Campus Design of Universities: An Overview

Preethi Agrawal[1]*, Madhura Yadav[2]

[1,2] School of Architecture and Design, Faculty of Design, Manipal University Jaipur, Jaipur, India

Corresponding authors: preethi.preechin@gmail.com[1], aalayamdesigns@gmail.com2*

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This paper reviews literature to understand the field of Campus Design and the factors impacting campus design in universities. Literature Review shows that most literature in the field of Campus Design has been authored by practising professionals and the attempt at academic research is relatively new in the field. This leads to a few often-quoted literature sources both in the global and the Indian scenario. Research into the aspect of physical planning of a campus and the quality of space as attributes to achieving effective teaching-learning and university objectives is only recently being considered. Most literature available is case-study based. Campus design parameters that help achieve university objectives need to be identified at the master plan level. Most researches, study campuses with a microscopic view of learning spaces, space comfort etc. Gross design issues which impact teaching-learning-research in Universities and provide a wholesome experience to largest user group, the student community, needs research. The new challenges faced by Indian university campuses, like the incumbent New Education Policy 2020 and situations like a global pandemic, which may affect campus design have been identified as parameters to study and consider when proposing campus design guidelines.

Keywords: Campus Design, University, Campus Master Plan, Learning Space, student satisfaction, sustainable campus

1. INTRODUCTION

Historically, Campus Design of Universities primarily been a product of university policy guidelines, the patrons governing the University, the faculties being taught and, in some cases, the "the star architects" design interventions. The places of Higher Education have changed in character through the ages. From the Newman Model that focused on monastic inward-looking single use campuses, the orientation of a university campus has now shifted to be a learning, research and teaching space. (Taylor, 2016) In this context, the connection between design and use of space in higher education is often not understood.

A campus is a product of immense investment and therefore is a very precious resource, both tangible and intangible. Hence, it is important to realize the need for university campuses to be well planned and designed 'for a physical and built environment, which allows for better education and ensures the best use of a college or University's resources. A plan or design that makes for the best use of land to meet a college or University's academic, research and outreach missions.'(SCUP, n.d.)

The New Education Policy 2020 is the incumbent education policy for contemporary India, and it is mandatory to understand its objectives for Higher Education and universities. The proposed guiding principles of NEP 2020 for the education system and the individual institution within it focuses on the following which, inherently impact Higher Education Institutions (HEI) and Universities:

- No hard separations between arts and sciences and between curricular and extra-curricular activities.
- Multidisciplinary and holistic education
- Extensive use of technology in teaching and learning.
- Outstanding research as a co-requisite for outstanding education and development.
- The NEP 2020's main thrust for higher education is to transform HEIs into large multi-disciplinary universities, aiming to have 3000 or more students.

Therefore, this paper reviews literature to understand Campus Design and the factors impacting campus design in universities, chronologically at the global level and in India. The attempt to identify literature that has contributed to analysing campus planning through pure research and by design authors, has been made across multiple faculties. This paper also investigates the aspects of all such parameters that have been adopted in campus design globally and India in particular. An attempt has been made to identify literature that investigates the aspects that define quality of space and learning environment in terms of design impact on teaching-learning and the achieving university objectives. The aspects of how campuses can be analysed as being successful and the tools of analysis which may be adopted to assess effective campus design are also presented.

I. History of University Campuses

University Campus is a place of special resonance(Coulson et al., 2010), which occupies a well-defined physical area, giving it a sense of identity and social focus, a set of many building types located in an ordered relationship between themselves and space around. (Edwards, 2014). In his book, The History of Building Types, Nikolaus Pevsner (1976), does not accord the university as a stand-alone building typology, which could be attributed to the reasoning that a university campus is a place of learning, along with being an ensemble of buildings and spaces, which we call the modern campus. (Fawcett & Jackson, 1998) .

Historically institutionalised places of higher education in terms of university scale have been in existence in India since the Takshashila University in 6th Century B.C (Apte, 1962) and then the Nalanda University and Vikramshila Universities in the 4th and 5th Century A.D respectively (Hosain & Mondal, n.d.) The historian Dr. Chitra Madhavan (2019) presents the Kanchipuram Ghatika, as one of the temple university's being established in Kanchipuram in the 5th Century A.D. The list of such universities is still partial since physical evidence is still being collected, a few of note being Valabhi, Pushpagiri, Jagaddala,

Odantapuri, Somapura, Bikrampur, Ratnagiri, Mithila, and Ujjaini.(Choudhary, 2008).

In Europe, the first indication of university scale places of higher education emerged in the early 1100s in France, Spain, and Italy, amid the power struggle between the monarchy and the monastical legions. Historian Perkin (2018) quotes in the History of Universities, "Only in Europe from the 12th century onwards did an autonomous, permanent, corporate institution of higher learning emerge and survive, in varying forms, down to the present day. The university was the accidental product of a uniquely fragmented and decentralized civilization. Though called a university, these were single building spaces, delivering one or a few subject matters for education, like religion or theology." The resurgence of the need for education, the emergence of multiple new disciplines needing studies and research occurred during the Industrial Revolution. A university college to host such changes was first established in Scotland and then in London in the 18th Century. University College of London became the blueprint for all provincial and colonial universities like the ones that emerged in United States of America, Africa, and India.(Perkin, 2008). University campuses and campus towns of the United Kingdom, like Oxford and Cambridge became precursors to the university towns of the United States of America and for the universities of India. These were the first of the multi-disciplinary university campuses, which is the first conclusive evidence where university campuses responded to the need to cater to multiple fields of study under one aegis.

Figure 1: Nalanda University Ruins Source:https://www.earthismysterious.com/universities-of-ancient-india/

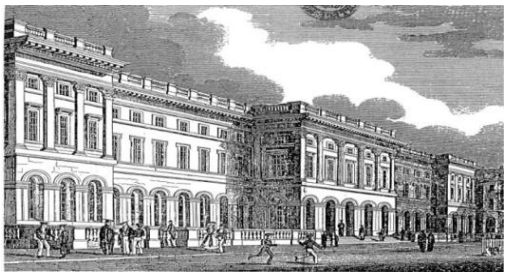


Figure 2: The King's College, London 1833 Source:https://victorianweb.org/history/education/ulondon/11.html

II. University campus typologies in terms of campus design and planning

Dober (1996) presents, based on case studies of the universities in the United States of America, that the campus form has historically been a product of the constant need to add on to their premises as and when the need arose especially when the university built on the older infrastructure. Other authors and researchers have also justified the same. (Coulson et al., 2015; Edwards, 2014; A. H. Hajrasouliha, 2015; Turner, 1986). University campus plans/design has been typified in various ways by different researchers. Research states that campuses are planned either based on departments of the academics taught or on the division of common-use infrastructure, whether they are built on older campuses or new ones (Kanvinde Achyut & Miller H J, 1969). Some researchers present that university campuses can be typified based on, the time, reflective of the length of the time a student is anticipated to spend on-campus/student population/number of programs to be run/enrolment size/on-campus housing/invested requirements and precision of the program/size of property/land use requirements and more, the physical area encompassed the precision of the program, and the design characteristics. (Richard.P. Dober, 1996). These typologies emerge because universities now are a complex organization and the planning of which, is driven by a three-pronged approach of academic planning, physical planning, and fiscal planning (Kanvinde Achyut & Miller H J, 1969). Other typologies emerge when a university is studied as a product of the education policies and approvals of the State, like State Universities, autonomous universities, universities under

private ownership approved by an Act, etc. (Choudhary, 2008). A university is also typified based on its primary academic objective of being academia based, research-based, vocation based, and on their rankings as assessed by the State policies. (Dolton, 1982)

Three campus scales have been postulated in terms of physical planning, and the geography covered by a university (L. C. Dalton et al., 2018):

1. The Campus Master Planning Scale, caters to the site design and development, focusing on the physical development of the visible campus.
2. The Campus-Community Interface Scale, caters to the physical interface between the campus and its surrounding community
3. The Campus District Planning Scale, deals with the campus's impact on the surrounding district at large.Edwards (2014) classifies university campuses based on the building layouts and the design theory and objectives, across all geographical scales. (Refer Table 1)

Table 1: University Campus Types

Type	Example	Architect	Advantage	
Place Making: Building centred	University of Birmingham	Aston Webb	Strong identity	15th-19th Century
	University of London	Charles Holden		
Place Making: landscape centred	Univeristy of Virginia	Thomas Jeffersen	Strong sense of place, Tranquil	
	University of California(Berkeley)	F L Olmstead		
	Technical Unversity of Helsinki	Alvar Aalto		
Collegiate	University of Cambridge	Various	Privacy with local identity	
	University of Stanford (partial)	Various		
Linear/Megastructure	University of Sussex	Basil Spence	Extendible, good internal communication	
	Simon Fraser University, British Columbia	Erickson and Massey		
Grid	Illinois Institute of Technology	Mies van der Rohe	Efficient in land utilization	
	University of North Carolina	Various		
Modular	University of York Royal	RMJM	Economomic with visual consistency	20th Century
	University College, London	E. Cullinan and Partners		
Molecular	University of Sunderland	Buidling Design Partnership	Ordered yet with diversity	
	Univeristy of Lincoln	RMJM		
Radial	Temasek Polytechnic, Singapore	Michael Wilford Landscape and Partners	Clarity of route, Integrated spaces	
Ad hoc	University of Stratchclyde	Various	Opportunistic but disordered	
	Massachusetts Insititute of Technology (MIT)	Various		

Source: (Edwards, 2014)

Review of the campus design guidelines of various universities, like the Kansas State University, Massachusetts State University, Yale University, the University of Nottingham and University of Michigan, Ann Harbor campus, (Campus Design Guidelines and

Standards,Houston, Univeristy of Houston, 2009; Coulson et al., 2015; Hajela, 2011; Kanvinde Achyut & Miller H J, 1969; Mayer, 2015; Richard.P. Dober, 1996; Taylor, 2016) typify university campus, much like Dober, based on:

1. Length of time spent by a student on campus
2. Student population or enrolment number
3. Types and number of programs or departments and research facilities
4. Size of campus property
5. University objectives: Research campuses, vocational studies, academics pursuits
6. Residential options
7. Sustainability objectives
8. Design characteristics.

In retrospect, the various researches that have typified university campuses work within the framework of the three major geographical or physical scales of Campus Planning/ Design, mentioned before. Hence it can be presented that within these three geographical scales, literature grossly covers four cross-cutting topics(L. C. Dalton et al., 2018), and that the campus design process of universities can be referred to as an integration of the four topics contributing to an overall plan.

1. Land use and Site Planning
2. Built Form and Design
3. Campus Sustainability and
4. University Objectives

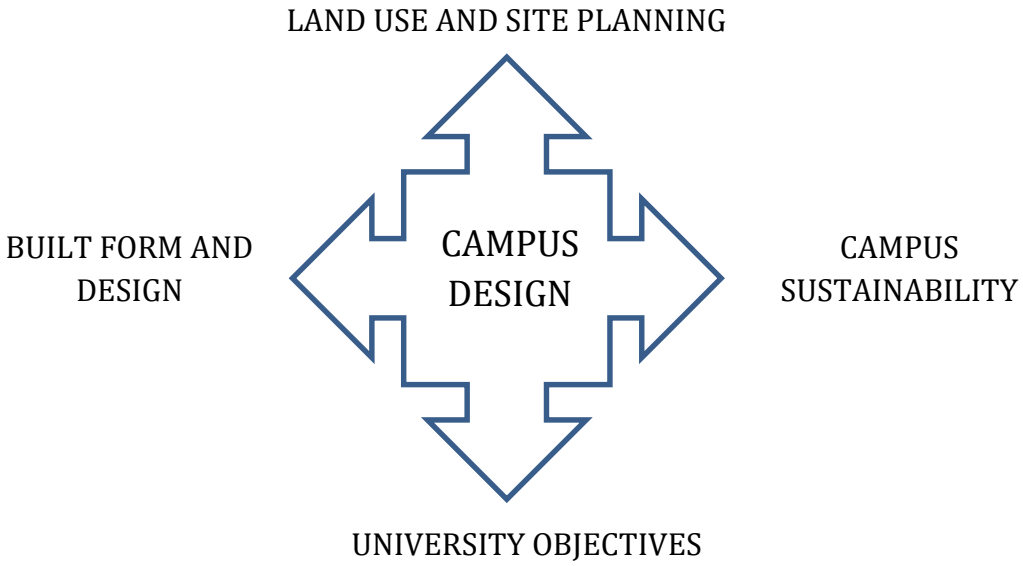


Figure 3: Campus Design Perspective in the current

Therefore, it is necessary to look at the available research into how each of the cross-cutting areas mentioned above, performs in the physical scale of the Campus Master Plan scale. Whereas the Campus-Community Scale and the Campus District Scale are also important, the review of literature in the Indian context is largely lacking at all scales (Hajela, 2011). Hence this literature review concentrates on the basic master plan scale to understand the global research at large and to assess how it could be translated into the local context.

III. Understanding Campus design at Master Plan Scale

III.I Land use and site planning

Site planning and land use allocation plan covers buildings, open spaces, circulation on campus (motorized and pedestrian), and utilities and should align to the institution's academic and strategic goals, maximize the use of critical resources, incorporate smart growth planning principles, and enhance safety and wellness. (SCUP, n.d.). A land use and site plan reflect the understanding of the university campus as a place to learn, teach, work, live, research, and socialize. (Puderbaugh, 1959). Researches based on case studies of existing universities also state that site plans and land use allocations

establish the importance of the sense of community and liveability(Mayer, 2015; Yale University A Framework for Campus Planning, 2000). Various authors have presented walkability of the campus, and its landscape design as positive markers for student success, campus quality impacting learning, and student satisfaction. (Calvo-Sotelo, 2010; Coulson et al., 2010; Douglas et al., 2006; Edwards, 2014; A. H. Hajrasouliha, 2017; McKinney et al., 2014; Mitchell, 2008; Temple, 2008).

Contemporary researches emphasise the importance of considering the advent of the internet age, teaching-learning methodologies, and the aspect of purely research campuses on the design decisions of the physical campus.(Coulson et al., 2015; A. Hajrasouliha, 2017; A. H. Hajrasouliha, 2015). Haggans (2016) postulates that the "learning environment should be composed of a liveable and sustainable physical environment, an active virtual environment, and a vibrant and safe social environment to address evolving needs of HEIs" and Kenney et al. (2005) present a set of land use guidelines using a mix of campus uses and density with the integration of technology to achieve a supportive learning environment. An effective methodology to assess space needs is suggested by Dober (1996), in which he proposes a unique dimension of the "Full-Time Equivalent (FTE)" as a unit for campus population as against students in absolute numbers for all calculations, including space standards, which allows a campus a degree of flexibility when enrolment numbers fluctuate due to various reasons. Another suggestion is rethinking the capacity by better management of space and time, and right-sizing the campus, (Haggans, 2016) considering the distance and blended learning. Researchers also suggest re-thinking the terms 'learning-space" to learning-environment" to include technology and distance learning options (Gilboy et al., 2015; Thomas, 2010).

Landscape design and campus greenness are also important markers of measuring campus quality. In his paper, Hajrasouliha (2017) presents campus greenness as one of the highest marked indicators of campus qualities in an On-Campus living University study.(A. Hajrasouliha, 2017). Given that students only spend only a fifth of their time in the classroom contributing to a quarter of their learning variance, researchers also propose that the natural landscape in university campuses is an attentional learning resource for its students. The same authors also propose greenness as the students' perspective of healthy design (Scholl & Gulwadi, 2015). Well-designed and connected networks of indoor and open spaces on campuses can be key, yet typically overlooked catalysts, in student learning and a strong influence on students' initial and longstanding experiences that promote a sense of belonging to the learning community. (Boyer, 1987; Greene, 2013). Park-like settings to allow for physical activity intensities differ across college campuses and efforts should focus on increasing awareness of outdoor campus amenities that promote physical activity for overall student health benefits(Roemmich , J. N. Balantekin & Beeler, 2015). Lau, Guo, and Liu (2014) propose that a healthy campus is one with flexible spaces that accommodate different activities, green buildings that incorporate open spaces, and encompass diverse open spaces to satisfy different purposes for the users, especially for high-density compact campuses.

Site planning and land use to achieve compactness and increasing visual connections by integrating the buildings with the surrounding environs have been postulated as a direct connection between the safe built environment and sexual assault(R. Dalton & Spiers, 2015; Eckert Erica, 2012). Multiple authors have presented clarity of wayfinding and placemaking through impactful site planning as qualitative markers of an interactive and engaging campus by (L. C. Dalton et al., 2018; R. Dalton & Spiers, 2015; Ruth Conroy Dalton et al., 2012; Eckert Erica, 2012; Hajela, 2011; A. Hajrasouliha, 2017; A. H. Hajrasouliha, 2015; A. H. Hajrasouliha & Ewing, n.d.).

III.II Built Form and Design

Campus design has focused on the building, its design, and its design theory(Edwards, 2014). Chronological case studies of the leading universities of the USA reveal that university management have focussed on individual building designs, which are largely products of 'star architects' as presented by Mayer (2015)

in his book on the history of the Ann Harbor campus of the Michigan University. (Mayer, 2015; O. Robert Simha, 2001). The architectural style of Indian universities is largely based on their historical stylizations(Hajela, 2011). Placemaking as a lead concept in contextual urban design terms has also been the reason to assign individual building design to master architects in various campuses(Kenney et al., 2005). The literature review in design understanding is very architectural and limited to the individual building blocks only. Case study research on the impact of contemporary urban universities and their design in India is largely unavailable in academic literature, but the designers' presentations on their approach may be adopted for further research.

Comfort factors play a role in built form and design. The thermal comfort of learning spaces plays a role in impacting student learning and research(Oblinger, 2006). The impact of efficient illumination on productive learning spaces and the impact of comfort on the productivity of teachers and learning has been presented as effective satisfaction markers in interior teaching-learning spaces (Castilla et al., 2018; Dursun, 2007; Strange & Banning, 2015). The idea of space syntax, response of the user to space in terms of a learning environments' informality, and belongingness have been presented as quality markers of experiential learning by multiple researchers and authors (Birdwell & Uttamchandani, 2019; Chism, n.d.; R. Dalton & Spiers, 2015; Ruth Conroy Dalton et al., 2012; Ison Radtke, 2018; Kolb, 1984; Long & Ehrmann, 2005; Oblinger, 2006; Thomas, 2010; Young et al., 2019). Studies looking at the empirical evidence of space design as a marker for interactive spaces impacting teaching-learning success in university campus design has not been explored

III.III Campus sustainability

Research in this area is seen to overlap between the aspects of built form, land use and site planning, academics, governance, and researches have presented campus circulation, parking, and transportation as central aspects of sustainability. (Roemmich , J. N. Balantekin & Beeler, 2015; Zhou, 2012).

university objectives. Thomashow (2014), former president of Unity College in Maine, identifies nine elements for a sustainable campus in universities: energy, food, and materials (infrastructural aspects), governance, investment, and wellness (community and living aspects); and curriculum, interpretation, and aesthetics (learning aspects). In their guidelines for their universities or institutions, all campus leaders aim for sustainability in pedagogy, research, energy consumption, and resource management. (L. C. Dalton et al., 2018).

An engaging, diverse, and interactive campus community also presents under the aesthetic sustainability marker (Terrell & Melvin C., 1992). As a part of the Sustainable Development Goals, equal and equitable education has been defined, which has been researched in terms of the impact of the physical environment on the teaching-learning process. The research presents that the new environment learning (NEL) compared to the traditional classroom (TC) encouraged student attention, participation in class, creativity, curiosity, critical thinking, motivation to learn, and mood(Galán-Casado et al., 2020). Here NEL is a "learning environment, which is defined as an open space that favours reflection, discussion and the design of hands-on methodologies with aspects such as enhancing exterior views with natural light, adjustable artificial light, the height of the learning space, the absence of physical barriers (open spaces), and surrounding the nature space were proposed to counter typical classrooms", as proposed by Heppel (2016). Sustainability in terms of university campuses has also been associated with the liveability of the campus, the interactions of the greens and built environment and its capacity to be interactive for students and other users, and to look at open spaces between built environments as space for alternative uses and experiential learning. These being markers of a good quality of student lives(R. Dalton & Spiers, 2015; Ruth Conroy Dalton et al., 2012; Edwards, 2014; A. Hajrasouliha, 2017; Turner, 1986). Other

III.IV University Objectives

Universities have always developed policies and practices to address issues of student enrolment, retention, education quality (A. H.

Hajrasouliha, 2015, 2017), safety and security (Yang, 2015), social issues like increasing diversity(Terrell & Melvin C., 1992), and ensuring discipline (Boyer, 1987; L. C. Dalton et al., 2018), Researches in the space of student satisfaction analysis present that the aspect of maintaining the quality physical environment, built environment quality, and built environment sustainability as supportive and impact factors in student satisfaction are addressed in the micro-scale. (Coulson et al., 2010; Douglas et al., 2006; Eckert Erica, 2012; Wiers-Jenssen et al., 2002) Whereas space standards are presented as baselines for design (Dursun, 2007), the quality of space, at campus master plan scale remains unaddressed. The need to assess the impact of quality built-environment in achieving sustainable university objectives of fostering education, student engagement, reach, outreach, interaction, and overall quality of student life is the priority (A. Hajrasouliha, 2017; SCUP, n.d.).

IV. Understanding research approaches adopted to study and analyse university campus design

The idea of a university campus is unique, encompassing aspects of urban design, urban planning, architecture, interior design, human physical comfort, education methodologies, physical and mental health, economics and finance, sociology, safety and security, governance, technology advancement, and more. Therefore, describing and analysing campus forms, keeping in mind that the primary purpose is providing a supportive environment for learning and delivering the institutions' missions, objectives, and governance,(A. Hajrasouliha, 2017) has to be both quantifiable and qualitative. Organizations like EDUCAUSE, the Society for College and University Planning (SCUP), and the PKAL Learning Spaces Collaboratory have aimed to identify assessment metrics, predictive evidence, and illustrative case studies that relate campus space to learning. But, Amir Hajrasouliha (2017) reports that "most works focus on the teaching-learning or research environments on the micro-scale and less on the contextual condition of the campus environment." Scholarly literature on the physical planning of a university campus is mostly comparative research or case studies based on authors' or editors' methods, emphasizing theory building. (Coulson et al., 2010; L. C. Dalton et al., 2018; Strange & Banning, 2015; Taylor, 2016). Individual case studies have been carried out by universities of the world, to analyse the effectiveness of achieving the institutional mission, to assess the current status, and to create progress reports or to have future proposals charted out by design professionals and financial planners, by the university management. These reports are based on chronological observations and course corrections of the university over time (Li, 2011; Massachusetts State University Campus Master Plan, n.d.; "Tongji University: 110 Years of Research and Education," 2016; Yale University A Framework for Campus Planning, 2000; Mitchell, 2008; O. Robert Simha, 2001). Researches involving transport and campus circulation rely on a quantifiable survey and predictive data analysis, to assess the future land use need and vehicular needs of a campus(Campus Planning & Design by Page Southerland Page, Inc. - Issuu, n.d.; Zhou, 2012). Researchers have also proposed rankings or credit scores as parameters to analyse the effectiveness of a campus(Gorman, 2016; Zhong, 2016). The most popular methodology across campus design/planning researches to analyse impact has been user surveys. Surveys have also been carried out to understand health in terms of student and teacher perspectives of learning environments. (Odum et al., 2020)This data analysis through statistical functions assesses user satisfaction of the campus built-environment for parameters like landscape, greenness, safety, campus crimes, walkability, built-environment impact on learning, comfort parameters, learning comfort, overall satisfaction etc(Chism, n.d.; Douglas et al., 2006; Eckert Erica, 2012; Wiers-Jenssen et al., 2002).

Amir Hajrasouliha, a campus planning researcher, in his studies of 2015 and 2016, chooses to analyse the campus built-environment through measurable physical attributes and their impact on student retention and graduate rates, using statistical modelling through Structural Equation Modelling and proposes a 'Campus Score'. The Campus Score

is a measurable metric, which scores research universities of the United States of America, on their built-environment parameters. (The studies were based on 50 sample university campuses of similar site size and then on 103 research university samples). He then presents through a statistical application, comparison of the built-environment parameters between universities. This method, the researcher postulates is very data-intensive, and similar grades of universities with similar missions are difficult to access for analysis. Space syntax software and ArcGIS have been used to analyse the physical environment of the campus, a raster from google maps.

The use of Space Syntax as an analytical tool is being considered seriously by many researchers in campus design. (Hillier, 2007) postulates through Space Syntax studies the relationship between the campus morphology and street networks can be quantified and has presented research establishing their relationship with walkability and land use. The path-breaking paper by (R.C. Dalton et al., 2015) presents the results of a wayfinding experiment, in which correlations were found between measures of a building's spatial configuration and indicators of wayfinding performance and navigation in the building's interiors through space syntax research. Isovist Analysis as a tool to capture responses to built-environment also has been proposed and applied to assess wayfinding and comparative analysis between various space morphologies (Dzebic, 2013).

Cognitive research and neuroscientific studies are the latest intervention in analyzing architecture. Researches in the area of wayfinding, satisfaction and user perception, and response to space are being conducted by architects with cognitive research scientists along with experimentation of space analysis through virtual reality (VR) and artificial intelligence (AI) experiments (R. Dalton & Spiers, 2015; Ruth Conroy Dalton et al., 2012; Suwarno & Pranuta Murnaka, 2020).

2. CONCLUSION: GAP IDENTIFICATION AND STUDY ORIENTATION

University campus planning/design research was pioneered by Richard Dober, whose postulations have guided most future research in the field of university campus planning and design research. Similarly Achyut Kanvinde and James.H.Miller's book pioneers campus planning research in India. Multiple authors quote, that most publications about campus planning/design are by practitioners(Coulson et al., 2010; A. H. Hajrasouliha et al., 2016; Kenney et al., 2005; Richard.P. Dober, 1996) and that very few academic studies verify the assumptions of campus planning practices adopted by practitioners. Dober (1996, p.12) observed, "Lacking an organised body of research or theory, campus planning is likely to be continued on a pragmatic basis." The understanding of university campus design is therefore largely based on authors' case-study-based observations or university reports on their chronological progress. The current researches hence rely largely on books written by Charles Dober, Brian Edwards and Coulson et al in the USA, and Achyut Kanvinde in India for literature references, making a review of literature slightly skewed. Especially so in the Indian context.

Temple, (2008) quotes, "campus design, in terms of how space can support the development of a university community, the needs of specialist spaces, and the impact of technology on space use, needs to be studied. Space issues are central to the operation of universities, and further research is needed to illuminate the connections between space and institutional effectiveness." Though researches on the influence of the physical environment of university campuses on the psychology of its various users are an established topic, there is much to study about the impact of the physical environment in helping a university achieve its overall objectives. Dober (1996) emphatically presents that this is a field that hasn't been researched enough especially with regards to the efficiency of physical planning of campuses or the impact of physical planning or design on the quality of higher education or quality of student life and education. One realizes that this academic gap exists in the Indian context too.

Campus design authors, who are mostly practitioners emphasise the importance of the

physical environment of a university on the quality of education it imparts and the quality of student life, more than the areas of fiscal and academic planning, which are largely managerial or institutional(Richard.P. Dober, 1996; Turner, 1986). The authors recommend that the built environment design of campuses should respond to human needs, in terms of quality of space for learning and living, access to natural environs, and adherence to design principles in the built form (A. Hajrasouliha, 2017; A. H. Hajrasouliha et al., 2016; Kanvinde Achyut & Miller H J, 1969; Richard.P. Dober, 1996)

Studies present that "the traditional virtues of campus coherence and place distinction" were overtaken by the unprecedented expansion of campuses (Chapman,2006,). The changing times, technology, teaching-learning methodologies, education delivery (including blended and online learning), need for safety, increasing student population, newer educational trends, student diversity, and growth of interdisciplinary fields of knowledge, have been conceptualized as the imminent challenges and adding complexity to the physical aspect of campus planning /design.(L. C. Dalton et al., 2018; Haggans, 2016; Hashimshony & Haina, 2006; Kenney et al., 2005; Strange & Banning, 2015; Taylor, 2016; Weaver, 2006).

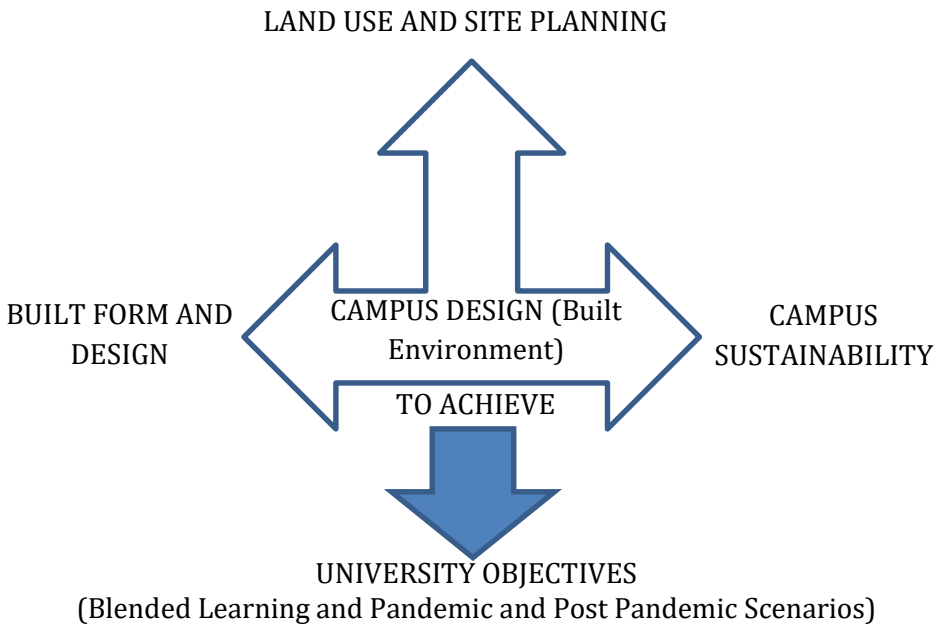
This overview concludes with the understanding of the need for academic research in the field of campus design of universities in the Indian scenario. Good quality, built environment can be a major contributor to effective teaching-learning-research, which, in essence is the university objective. The physical design of campus needs hence, is an impact factor that needs understanding, research and outlining.

The following parameters adopted from the research presented by (A. H. Hajrasouliha, 2015), come up as markers to analyze campus design of universities within the context of user satisfaction, effective teaching-learning-research spaces and a safe built environment.

- Land use Organization
- Building configuration and integration with the landscape
- Compactness
- Connectivity
- Campus Living and optional uses of designed spaces.
- Greenness and
- Context

The overview of the research in university campus designs presents that further research could aim to presenting suggestive guidelines for university campuses. Campus Design Guidelines can be typically looked at to deal with open space, circulation, landscape regulations, site lighting, furnishings, signage plan, building placement, and orientation, building massing, materials, and colour palette.(L. C. Dalton et al., 2018). According to Kenney et al., (Kenney et al., 2005), a comprehensive campus plan should follow:

- Giving precedence to the overall plan over individual buildings and spaces
- Using compactness (density) and mixing campus uses to create vitality and
  Interaction
- Creating a language of landscape elements that expresses the campus's individuality and relationship to its regional context
- Embracing environmental considerations
- Taming the automobile
- Utilizing campus architecture to further placemaking
- Integrating technology
- Creating a beneficial physical relationship with the neighbourhood
- Bringing meaning and beauty to the special places on campus.



Source: Author

Figure 4: Proposed direction of research: Campus design guidelines to achieve University objectives

Contemporary university management and planning forums have understood the importance of Campus Design Guidelines, which will help guide future designers with a format to achieve optimum space quality to contribute to successful teaching, learning and research environments. In the Indian context, the New Education Policy 2021 and the current pandemic situation further create an urgent need to acquire insights to look at Campus Design for Universities in India for now and the future. The need therefore is to study the possible impact of the physical or built environment of university campuses in achieving the university objectives with a focus on blended learning, New Education Policy and in the context of relevant health scenarios, like the pandemic and post-pandemic, as sustainability markers (engagement, health, and livability), in the context of Indian universities.

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