

Technical, Functional, and Behavioural Aspects and their Attributes in Survey Questionnaire for Post Occupancy Evaluation of Residential Hostels

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ABSTRACT

The structure of a questionnaire becomes critical in gathering accurate feedback in a post-occupancy evaluation of a building. A survey instrument like this one consists of questions based on various aspects of a constructed facility. The questions and the qualities reflect the goals and determine the nature of the survey, which can be classified into several types. Therefore, a survey instrument uses appropriately described attributes. This ongoing research aims to provide an appropriate technique for framing the Questionnaire, taking into account the relevant aspects of the study and its defining features that analyze building performance from the user's perspective, which can further benefit the architects, planners, and designers in designing user-friendly spaces.

KEYWORDS: *Questionnaire, Attributes, Building Performance Evaluation [BPE], Survey, Research*

1. INTRODUCTION

Indian universities actively strive to attract and retain students, employing various strategies to achieve these goals. Prior research has illuminated the influence of university housing options on students' decision-making processes. As universities grapple with the increasing demand for student housing, students' satisfaction with their accommodations emerges as a pivotal factor in enhancing the living environment. Moreover, in the public sector, where these facilities are typically provided, satisfying students becomes challenging, particularly when diverse desires and expectations shape the environment. Satisfaction with one's living situation is fundamentally rooted in the congruence between actual and desired conditions. Discontent may arise when such alignment is absent. While several factors impact student satisfaction, students often opt for hostels, seeking quality housing and services at an affordable cost.

In contrast to the extensive research into factors influencing homeowners' contentment with their homes and communities, there is a noticeable gap in understanding students' satisfaction with university housing. Numerous studies have explored elements affecting students' contentment with their living environment. However, the most effective approach to evaluate and comprehend a building's performance is to solicit feedback from its occupants. End-user satisfaction represents the most valuable metric in this regard.

In rapidly developing nations like India, infrastructure, especially in the commercial, public, and government educational sectors, is rising. While government agencies are responsible for constructing these assets, a notable absence of effective post-construction oversight exists, particularly concerning asset maintenance. Additionally, the lack of enthusiasm among users/occupants toward these assets complicates the assessment of their performance post-occupation. Significant infrastructure development entities in India's centrally funded technical institutions [CFTI] encompass agencies like the Central Public Works Department, the State Public Works Department, and a few public sector companies. Given the significant financial investment in maintaining government residential housing for students, visitors, and residents in CFTIs, the need for a metric to evaluate the effectiveness of maintenance agencies and their methodologies becomes evident. Mere expenditure of allocated funds by the end of a fiscal year does not necessarily reflect actual expenditures accurately.

Furthermore, maintenance firms' technical evaluations of building conditions may introduce bias into assessments. Therefore, an integral stakeholder in this process—the end-user—represents the path to evaluating maintenance effectiveness. User satisfaction is an endorsement of asset performance and the validation of maintenance agencies' processes.

Furthermore, the COVID-19 pandemic has significantly impacted students' sense of place, ushering in substantial changes in living conditions globally. Many campuses have transformed into unfamiliar, sombre, and desolate settings. Concerns about returning to campus life are prevalent among both students and parents. In light of the pandemic, architects and planners involved in designing and developing on-campus residential dormitories must consider the psychological and

practical dimensions of the challenge. The epidemic has induced profound social, environmental, and economic repercussions across all educational levels, from primary to tertiary. It has also reshaped students' perceptions of hostels over time. Planners and architects must make informed decisions moving forward, recognizing the evolving perceptions of space among youth in this era of rapid development.

The primary objective of this study is to devise an appropriate methodology for constructing a questionnaire. Research and descriptive attributes that evaluate building performance from the user's perspective are instrumental in improving user satisfaction through building performance evaluation tailored to user needs. This paper outlines the development of a tool for gathering user satisfaction feedback from students residing in CFTI's residential hostels. The Questionnaire's content is meticulously curated to reflect user requirements about building performance. A questionnaire of this nature, thoughtfully constructed based on user needs aligned with building performance, will undoubtedly aid architects, planners, and designers in creating user-friendly student spaces. It will also assist facility managers in prioritizing their efforts and allocating available resources to areas that significantly enhance user satisfaction.

Moreover, it will empower facility managers to optimize intervention methods effectively. Once these user satisfaction survey results are transformed into an index (currently in development), facility managers can scrutinize the performance of facility maintenance systems and procedures and assign responsibilities accordingly. Ultimately, it will serve as a benchmark for the care and maintenance of CFTI's residential hostels.

1.1 Purpose

The primary objective of this research is to design a questionnaire that can effectively assess the performance of constructed facilities. The Questionnaire will employ attribute descriptors to elicit more objective responses from users during satisfaction surveys within Central Funding Technical Institutions (CFTI).

1.2 Background

1.2.1 Questionnaire

A questionnaire is a well-established tool for gathering insights into participants' social characteristics, behavioural patterns, attitudes, opinions, and motivations for their actions (DK Bird, 2009). It is a measurement instrument for collecting information from a specific population or sample (Fairfax County, PMT, 2007). Questionnaires offer consistent data collection, allowing for generalization to a larger population based on a representative sample from a defined group (Martyn C. Jones and Janice Rattray, 2005). In cognitive research on survey techniques, it is recognized that responding to survey questions involves complex information processing steps, including understanding the question and retrieving relevant information (Petra Lietz, 2009). Using questionnaires can facilitate user-friendly structure design and contribute to efficient management.

1.2.2 Stages in the Formulation of Questionnaire

The creation of any questionnaire typically follows a systematic process:

(A) Content of the Questionnaire:

Questionnaires comprise questions requiring respondents to address a series of inquiries or statements. These responses are then transformed into numerical data and subjected to statistical analysis. Hence, the content of the Questionnaire must be pertinent and acceptable to the intended audience while consistently operationalizing the critical concepts related to specific research questions (Janice Rattray and Martyn C. Jones, 2005).

(B) Range of Scale:

Questionnaires employ a variety of scales and response formats. These scales create different levels of data, which in turn influence the analytical possibilities. Therefore, it is essential to comprehend the scale range and response style used in constructing the survey instrument. Although various frequency scales exist, such as Thurstone, Guttman, and Rasch, the Likert scale is the most commonly utilized. Likert scales employ fixed-choice response formats to assess attitudes and opinions. The Likert-type scale assumes linearity in the intensity of experience, quantifying sentiments on a scale from "strongly agree" to "strongly disagree." A 5-point Likert scale is often employed to evaluate participant satisfaction (Janice Rattray and Martyn C. Jones, 2005).

(C) Item Generation, Wording, and Order:

Considerable effort is dedicated to refining the language and content of questionnaire items during its development. Multiple sources contribute to this process, including consultations with subject-matter experts, suggested responses, and items drawn from an extensive literature review. This meticulous attention is crucial because the type of question, its

phrasing, and the arrangement of items can all impact the outcomes. It is advisable to avoid commencing a questionnaire with contentious or sensitive questions, as items are typically presented and assessed in the order they appear. Demographic information is usually placed at the end of the Questionnaire to maintain respondent interest. Care should be taken to avoid posing specific questions that may lead to double negatives, double-barreled inquiries, or similar complexities. A blend of positively and negatively worded items can mitigate the risk of passive response bias, where respondents tend to agree with statements or respond uniformly. In some instances, open-ended questions may pique respondents' interest; however, these can pose challenges regarding comprehension, quantification, and analysis of responses (Martyn C. Jones and Janice Rattray, 2005).

(D) Validation

When developing a questionnaire, it is essential to conduct a pilot survey to validate the instrument (Martyn C Jones and Janice Rattray, 2005). The validation process involves three key components as outlined by Parsian, Nasrin, and Trisha Dunning in 2009:

I. Content Validity and Face Validity: These aspects aim to achieve Translational validity, ensuring that the Questionnaire accurately reflects the intended concepts and is easily understandable by respondents.

II. Principal Component Analysis of Variables: This step is employed to attain Construct validity by analyzing the interrelationships between variables used in the Questionnaire.

III. Reliability Establishment: Reliability is ensured through methods such as assessing Internal consistency and conducting test-retest cycles.

1.2.3 Trends in Question Formulation

In previous research, Eziyi Offia Ibem et al. (2013) employed customer satisfaction to measure public housing performance. However, a closer examination of their Questionnaire suggests that the design of the questions might not effectively elicit customer responses. Researchers had hoped that the developed Questionnaire would employ attribute descriptors, yet respondents may not entirely grasp the researcher's intentions regarding these descriptors, leaving room for subjective interpretation. An example question illustrates this challenge (Col. S Gopikrishnan, 2014).

For instance, in a question about safety (as depicted in Figure 2), respondents might interpret it differently, considering physical safety, fire safety, disaster safety, and safety from theft or burglary. This interpretation can be influenced by individual characteristics such as social, economic, and educational factors. Consequently, the researcher may not receive the specific information they seek from respondents, resulting in varying and subjective responses. Similarly, questions about the impact of natural light on satisfaction can yield divergent responses based on individual roles, characteristics, and preferences, as indicated in Figure 1. Respondents may also provide inconsistent ratings and additional comments, adding to response irregularity.

While questionnaires are widely used for gathering user input, the subjective nature of current user satisfaction evaluations may not always accurately represent actual performance. Hence, there is a need for a survey instrument that effectively captures real-world conditions to assess user satisfaction. Such a survey instrument should clearly define the characteristics being addressed.

1.3 Approach

This study draws upon various case studies evaluating building performance in student residential accommodations. It identifies gaps in post-occupancy evaluations (POE) and explores significant environmental behaviour parameters that can address these gaps. Depending on the survey's objectives and the facility in question, the study proposes a methodology for designing a more objective questionnaire using attribute descriptors that reflect user satisfaction. The reliability and validity of the Questionnaire are assessed through a pilot survey conducted among residential students in CFTIs.

1.4 Implications in Practice

This study provides valuable examples of attribute descriptor development and a questionnaire design approach. It highlights the importance of creating a user-friendly questionnaire and the trade-off between questionnaire length and objectivity.

1.5 Research Limitations

The research is based on limited case studies, which may restrict its generalizability. The innovative questionnaire design approach also requires further testing and validation, as the analysis is conducted only in CFTIs with architecture programs.

1.6 Originality/Value

This study introduces a more systematic approach to questionnaire formulation, particularly in questionnaire preparation. It can enhance knowledge and practices in questionnaire design to objectively assess facility performance in residential hostels, benefiting academic research and practical applications.

1.7 Objectives

The study's objectives include:

We are enhancing the objectivity of user responses obtained through surveys by addressing questionnaire design issues.

Developing a questionnaire based on attribute descriptors to solicit objective user feedback when evaluating constructed facilities.

1.8 Methodology

The Research Methodology Involves:

1. A review of relevant literature on post-occupancy evaluations and environmental behaviour studies in student accommodations to gain theoretical insights.
2. A comprehensive review of literature on methods for formulating survey questions.
3. Identifying significant environmental behaviour attributes for designing a POE questionnaire for student accommodation surveys.
4. Conducting an initial pilot survey to identify attributes relevant to user satisfaction among CFTI students.
5. Formulating questionnaire items based on the sample attribute descriptors obtained through literature review and the initial pilot survey.
6. Creating a questionnaire using attribute descriptors.
7. Conducting a pilot survey to test the Questionnaire's reliability and validity.

2. THE STATE OF THE ART

One of the most widely recognized methodologies for assessing the effectiveness of any constructed facility is user satisfaction. This metric quantifies the variance between the actual performance of a facility and the expectations it was designed to meet in terms of fulfilling the needs and desires of its users (Eziyi Offia Ibem and others). The initial phase involves identifying user characteristics within a built environment to evaluate user contentment. These characteristics can differ depending on the university attended by a student. Building indicators may encompass technical, functional, and behavioural aspects (O'Sullivan et al., 2004; Khar et al., 2012). Furthermore, individual attributes, such as social, economic, and educational backgrounds and personal preferences, influence user satisfaction.

In recent years, numerous strategies and approaches have emerged for assessing the performance of commercial, residential, and office buildings (Kim et al., 2005; O'Sullivan et al., 2004; Khai et al., 2012; O'Sullivan et al., 2004). Its occupants or residents establish performance standards for a building based on the benefits it is expected to provide and the requirements it should meet. Different individuals can perceive the same structure differently concurrently, or for the same individuals to have different perceptions at different times. Different individuals, groups, and communities each have unique expectations. According to research (Kim and colleagues, 2005), when user and community expectations regarding buildings diverge, they may measure the same indicators or qualities (Kian et al., 2001; Meir et al., 2009).

While much of the research on student residential satisfaction has been conducted outside of India, several higher education institutions have explored learning environments, student residential contentment, its impact on academic achievement, and other related aspects. However, due to India's diverse climatic and cultural conditions, these studies, while sharing a vision, may not directly apply to the Indian context. The pilot survey aims to bridge this gap by identifying specific and significant local issues and concerns. It will assist in establishing a robust survey procedure for conducting Building Performance Evaluation (BPE) by drawing on the conceptual framework and previous research.

2.1 Post-Occupancy Evaluations (POE) in Student Accommodations

Post-occupancy evaluation studies have been periodically conducted by the public and private sectors (Woon et al., 2015). These studies, particularly those focused on student housing, have garnered global attention (Liu et al., 2013). An example of such a study delved into the technical and functional performance of student hostel facilities in Saudi Arabia, as conducted by Hassanaian, as cited in Liu et al. (2008). Meanwhile, a POE study was carried out in Malaysia to gauge students' satisfaction with university housing options (Najib et al., 2011). Nigeria has also seen extensive research on university students' POE of dormitory facilities, with Oladiran's work indicating general contentment with amenities like water supply, ventilation, internal temperature, and natural lighting.

Further contributing to this body of research, Adewunmi et al. (2011) conducted a study focusing on the facilities of postgraduate student housing in Nigeria, revealing high levels of satisfaction across various elements, including cleanliness, lighting, comfort, and noise levels. However, Ojo et al. (2013) conducted a POE of privatized student housing on the Federal University of Technology campus in Akure, Nigeria, finding a contrasting trend where most respondents expressed dissatisfaction with campus facilities. South Africa saw its student housing undergo POE as well, courtesy of Eke et al. (2013), with findings suggesting resident students were content only with artificial lighting levels in their rooms and accessibility features. Dissatisfaction was noted regarding study hall size and natural light quality.

While POE studies initially focused on hostel accommodations (Woon et al., 2015), broader applications have emerged. Nawani and Khalil (2008) developed a comprehensive guideline for POE practice in Malaysia, particularly for governmental and public buildings. Their study revealed that 74% of the factors examined significantly impacted building occupants' happiness.

It is important to note that comparing POE findings can be challenging due to variations in research contexts, locations, and user preferences. Nonetheless, such comparisons can offer valuable insights into optimizing building occupants' comfort and satisfaction across diverse environments.

POEs may incorporate subjective and objective assessment criteria (Cho et al., 2011). User perception of a building's performance reflects the Interaction between people and the built environment, with personal attributes influencing user satisfaction (Lai, 2014), as Zhang (2019) noted. Research has demonstrated how poorly constructed environments can negatively affect productivity and vice versa (Frontczak and Wargocki, 2011; AghaHossein et al., 2013). POEs, emphasizing user feedback (Hassanain, 2008; Li, 2018), have focused on measuring service quality using tools to gauge users' perceptions rather than technical quality. This approach considers users' subjective responses to products (Parasuraman et al., 1985; Nelson and Nelson, 1995).

In contrast to earlier POE studies employing diverse methodologies (Roberts et al., 2019), Zhang's recent work (2019) analyzes indoor library environments in Chinese universities using an integrated cross-field customer satisfaction index (CSI) theory and POE theory. Schweiker, Ruiz, O'Brien, and Day (2019) emphasized the importance of understanding building context and human-building Interaction, particularly when employing behavioural techniques, yielding qualitative and quantitative insights. Akuetea, Nduka, and Ogundipe (2020) examined maintenance feedback mechanisms and constraints of POE to enhance future inhabitants' satisfaction in Nigerian university hostels. Wong and Jie (2022) investigated college students' preferences for on-campus accommodation, emphasizing the need for hostel qualities to align with students' expectations.

Akanmu et al. (2022) conducted a study on the post-occupancy evaluation of buildings in higher education institutions in Niger State, identifying functional and technical performance characteristics. Their findings underscore the necessity of reviewing indicators related to reachability, efficiency, accessibility, proximity, lighting, comfort, and sustainability for a practical post-occupancy evaluation of higher education buildings in Niger State. In light of the above literature review, selecting appropriate attributes for post-occupancy evaluations is critical to ensure the validity of survey findings.

2.2 Students' Residential Accommodations and the Gap in Post-Occupancy Evaluation

In evaluating building performance, users are often asked to rate their satisfaction with specific building performance parameters through surveys to gauge how well they perceive the quality of the facilities. However, this method has faced criticism as it is considered subjective in measuring performance since satisfaction is a highly personal experience influenced by individual characteristics and past experiences. To address this challenge, the gap hypothesis was introduced in service marketing to provide a more precise way of assessing how people perceive service quality. In this context,

perceived service quality refers to the size and direction of the gap between customers' perceptions and their expectations. Understanding these perceptions led to the concept of pre-consumption user expectations, which serve as a standard against which actual service performance is evaluated (Zeithaml et al., 1990). The "SERVQUAL" model was developed to measure service quality based on the gap hypothesis (Parasuraman et al., 1985).

Building users' experiences are influenced by various features and services within a facility. In line with the gap hypothesis, Lai (2013) introduced the GTbPOE approach for conducting post-occupancy evaluations in hostels. This method calculates the "gap" between students' expectations and satisfaction levels with six distinct parameters assessing hostel effectiveness. Although not all six parameters were utilized in this analysis, this study laid the groundwork for applying the gap theory approach to measure how building occupants perceive performance. These parameters include:

- Visual comfort (natural and artificial lighting facilities).
- Thermal comfort (mechanical ventilation/air conditioning/natural ventilation).
- Acoustic comfort (outdoor and interior noise control facilities).
- Fire safety (passive and active protective facilities).
- Sanitation (flush water supply and drainage discharge facilities).
- Information technology-based communication (hardware and user interface facilities).

However, it is essential to note that conducting a post-occupancy evaluation at the user end in student accommodations using information technology-based communication is limited in assessing how students perceive their experiences regarding privacy, security, social interactions, defensible space, and territoriality. Therefore, substantial research is required to address this gap and identify the appropriate attributes needed for a comprehensive post-occupancy evaluation.

2.3 Architecture and Environmental Behavior Studies

Environmental Behavior Studies (EBS) is a multidisciplinary field that strongly emphasizes user engagement and systematically evaluates user-related factors throughout the design process. This field is known by various synonyms, including "environmental psychology," "human environmental studies," "human factors," "behavioural architecture," "social ecology," and "programming." However, the most encompassing term for this field is "environment-behavior studies" (EBS).

In designing to effectively meet human needs through the built environment, architects often make assumptions about these needs. However, these assumptions are often unintentional, the decision-making process may lack a methodical and scientific approach, and the resulting structures are seldom evaluated to determine their functionality. Architect Neils Prak from the Netherlands aptly notes that "architects' 'common sense' differs from that of the user, primarily because one has professional training and the other does not. Hence, we should approach architects' intuitions with scepticism and employ experimentation and reasoning to identify areas where people's needs have been overlooked. Unfortunately, the answers are not readily apparent."

Architects and other professionals may have different perspectives on the built environment due to their specific training and expertise. Therefore, closing the design gap requires making decisions based on user perceptions, preferences, needs, and values. To bridge this gap effectively, Environment-Behavior Studies (EBS) was developed by merging the fields of architecture, urban planning, and urban design with insights from sociocultural and behavioural sciences. EBS aims to comprehensively address the challenge of aligning consumer preferences with architectural design. It systematically explores the relationships between the built environment and human behaviour, focusing on their practical application in the design process. Post Occupancy Evaluation (POE) tools are instrumental in conducting EBS. To illustrate the scope and interrelatedness of EBS sub-fields, Gary T. Moore has created a set of images (see Fig. 3).

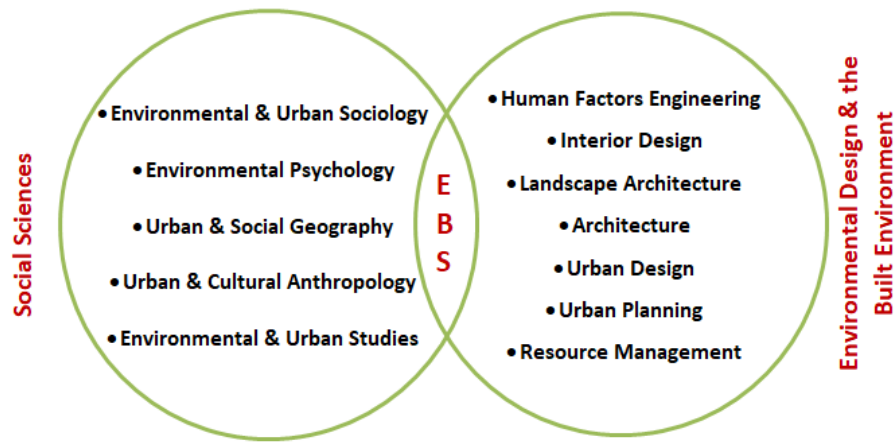


Figure 3 Gray T Moore , Emergence Of EBS By Including Multiple Domains.[Kumar, Meenal, Khan, Smita H. 2022/01/01 Using post-occupancy evaluation as a methodological approach to assess residential hostels in CFTI Archnet-IJAR: International Journal of Architectural Research Emerald Publishing Limited 2022/06/22.]

2.4 Design Process and EBS

EBS research is a step in the cycle of the built environment professions, which also involves users, post-occupancy evaluations (POE), information gathering about user experiences and user reviews, using EBS research based on POE data and the study findings as guides for drafting and changing planning, designing, and construction policies. The John Zeisel model asserts that EBS information and ideas should be applied and integrated into all stages of the design process, from the development of ideas and concepts until the execution and delivery of the building projects, in order to focus on the specific role of environment behaviour in the design process. It may also be brought up in this context to analyze how people respond to finished structures or other undertakings. In his research, Gary T. Moore used and improved this model.fig4

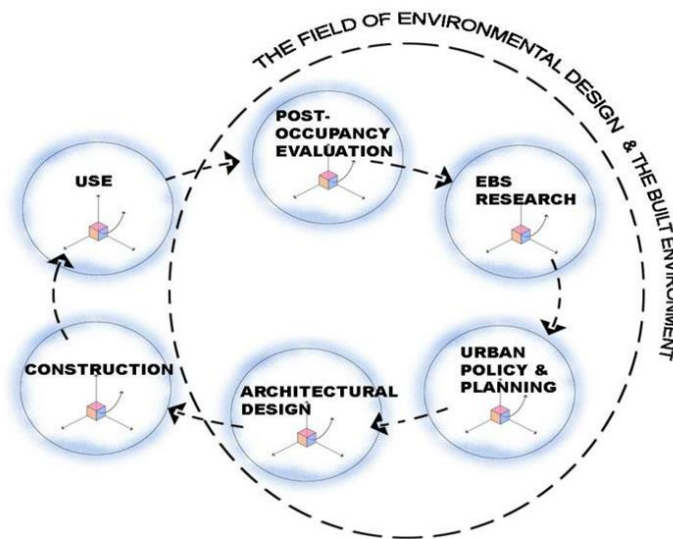


Fig 4 Gray T Moore - The professions of environmental design and the built environment as a cyclic process among EBS research, policy and planning, design, construction and use, and post-occupancy evaluation

3.1 Attributes

A comprehensive literature review was conducted to identify the attributes that signify user satisfaction with building performance in the context of measuring building performance. Attributes encompass functions, measurements, and indicators employed to assess the performance of a facility. The selection of these attributes may vary depending on the institution in question and the specific objectives of the performance evaluation. Furthermore, the nature of the users themselves influences the choice of attributes. The selected attributes must hold relevance both in the holistic evaluation of a facility and in examining specific facets of its performance (Sarel Lavy et al., 2011).

The evaluation's purpose guides the selection of attributes in building performance assessments. Various scholars have categorized distinct attributes based on the focus of the evaluation, as evidenced by a literature review on building

performance evaluation. Several classifications of attributes have emerged from these scholarly endeavours. Conversely, the intent of the evaluation dictates the choice of factors.

For instance, Mohammad Abdul Mohit and Mohammad Azim (2011) categorized 46 elements used to assess resident satisfaction in a housing colony into four categories: housing and physical characteristics, services provided within the housing area, public facilities, and the social environment within the housing area. N.E.M. Nik-Mat et al. (2011) segmented 16 criteria into functional, technical, and image components for evaluating the maintenance aspects of a complex of high-rise office buildings. Eziyi Offia Ibem et al. (2013), in their study on the effectiveness of residential structures, divided 27 attributes into five groups. In their post-occupancy assessments of public structures, Natasha Khalil and colleagues (2009) identified 19 factors influencing building performance. Xianhai Meng and Michael Minouge (2011) utilized 11 indicators to evaluate building maintenance performance. Ahmed E. Hashim et al. (2012) ultimately categorized the ten criteria into four groups: space, comfort, serviceability, and safety.

These examples highlight the myriad factors employed to evaluate the performance of constructed facilities. Questionnaires collected feedback from various stakeholders, including occupants/users, in all such examinations. Furthermore, the adaptation of questions for participants in user satisfaction surveys

3.1.1 Attributes for Building Performance Evaluation [BPE]

An exhaustive literature review was undertaken to identify the attributes that effectively capture user satisfaction with building performance in the context of measuring such performance. Initially, 56 attributes were identified through this process, which were subsequently refined to 29 attributes following a meticulous evaluation regarding the purpose of the assessment. These attributes were drawn from the insights and perspectives of various stakeholders, including architects, engineers, consultants, and scholars. The interactions with these experts were facilitated through email correspondences and personal discussions.

Feedback was sought from these experts to establish the suitability and acceptability of the identified building performance attributes in gauging user satisfaction levels during facility assessments. A total of 19 responses were obtained, culminating in selecting attributes that were deemed acceptable for evaluating user satisfaction concerning the performance of constructed facilities. Each attribute was comprehensively defined, and a brief reference was provided for each.

It is imperative that the questions framed based on these attributes are comprehensible to survey participants and align with the researcher's criteria to elicit objective feedback, irrespective of the participants' backgrounds. While it is acknowledged that user assessments may exhibit variations due to individual differences in social, economic, educational, and financial backgrounds, among other factors, the researcher can ensure that respondents precisely comprehend the essence of what is being inquired by providing precise descriptions for each attribute. Moreover, these descriptions facilitate the formulation of straightforward, focused questions corresponding to each attribute. The National Building Code 2005 of India, which serves as a fundamental reference for construction projects in the country, played a pivotal role in defining the attributes of each element. To illustrate, let us consider the descriptors for two of these attributes: 'safety and security' and 'illumination.'

Sr.No	Attributes	
1	Physical Condition	Building Integrity Like Cracks, Leakage, Seepage, Dampness Etc
2	Space	Size/Grouping Of Rooms, Common Areas, Open Spaces Etc
3	Indoor Air	Ventilation And Air Conditioning For Thermal Comfort
4	Illumination	For Adequacy And Visual Comfort
5	Safety And Security	Against Fire, Lightning, Accidents, Infections, Insects, And Crime Level
6	Accessibility	Connectivity, Internal Roads, Staircases, Lifts, Escalators
7	Air, Noise, And Water	Environmental Aspects Of Quality Of Air, Water, And Noise
8	Waste Disposal	Including Garbage Collection And Disposal
9	Drainage	Rain Water, Sewage, And Sullage
10	Finishes	Internal And External Finishes
11	Amenities	Drinking Water, Washrooms, Water And Electricity Supply Etc
12	Aesthetics	Including Landscaping, Visual Comfort, Psychological Comfort Etc
13	Parking	Its Location And Adequacy

Table 1. Attributes For Building Performance Evaluation[1]

A) Safety And Security Description – The attribute safety and security is described in Table 2 below to help frame queries about safety and security.

Sr.No	Characteristic	Description
1	Physical Safety	Provides safety against accidents due to falling, tripping, etc
2	Safety Against Insects	Protects from insects in the form of mosquito proofing, Fumigation, etc
3	Fire Safety	<ul style="list-style-type: none"> • With adequate fire extinguishers, water sprinklers, fire alarms, etc • Placed at prominently visible places for access • Have signboards indicating the location of equipment and fire exits • With passages and fire exits free of obstructions • Sufficient ventilation to avoid choking due to smoke during a fire • With an adequate water supply dedicated to fire fighting
4	Electric Safety	Against electrical accidents due to loose fittings, wires, etc
5	Security	Against theft, burglary, the crime rate in the area, etc

Table 2: Description of safety and security

B) Description of Illumination

The attribute of "Illumination" encompasses both natural and artificial lighting within the built environment. To enhance user satisfaction with lighting conditions, this attribute has been aptly termed "Illumination." A detailed description of this attribute is provided in Table 3 below.

For elucidation, this research presents only two sample descriptors, one for "Safety and Security" and the other for "Illumination." Analogously, attributes and their respective descriptions can be devised and seamlessly integrated into the survey instrument to solicit objective feedback from users and occupants. Each attribute is expounded upon in the theoretical framework, outlining their respective traits. For comprehensive examples of attributes, one may refer to relevant literature sources. Additionally, once the attribute descriptors have been translated into survey questions, their interpretations based on the 2005 National Building Code of India can be explored, especially within the Indian context. It is paramount to adhere to fundamental principles in question design, such as avoiding dual-meaning queries, negations, and ambiguities while crafting questions. Question formulation should steer clear of threatening language, convoluted inquiries, biased phrases, leading questions, and vague responses to ensure the accuracy and effectiveness of the data collected.

Sr.No	Characteristic	Description
1	Uniformity	Uniformly lit to perform the tasks and improve performance
2	Glare	Has proper shading devices to avoid glare
3	Visual Comfort	It does not cause any visual discomfort like flickering, overlighting
4	Safety	Promotes safety of occupants during movement
5	Control	Has easily accessible control to both natural and artificial lighting
6	Lighting Type	It also provides for natural lighting
7	Appearance	Improves the appearance of the area
8	View	Has a choice for the view outside
9	Psychological Effect	Has a positive psychological impact on the occupant
10	Maintenance	Facilitates easy access and handling of maintenance
11	Energy Savings	Facilitates energy savings

Table 3: Description Of Illumination[1]

3.2 Assigning Attributes For Research

Incorporating students in research procedures makes it easier to obtain meaningful feedback, which is a crucial element of any survey. In environmental behaviour research, user perception is essential to determine which parameters are allocated to perform useful POE in building performance evaluation. For example, the literature study and initial survey of students living in residential hostels assisted in identifying the key factors that influenced their decision to stay there.

Students' satisfaction with the quality and administration of CFTI residential hostel facilities and services. Furthermore, when studying residential hostels, the environment and surroundings are essential factors to consider because they significantly impact students' attitudes and behaviour; once the different qualities critical to the study complete POE, they are classified into functional and behavioural requirements.

The following identified student-centric parameters oriented to the POE methodology:

Functional Needs

- Comfort In Using Environs
- Quality Of Facilities And Amenities
- Personal and Social Spaces

Behavioral Needs

- Personal Space
- Comfort
- Privacy
- Territoriality
- Sense Of Belonging
- Security And Safety
- Social Interaction
- Way Finding

4.1 QUESTIONNAIRE FORMATION

The cornerstone of this study is rooted in comprehensive ground investigation. While a substantial body of research on learning environments and student residential satisfaction has been conducted in higher education institutions, predominantly in non-Indian contexts, these studies, though insightful, often fall short of providing pragmatic insights due to the inherent diversity in climatic and cultural settings within India.

The initial survey played a pivotal role in narrowing the gap by addressing on-ground issues pertinent to this research, thus facilitating the customization of the Post-Occupancy Evaluation (POE) model, as depicted in Figure III.

The extensive literature review and the pilot survey enabled a direct and insightful examination of activities within residential hostels and concerns related to the spatial environment. This approach significantly enhanced comprehension of the hostel's surroundings from the perspective of its primary users, the students. It was conducting a walk-through evaluation that offered firsthand insights into spatial challenges within the hostels, encompassing aspects like building quality, maintenance levels, and user attitudes towards the built environment. Moreover, it provided a practical yardstick to validate user assessments.

Furthermore, by collating occupancy data for each institute sampled, we established the foundation for rudimentary comparisons regarding overall hostel occupancy and gender distribution among on-campus residents. The analysis of architectural drawings aided in dissecting spatial design, pinpointing key locations within residential and educational settings, and delineating their critical attributes, thus underpinning the evaluation research, as presented in Table 4.

Engagement with hostel wardens and administration unveiled the diverse cultural tapestry inherent to each hostel. These interactions substantially bolstered the success of the evaluation methodology. Additionally, engagements with the university's foundation department profoundly influenced the conceptual underpinnings of the design.

MODIFIED ASPECTS OF BUILDING PERFORMANCE EVALUATION RELEVANT TO STUDY

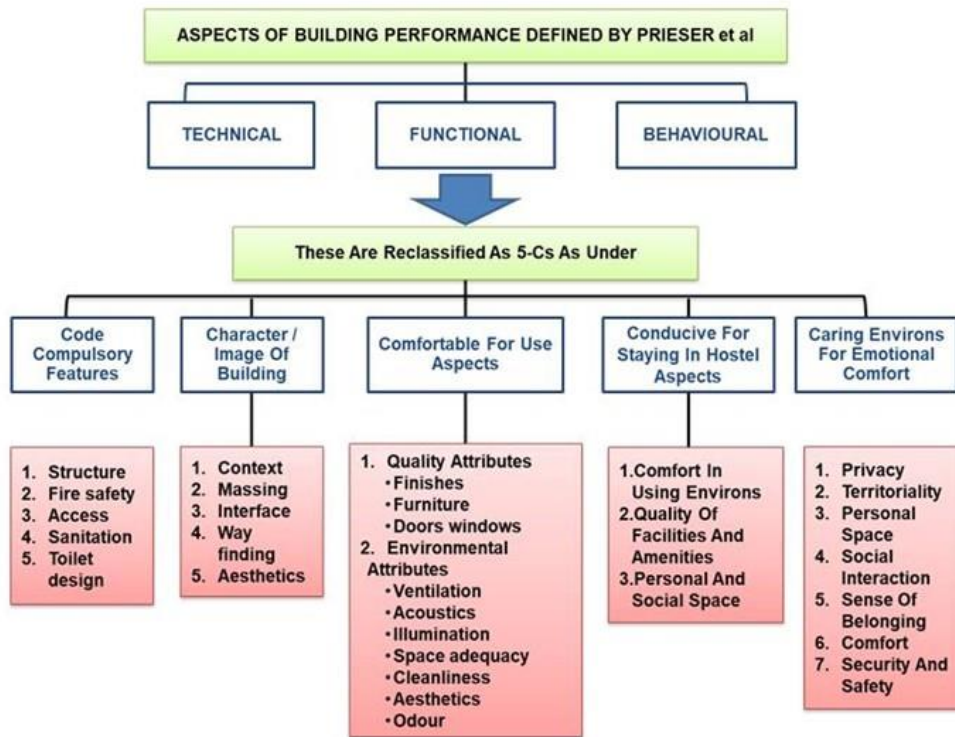


Figure 5. Kumar, Meenal,Khan, Smita H. 2022/01/01 Using post-occupancy evaluation as a methodological approach to assess residential hostels in CFTI Archnet-IJAR: International Journal of Architectural Research Emerald Publishing Limited 2022/06/22

IDENTIFIED SPACES IN RESIDENTIAL HOSTELS AND THEIR ATTRIBUTES		
Indoor Spaces	<ol style="list-style-type: none"> 1. Rooms 2. Mess / Dining 3. Canteen 4. Recreational / Activity Areas 5. Toilets / Washrooms 6. Laundry Room 	<p>Functional Attributes</p> <ol style="list-style-type: none"> 1. Space Adequacy 2. Natural Ventilation 3. Natural Light 4. Accessibility 5. Acoustic [Noise] 6. Odor 7. Aesthetics 8. Cleanliness 9. Quality Of Finishes 10. Quality Of Doors And Windows 11. Flexibility Of Furniture 12. Sanitation [Waste / Garbage Disposal] <p>Behavioral Attributes</p> <ol style="list-style-type: none"> 1. Personal Space 2. Comfort 3. Privacy 4. Territoriality 5. Sense Of Belonging 6. Security And Safety 7. Social Interaction 8. Way Finding
Transition Spaces	<ol style="list-style-type: none"> 1. Entrances 2. Corridors 3. Staircase 4. Elevators Space 5. Drinking-Water Area 	
Open Spaces	<ol style="list-style-type: none"> 1. Courtyards 2. Parking 	

Table 4: Identified Spaces in Residential Hostels in CFTI . [Kumar, Meenal,Khan, Smita H. 2022/01/01 Using post-occupancy evaluation as a methodological approach to assess residential hostels in CFTI Archnet-IJAR: International Journal of Architectural Research Emerald Publishing Limited 2022/06/22]

4.2 Questionnaire as Survey Instrument

Based on the identified characteristics and sub-attributes, the Questionnaire was developed for a student satisfaction survey in a residential hostel. For qualitative analysis, a student survey supplied categorical data. The questions bring up specific difficulties. They were handling Every primary concern that had surfaced. The Questionnaire is limited and targeted for the most part. It is suitable for statistical analysis. The statistically assessed questions were on a five-point Likert scale with SPSS software for the qualities directly relevant to building performance. Dichotomous questions explored residents' impressions of external elements such as accessibility, facilities, and societal issues. The participant knows what the researcher is asking Through the way questions are framed and can offer the most accurate and precise response. The scores are designated uniquely to the responder's point of view. Rather than being numbered from 1 to 5. Table 5

QUESTIONNAIRE FRAMEWORK		
Parts	Headings	Sub Headings
Part 1	Personal Demographic Data Of Students	1.Name 2.Email 3.Department Name 4.Studying In Which Year 5.You Have Been In Hostel Since
Building Performance Evaluation		
Part 2	Space, Comfort , Security / Safety and Quality of spaces [Technical & Functional Attributes]	2.1 Rate Each Space In Terms Of Specific Qualities 2.2 Rate Spaces For Its Overall Quality 2.3 Rate Spaces In Hostel For Its Overall Comfort 2.4 Rate Spaces In Hostel For Its Overall Safety And Security 2.5 From The Above Spaces, Pick Three Spaces You Like The Most In Hostels 2.6 From The Above Spaces, Pick Three Spaces You Dislike The Most In Hostels 2.7 Rate The Quality Of Your Hostel Building A. Way Finding B. Context C. Massing & Look Of Building D. Interface
Part 3	Place Identity Place Dependency [Behavioural Attributes]	3.1 How Do You Identify With The Hostel Spaces & Students Around A. Personal Space B. Territoriality C. Social Interactions D. Privacy E. Sense Of Belonging 1.2 How Dependent Are You On Hostel Concerning Social/ Economic /Physical Aspects
Part 4	Management Facilities [Satisfaction with Management Facilities]	4.1 Rate The Management Facilities based on Its Nature And Quality 4.2 From The Above, Pick Three Facilities You Are Dissatisfied The Most In Hostels 4.3 From The Above, Pick Three Facilities You Are Satisfied The Most In Hostels

Table 5 Characteristics of Residential Hostels in CFTI [Kumar, Meenal,Khan, Smita H. 2022/01/01 Using post-occupancy evaluation as a methodological approach to assess residential hostels in CFTI Archnet-IJAR: International Journal of Architectural Research Emerald Publishing Limited 2022/06/22]

5.1 Pilot Survey

A pilot survey was conducted to confirm the Questionnaire's reliability and validity. This study was conducted in the VNIT girls' and boys' hostels. Examining the building's user profile helps draw samples using a stratified random sampling method. The Questionnaire circulated was among 100 (n) students, 50 (n) of whom were females and 50 (n) of whom were boys. The survey was conducted online, with questions distributed to all participants through email and Whatsapp.

5.2 Results Of the Pilot Survey

A) Translational Validity

I tested the Questionnaire's content and face validity by distributing it to industry specialists such as architects, academicians, and hostel students. The Interaction was via email and personal conversations to get their thoughts on building performance evaluation sufficiency and suitability. Before embarking on the pilot survey, The 40 responses obtained aided in fine-tuning the Questionnaire.

B) Construct Validity

Because attribute descriptors employed were in the wording, the questions were categorized. Therefore, exploratory factor analysis was unnecessary in this case. Instead, confirmatory factor analysis was used to establish the instrument's concept validity—verification of sample size for applicability using Spss software. Table 6 displays the results.

TEST	PURPOSE	RANGE	RESULTS
KMO correlation coefficient	Sample Adequacy	0.5-0.7 = Mediocre 0.7-0.8 = Good 0.8-0.9 = Very Good > 0.9 = Excellent	0.8 – 0.89 for all Attributes
Eigen Value	Factor Relevance	> 1	> 1 for all Attributes
Factor Loadings	Correlation	> 0.5	> 0.5 for all Attributes
Cronbach Alpha	Reliability	0.5-0.59 = Poor 0.6-0.69 = Questionable 0.7-0.79 = Acceptable 0.8-0.89 = Good > 0.9 = Excellent	> 0.8-0.89 for all Attributes

Table 6 Construct Validity And Reliability Check For Questioner

C) Reliability

Internal consistency reliability was used to assess the dependability of the Questionnaire. The Cronbach item interrelation coefficient for the attributes varied from 0.8 to 0.9, showing a good correlation between the items and a consistently valid questionnaire.

5.3 Analysis Of Data

SPSS software was used to analyze data from questionnaires at each parameter level. Despite monitoring statistical methodologies at multiple levels, it could associate the researcher's (qualitative) assessment and the evaluator's (categorical) opinion of their hostel surroundings. The examination was done by combining the two data sources.

6.1 Practical Implications

A) The Implications of Descriptor Definitions

Before administering the Questionnaire, a comprehensive statistical analysis was conducted to ensure robust output from the survey. Several SPSS tests were employed to assess the data. The Kaiser-Meyer-Olkin (KMO) test, which evaluated all the data collectively, indicated a significant correlation among the data. The examination of variable collinearity gauged the strength of connections between individual variables. A KMO measure equal to or greater than 0.8 is deemed highly relevant. Eigenvalues were employed as a criterion for factor determination according to the Kaiser Criterion. If eigenvalues exceed one, it signifies a factor; if they are less than one, it does not. Variance extraction requirements necessitate eigenvalues exceeding 0.7 for consideration as a factor. It also delineates the percentage of total variance accounted for by that specific component. Commonality values reveal how much of the overall variation is explained by each factor. Factor loading, representing the correlation coefficient between the variable and the factor, elucidates the proportion of variance captured by the variable on the given factor. In structural equation modelling (SEM), a factor loading of 0.7 or higher implies sufficient variance capture from that variable. All attributes identified in the study exhibited correlations exceeding 0.5.

Cronbach's alpha, developed by Lee Cronbach in 1951, is employed to evaluate the reliability or internal consistency of surveys featuring multiple Likert scale questions. These questions delve into latent or unobservable traits like neuroticism, openness, and conscientiousness, which can be challenging to measure in real-life scenarios. Cronbach's alpha assesses the extent to which two or more variables are interrelated.

The Questionnaire rigorously tested the implications of the descriptors. As demonstrated in the study, providing comprehensive definitions for attributes facilitates effective question item formulation, enabling respondents to comprehend the attributes holistically. Through this descriptive approach, researchers can ensure that they convey the specific attribute accurately. This process enhances the rate of user input while minimizing respondent subjectivity. However, it is essential to note that descriptors may vary based on the specific facility under evaluation. Descriptors similar to these provide objective assessments as a precursor to question generation.

B) Questionnaire Length

Despite creating more extensive questions based on descriptors, respondents responded positively to the Questionnaire. It was observed that the objectivity achieved through this Questionnaire justifies its length. Respondents typically dedicate between 15 to 20 minutes to complete the Questionnaire.

6.2 Conclusions

This study has provided valuable insights into the performance indicators used for evaluating buildings once higher education institutions have occupied them within the context of CFTI in India. The research has successfully identified pertinent functional, technical, and behavioural performance indicators that form the basis for constructing a comprehensive questionnaire for conducting post-occupancy evaluations of buildings. Although the study's scope was limited to qualitative feedback from students within the selected CFTI, the established performance indicators can serve as a valuable framework for conducting realistic post-occupancy evaluations of buildings at other public and private higher education institutions.

6.3 Recommendations

1. Based on the study's findings, several recommendations are proposed:
2. The study effectively solicited student feedback and identified relevant attributes that represent user requirements. Consequently, following the creation and validation of the Questionnaire, it is deemed suitable for use in large-scale user satisfaction surveys.
3. The initial survey achieved an excellent response rate, with direct engagement between the researcher and respondents ensuring substantial feedback. Concerns about the Questionnaire's length proved unfounded, as most respondents did not express objections. Adequate time allocation for the survey is crucial. The pilot survey has validated the questions' legitimacy, paving the way for their incorporation into a full-scale user satisfaction survey for assessing building performance.
4. The study at CFTI VNIT focused on eliciting user satisfaction with building performance. Its scope can be expanded to encompass similar government-owned or public-sector residential structures.
5. The process of constructing a questionnaire remains consistent regardless of the facility. Ethical considerations related to user surveys have been addressed. If new layers of attributes are introduced in the future, with the current set serving as foundational attributes, the revised Questionnaire can encompass a broader range of facilities and construction agencies.
6. Specifying and breaking down attributes into sub-questions enhances questionnaire objectivity. This approach is more likely to yield objective user responses that closely mirror reality. The Questionnaire's effectiveness and the value of the collected data depend on selecting crucial attributes, their identification and description, and their conversion into easily comprehensible questions.
7. Facility managers can effectively address critical concerns when equipped with a near-complete understanding of a built facility's actual performance from the user's perspective. The Questionnaire for evaluating building performance has undergone testing and validation, confirming its suitability for user satisfaction surveys.

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