
3.3 Screening and Inclusion

Using the above-mentioned keyword combinations, a total of 548 numbers of research papers were identified, located, and downloaded from the repository in the form of a CSV file, making sure that no important research paper is left. The CSV format of Scopus Custom Data offers a well-organized collection of metadata fields as column headers, containing key bibliographic and indexing information for each article. These fields include Author Names, Affiliations, Title, Year, etc. Duplicate items were negligible because the data came solely from a single database. The English language criterion was used for the first screening, and studies were then further filtered according to how well they addressed topics about sustainable development, the built environment, and campus planning. Only high-quality papers that satisfied the inclusion requirements were kept for full-text examination. Out of the 548 records initially identified through Scopus, 1 duplicate record was removed, resulting in 547 records for the screening stage. 223 articles were removed as they were outside the scope of planning, architecture, urban design, or education in the subject area filter. Finally, a total of 246 articles were excluded based on irrelevance to the research topic after reviewing titles and abstracts. Hence, we are left with 77 papers to be reviewed in full text eligibility assessment.

The next phase aimed to ensure that each study aligned with the central research objective of evaluating the role of the built environment, including campus design, particularly. Studies were excluded if they did not have full-text availability, which was found to be none. Further studies were excluded if they did not address capacity or Level of Service (LOS) within the context of campus infrastructure and its impact on educational outcomes, and the number was around 61 papers. Hence, 16 articles were eligible based on their alignment with the research scope and were moved forward to the inclusion phase.

In the final inclusion stage, 16 eligible studies were identified from the Scopus database search as highly relevant to the research topic. To strengthen the comprehensiveness of the review, a manual search was also carried out. Here I have scanned the reference list of related articles. This resulted in the addition of 9 articles, which met the same eligibility standards. As a result, the total number of studies included in the systematic literature review is 25. These studies form the basis for a critical synthesis of how the physical and spatial dimensions of university campuses relate to academic performance, student outcomes, and overall educational quality. Below is the PRISMA flow diagram. This illustrates the reasons for exclusions at each stage of the process, helping to clarify the flow of studies throughout the review process.

Figure 1 Prisma flow chart



4. DISCUSSION

The diagram shows how many studies were excluded at each stage for reasons such as article type, duplicate articles, language, subject area, title and abstract, articles not having full text available, and articles that do not address capacity or LOS within the research context. I have covered 25 articles related to campus planning from 2000 to 2025. The objective was to identify research trends directly related to the study domain. Our survey followed a systematic process as prescribed by the PRISMA guidelines, ensuring that our conclusions are valid and reliable for future research. In total, we screened over 548 articles retrieved from four electronic databases (e.g., Scopus). The review identifies a significant gap in the literature concerning demographic and physical environment factors to bring out the potential for new research directions in this field.

These findings highlight the significance of planning and design of university campuses on students' success rate or satisfaction and suggest that further research should focus on the importance of designing educational spaces. (Owoseni, Ibem, and Opoko, 2020). The findings of this systematic review reveal that warm, flexible environments with natural light, ventilation, and engaging aesthetics significantly enhance student wellbeing and performance, especially when indoor and outdoor learning are integrated (Manca *et al.*, 2020) indicating the need

for better tools to assess outdoor learning environments and suggesting future research should explore how indoor and outdoor spaces connect. This suggests the need for spaces that feel homely, safe, bright, and connected to the outdoors. The findings also stress the value of emotionally supportive and well-designed environments, calling for collaborative, jargon-free design approaches to improve learning outcomes Berris and Miller, 2011. A study examined widely recognized university ranking systems—including Times, QS, ARWU, and Webometrics—and identified several limitations, such as concerns with construct validity, limited data availability, inadequate adjustment for institutional size, and misinterpretation of measurement criteria. It says that these systems are globally popular, none offer a fully accurate measure of academic excellence, hence leaving a lot of room for improvement (Anowar et al., 2015), addressing the research gap. Colleges have seen positive changes so far because of the newly designed buildings, which can support new pedagogies, and have enhanced students' experiences worldwide (Berman, 2020). These practices enhance collaboration. However, on the other hand, if pedagogical techniques are not in harmony with the campus planning, it adversely affects the quality of education (van Merriënboer *et al.*, 2017). Therefore, while planning campuses, care should be taken to design them in ways that support student well-being, boost academic success, and help reduce mental fatigue. Consideration should be given to how campus design affects student performance and academic excellence. Hence, evidence-based practices are recommended (Hajrasouliha, 2017). Author (Garibaldi and Josias, 2015) suggests that schools must create environments that support both academic success and social-emotional learning. His research shows that the built environment impacts student outcomes, but often focuses on isolated factors rather than the whole experience. It also suggests that designers and policymakers should collaborate to develop principles that align physical spaces with learning and emotional needs. Well-designed school environments have a great potential to enhance student engagement, safety, and performance. A study highlights that learning spaces shape entrepreneurship education by influencing team dynamics and learning outcomes. A model that links place and pedagogy, showing that spatial design impacts relationship building, concept development, and student identity, has been studied. (Christensen, Arendt and Hjorth, 2023). The survey at Dutch universities aims to identify built environment factors influencing study success. Results show that clean, well-equipped classrooms, front offices, and Information and Communication Technology (ICT) quality positively impact success. Conversely, closed spaces and larger institution size negatively affect outcomes (Kok, Mobach, and Omta, 2015). A study by (Marchand *et al.*, 2014b) examined classroom light, sound, and temperature set within or just outside comfort zones, affecting undergraduate learning and mood. Results showed lower comprehension scores in the uncomfortable outside the comfort zone (OCZ), listening condition, but no difference in reading. Students in the OCZ reported more negative feelings and perceived the environment as hindering performance. Those in reading tasks were more likely to blame sound levels for poor performance than those in listening tasks.

A study by (Marchand *et al.*, 2014b) implies that student learning is significantly influenced by the learning space design and pedagogical approaches. This study aimed to bridge these gaps and align space design with user well-being and learning effectiveness. It analysed existing design guidelines and codes from countries like the US, UK, Australia, and China, highlighting gaps in specifications related to space flexibility, individuation like factors. This paper discusses how the physical characteristics of learning spaces like layout, noise levels, temperature, lighting, and even furniture quality, affect students' behaviour, cognitive and emotional development, self-esteem, and academic performance. A recent study by (Gür, 2024) assessing the students' Quality of Life (QoL) at the campus has suggested some factors with their decreasing order of effectiveness being campus life satisfaction, spaces of education, people's perception, transportation, and accessibility. Hence, campus life and quality of education spaces remain as the top priority, strengthening our need for research concerning students' mental and physical health and their direct relation with their satisfaction, as reflected in the students' performance in my research. Therefore, we aim to take the domain of the built environment as a determinant of academic excellence and mental health. However, very few studies have investigated the same in the Indian context. South Asia is undergoing development. Therefore, sustainable development in campuses is of utmost importance. A paper by (Mansor *et al.*, 2023) systematically reviews 52 research articles published between 2002 and 2022, focusing on campus and planning design in the region within the context of the SDGs. It identifies key themes of a sustainable and inclusive campus. These themes were spatial layout, transportation design, outdoor environment, psycho-social environment, living quality, and more. These themes were mentioned to be essential for supporting academic success across Southeast Asian campuses. SLR suggests that assessing the built

environment has made considerable progress across various fields, including planning, design, teaching pedagogy, and medical science. We argue that while physical and spatial characteristics do influence the quality of higher education, most research to date has focused on micro level built environment characteristics. However, student performance and the quality of education can also be enhanced by incorporating macro level characteristics into this existing research. Based on this SLR, we conclude that macro level features can influence micro level dynamics. Therefore, we need a holistic approach that impacts students in both dimensions. This approach may lead to more reliable and effective outcomes. In conclusion, this SLR serves as a reference for scholars seeking to explore the built environment and its effects on users within educational settings. This discussion highlighted existing studies that have examined the built environment, particularly in relation to students' well-being and academic performance. Overall, this systematic review demonstrates a significant correlation between the learning spaces at micro and macro levels with student performance. The findings suggest that features of the physical environment should be studied holistically to better assess their impact on student outcomes. Further studies are recommended to develop comprehensive approaches to designing learning spaces that support contemporary teaching and learning practices.

5. ANALYSIS

With the help of the table below, this section aims to study and identify the significant morphological campus design parameters discussed in the design of educational institutes, which in turn affect students' academic excellence/performance. According to (Wilkins, Hazzam and Ireland, 2024) campus facilities and their design influence students' decisions while picking an institution to pursue their careers. Studies have found that the physical environment also impacts students when selecting an institution. This suggests that a well-designed and constructed campus can benefit both the institution and the students. Another recent study (Boltami and Boltimi, 2025) investigated the relationship between facilities available at the university and student satisfaction, as well as its impact on their academic performance, and found to have a positive correlation. Some facilities, like classroom environment, library services, and teaching methods, were found to contribute to student satisfaction, thereby positively impacting their academic performance. The scale of these studies was found to be different. One similar study, conducted at the architectural level, found that natural light, windows, ventilation, building material, and closeness to nature had a strong positive impact on student satisfaction (Mahrous *et al.*, 2024). Previous studies have primarily examined student performance and satisfaction at the classroom and curriculum levels. Building on this foundation, I aim to investigate the relationship of physical attributes at the urban design scale with student performance and satisfaction. Variables identified from existing literature were categorized under key urban design principles and used in the analysis to understand the relationship between the variables.

Principles of urban design: Relevant identified literature was grouped based on urban design principles, given as follows:

- Group A: Pedestrian mobility and connectivity factors
- Group B: Spatial layout/ segregation of land use factors
- Group C: Ecological significance/ green and open spaces factors
- Group D: Transportation and connectivity factors
- Group E: Overall outdoor environment factors
- Group F: Social and behavioural factors

Table 2 Summary of parameters that play a major role in designing a well-planned and effective educational campus.

S. No.	Author(s)	Title of the paper (s)	Group A: Pedestrian Mobility and Connectivity Factors	Group B: Spatial Layout/ Segregation of Land Use Factors	Group C: Ecological Significance/ Green and open spaces factors	Group D: Transportation and connectivity factors	Group E: Overall Outdoor Environment factors	Group F: Social and behavioural factors
1	(Wilkins, Hazzam, and Ireland, 2024)	Servicescape in transnational higher education: the effects of campus design, physical environment and facilities on student experience and satisfaction.		✓				✓
2	(Boltami and Boltimi, 2025)	Student Satisfaction with University Facilities and Services and its Impact on Academic Performance: A Study in Higher Education						✓
3	(Mahrous <i>et al.</i> , 2024)	The impact of biophilic attributes on university students level of Satisfaction: Using virtual reality simulation			✓			
4	(Lavista, Prasetyo and Hermawan, 2016)	Dynamics Change of the Above Carbon Stocks in Bogor Agricultural University, Darmaga Campus			✓			
5	(Andoko and Prastomo, 2021)	Holistic Approach for Creating Environmentally Friendly Campus		✓				
6	(Mansour, 2020)	Outdoor recreational activities and its relation to learning motivation among Mansoura University students		✓			✓	
7	(Yusuf and Fajri, 2022)	Differences in behavior, engagement and environmental knowledge on waste			✓			✓

		management for science and social students through the campus program							
8	(Susilowati <i>et al.</i> , 2021)	Maintaining tree biodiversity in urban communities on the university campus			✓				
9	(Putri, Amrina and Nurnaeni, 2020)	Students' Perceptions of the Implementation of Sustainable Campus Development Based on Landscape Concepts at Andalas University					✓		
10	(Jalalkamali and Ghraei, 2012)	The Cycling Potentials of Malaysian Students in UiTM Campus				✓			
11	(Abdullah <i>et al.</i> , 2011)	Architecture design studio culture and learning spaces: a holistic approach to the design and planning of learning facilities					✓		
12	(Hashim <i>et al.</i> , 2013)	Assessment of Campus Bus Service Efficacy: An Application towards Green Environment				✓			
13	(Abd-Razak <i>et al.</i> , 2011)	Campus Sustainability: Student's Perception on Campus Physical Development Planning in Malaysia		✓					
14	(Sedaghatnia <i>et al.</i> , 2015)	Experience of Social Inclusion among Students in University Campuses of Malaysia						✓	
15	(Hashim and Denan, 2015)	Importance of Preserving the Natural Environment in the Design Schools in Malaysia					✓		
16	(Applasmay <i>et al.</i> , 2014)	Measuring Happiness in Academic Environment: A Case Study of the School of Engineering at Taylor's University (Malaysia)						✓	
17	(Din <i>et al.</i> , 2015)	Technology Supported Cities and Effective Online Interaction for Learning						✓	
18	(Ramu, Taib and Aziz, 2020)	The attributes of future social learning built environments towards 21st-century education in tertiary education						✓	
19	(Chen <i>et al.</i> , 2021)	Hybrid Bayesian Network Models to Investigate the Impact of Built Environment Experience before Adulthood on Students' Tolerable Travel Time to Campus: Towards Sustainable Commute Behavior				✓			
20	(Tao <i>et al.</i> , 2019)	An investigation of semi-outdoor learning spaces in the tropics: Spatial settings, thermal environments and user perceptions		✓					

22	(Wattanapisit <i>et al.</i> , 2016)	Physical activity among medical students in Southern Thailand: a mixed methods study					✓	
23	(Mahrous <i>et al.</i> , 2024)	The impact of biophilic attributes on university students level of Satisfaction: Using virtual reality simulation			✓			
24	(Murwadi and Dewancker, 2017)	Study of Quassessment Model for Campus Pedestrian Ways, Case Study: Sidewalk of the University of Lampung	✓					
25	(Lavista, Prasetyo and Hermawan, 2016)	Dynamics Change of the Above Carbon Stocks in Bogor Agricultural University, Darmaga Campus			✓			

The thematic mapping of the 25 research studies mentioned above is based on urban design principles, split into groups. Group F: Social and behavioral factors have been the primary focus for most of the research, highlighting how built environments influence student behavior and social dynamics. This suggests a strong academic interest in student experience and the psychological impacts of campus design. A considerable amount of focus on Group B: spatial layout/segregation of land use factors, Group C: ecological significance/green and open spaces, and Group E: overall outdoor environment factors reflects a balanced concern for physical parameters such as zoning, comfort, and outdoor space quality. Group D: transportation and connectivity factors received moderate attention, which suggests they might be comparatively less explored. Meanwhile, Group A: Pedestrian mobility and connectivity factors show strong potential for future exploration. Its underrepresentation highlights a direction for further research. Interestingly, these factors are not isolated; they are interconnected. The overall outdoor environment factors can influence social and behavioral outcomes. Therefore, understanding these themes holistically is essential for evidence-based research in the domain of effective campus design.

6. TECHNIQUES AND METHODS

According to the studies conducted by (Hajrasouliha, 2015) and (Mansor *et al.*, 2023) the analytical models used for GIS-based modelling were primarily space syntax techniques. Another technique applied was SEM to test the hypotheses. They are discussed in detail below.

Space syntax: It is a spatial analysis tool that models and quantifies the connectivity and visibility of spaces. It uses mathematical and computational techniques at the backend of the software. This tool studies the layout of spaces and how it affects people's movement and usage patterns. It helps with designing user-friendly spaces. It was developed by Bill Hillier and colleagues at University College London (van Nes and Yamu, 2021).

Structural Equation Modelling (SEM): An analytical method that can establish complex relationships between observed and latent variables in a study. It integrates multiple regression and factor analysis, making it possible to analyse multiple dependent relationships simultaneously (Hair *et al.*, 2021). Because of this key advantage, I will be using SEM over other traditional analytical methods in my research.

7. IMPLICATION

The National Institutional Ranking Framework was launched by the Honourable Minister of Human Resource Development in 2015. This ranks institutions across India based on five comprehensive parameters. Overall ranking of a university depends on = (Teaching, Learning and Resources) X0.3 (weight of the parameters) + (Research and Professional Practices) X0.3 + (Graduation Outcomes) X0.2 + (Outreach and Inclusivity) X0.1 + (Perception/Reputation) X0.1. Further subdivision of these parameters into subparameters with their weights is mentioned in the table below:

Main Category	Subcategory	Weightage in %
Teaching, Learning & Resources (Total: 100)	Student strength with UG, PG, and Phd candidates.	20
	Faculty-student ratio	25
	Faculty with PhD & experience	20
	Financial Resources & Utilization	20
	Online Education	15
Research & Professional Practice (RP) (Total: 100)	Metric for Publications	35
	Citations	35
	IPR and Patents	15
	Research Projects & Professional Practice	15
Graduation Outcome (Total: 100)	Placement & Higher Studies	40
	University Examinations	15
	Median Salary	25
	PhD Students	20
Outreach & Inclusivity (Total: 100)	Countries-Region Diversity (%)	30
	% of women students & faculty	30
	% of economically and socially disadvantaged	20
	% of physically challenged students	20
Perception (Total: 100)	Peer Perception	100

The scores of these rating parameters reflect the performance of institutions in different stated areas. These parameters and scores are generally popular among students as they help them select the right college to pursue their dream careers. There is no direct mention of the built environment, campus buildings, or planning in the form of NIRF parameters. However, under the “Financial Resources & Utilization” subcategory of “Teaching, Learning & Resources”, this rating system indirectly encourages investment in their infrastructure and facilities, like research, procurement of equipment for the advancement of the research, and other campus amenities. We argued that a direct consideration of campus planning in this ranking system will not only contribute to a fulfilling college experience but will also enhance students' experiences in academic and non-academic aspects. Better infrastructure will not only attract students and highly qualified faculty but also increase the chances of international collaboration, enabling the Indian colleges to meet the global standards. Therefore, adding a parameter that advocates the overall campus planning will impact the overall NIRF score and could play a transformative role in elevating academic excellence and student well-being. The above research and publications imply that the tangible and intangible parameters can significantly affect student satisfaction and overall academic performance. Considering students' fulfilling college experience, which affects their performance, it is important to acknowledge the built environment as a main category or even as a subcategory of a parameter and assign appropriate weight to it. Indian universities aim to compete globally and strive for excellence. It is clear from the literature that the built environment shows a positive correlation between campus planning and students' performance. Parameters of campus planning in NIRF can also have other benefits. To start with, this can promote sustainability, which aligns with the SDGs and the NEP altogether. Green campuses can also be encouraged in terms of green building certifications. Secondly, under the “Outreach and Inclusivity” with a weightage of 10%, there is a sub-parameter for Facilities for Physically Challenged Students. Considering campus planning as a main parameter can further strengthen this category by addressing aspects such as campus

friendliness for specially-abled students, gender inclusive design, and many more. Finally, NEP 2020 has a main focus on student well-being and mental health. In this regard, access to green areas and quiet zones can help reduce anxiety, help creative thinking, and support social interaction. As a result, improved infrastructure quality will attract foreign international students and teachers. Incorporating campus planning into NIRF would make the framework more holistic, globally relevant, and ready to help next-generation minds and talent. Therefore, it is important to address the limitations in the existing ranking system and contribute to a holistic rating system. This study addressed how both micro and macro scale parameters of campus planning related to students' academic performance, helping bridge the gap.

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