

Investigating the User Group Satisfaction in an Institutional Building of Higher Learning

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Abstract—Post Occupancy Evaluation of the building is a loop based feedback process that addresses every stage of building delivery. It is a reliable tool to understand the user perspectives and its application has extended into all building typologies. This study particularly focuses on institutional building that accommodates two diverse departments and is a part of campus that is reputed for higher learning. India has well established higher education institutions that have very supportive built environments. Given the intensity of use and the importance of occupant satisfaction in higher education buildings of India, application of POE is a pre-requisite to understand user satisfaction and to create benchmarks for future education buildings. Focusing on physical and psychological aspects this study investigates the four types of users and their level of satisfaction in using the building. This helps to fill the gap between building professionals and building users, especially in higher education buildings of India. Twenty-five physical aspects and six psychological aspects are analyzed for the four types of user groups. Teaching, non-teaching, housekeeping, and students are the four user groups, whose perception was calculated by using user Satisfaction Index. The strongly satisfied and strongly dissatisfied aspects of the building suggest the areas of improvement and areas of considerations for future buildings. Safety instructions, communication systems and provision of covered parking are areas of improvement on priority whereas large central courtyard, feeling of safety, air movement and day lighting are areas of strong satisfaction.

1. INTRODUCTION

The evolution of Post Occupancy Evaluation (POE) of buildings began in 1960's, majorly originated in developed countries. With more than 50 years of history, POE has evolved from simple understanding of buildings to Building Performance Evaluation and Universal Design Evaluation. It is a holistic and process oriented approach to building evaluation. POE is defined as "the process of systematically evaluating the performance of buildings after they have been built and occupied for some time" [1]. The central trait of POE is a loop based feedback process, right from inception to completion to occupation, feedback at every stage of building is not only for the buildings under construction but also for the future buildings. In the last two decades some of the essential

contributions that offer insight into methods for monitoring and understanding building performance have been developed, which can be used worldwide [2]. Criteria for designing new buildings should be from the performance of the existing buildings. In any evaluation study, results and their application is highly significant [3].

There are two performances that are central to POE. Technical performances such as thermal comfort, visual comfort, acoustic comfort, indoor air quality, fire safety and functional performances such as designated spaces, finishes, facilities and psychological factors [1-2]. POE of a cafeteria in a higher education institute focused on the technical and functional performances [1].

Built environment in higher education institutes is to support teaching, researching and other community related activities [1]. POE's form the benchmarking of the existing facilities and for future buildings of same typology [4]. This is also central to the output that forms the core of higher education. In this regard, a building that hosts two diverse departments is selected for POE study. Apart from the fact that the selected building is part of a highly reputed technical institution, the central objective of the study is to understand the various user group satisfactions and compare across the physical and psychological aspects of the built environment. The need for the study arises from the fact that identification of the balance between supply side of the building, that is user's perspectives and demand side of the building, that is how much a building can accommodate is crucial in making & delivering highly functional and sustainable institutional buildings [2].

1.1 Components, types & phases in POE

POE is essential for every stage of building delivery, starting from planning to construction and occupation and post occupation [2-4]. It is a tool to collect the feedback from the organizations who occupy the space and the individual end user requirements. It is can be used to check the level of satisfaction of the design of building and its central intentions [5]. POE is also called as Evidence based design process,

where in the feedback from the user is collected through questionnaires, interviews and workshops and at the same time includes objective measures like environmental monitoring, space measurement and cost analysis of the buildings. POE follows the qualitative and quantitative measurements to assess the feedback of the occupants. Survey methodology plays a major role in assessing the building through questionnaires or interviews or workshops. Apart from the environmental monitoring measures, occupational density, solid waste management, infrastructure requirements and financial viabilities also form the other aspects of POE.

There are three types of POE [2] - Indicative POEs are about the strength and weakness of the building for which the performance is evaluated. It includes interviews of informants and walk through of the facility. Investigative POEs are about addressing the effects and causes of issues in the buildings. Diagnostic POEs is the relation between the feedback obtained from the occupants and the data about physical environment of the building. It results in the new idea about the performance of buildings. Further there are six major phases of building delivery and life cycle - Planning, Programming, Design, Construction, Occupancy and facility management, and Adaptive reuse/recycling of facilities [2]. Given the fact that building delivery is “disjointed, cost-driven, time-limited, conflict-ridden, ignorant [2], Building Performance Evaluation consolidates all these factors.

1.2 Details of the selected building

OJAS is the institutional block designed for Physics and Chemistry departments. It is part of National Institute of Technology Trichy and is located in the western side of the campus. It also includes the facility for research laboratories of various other departments. The building is divided into two sections by the imaginary axis line and the same axis divides the two departments Physics and Chemistry. The large central courtyard has the provision to function as open air theatre. OJAS is approached by five entrances, main entry in the southern direction and two entries on the east and west side of the building.

Building type: Institutional / laboratory

Total built up area: 19275 Sq.m (6425 Sq.m per floor), Ground + 2 floors of 3.6m height each, RCC frame structure

Labs: total 24, 8 labs per floor, measuring 18m X 12m each

Faculty rooms: total 48, 16 per floor, measuring 4m X 4.5m, (12 locked)

Admin rooms: total 04, measuring 8m X 4.5m

Toilets: total 04 blocks

Common areas: 3.3m wide corridors

Ground floor: RS labs of other departments, admin rooms, and faculty rooms

First floor: Western wing – Department of Chemistry (DoC), Eastern wing – Department of Physics (DoP), labs for UG and RS

Second floor: Western wing – DoC, Eastern wing – DoP, labs for PG and RS

Apart from laboratories this building has class rooms, meeting halls and faculty rooms. The internal partitions are made based on their functional needs so each interior layout is different from the other. The total number of users is 479 which includes research scholars, under graduates, post graduates, teaching, non-teaching, security guards and housekeeping staff. This building is open 24x7 and is majorly used by research scholars after the working hours.

2. METHODOLOGY

The purpose of the POE is to evaluate the performance of buildings with respect to user satisfaction. Since the focus of the study is to investigate various user groups satisfaction levels, questionnaire is classified into physical aspects and psychological aspects.

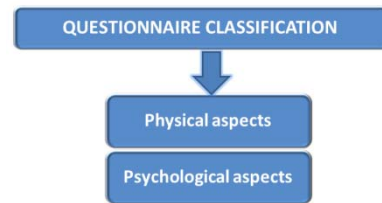


Figure 7: Aspects of questionnaire; Source: author

Table 01: Occupant satisfaction survey; Source: author

OCCUPANT SATISFACTION SURVEY			
Information Required		Source	Tools
Physical aspects			
Building Design	Building layout, Functional characters, space utilization and user pattern.	Occupants	Questionnaire
Psychological aspects			
Comfort & Controls	Thermal Comfort, Noise, Air & Light, Quality; Heating, Lighting and Ventilation	Occupants	Questionnaire

The questionnaire includes the main aspects of building use such as circulation, space and furniture for individual work, space for work and teaching, internal environmental comfort, building “expression” especially its look and feel, the building’s management and user’s view of how the academic block satisfies their need and perceptions. There are four types of targeted users and it is expressed graphically represented in the figure 11.

From the literature total of 25 aspects in physical dimension and 06 aspects in psychological dimension are identified and

form the basis for the questionnaire. These are given in the Annexure 01.

3. DATA & ANALYSIS

In total 123 responses are collected from the 479 users. In that students are 100, teachers are 5, Non – Teachers are 10 and Supporting Staff are 11 in numbers. The age of the user group is taken into account during the survey; 75% of users are between 15 – 40 years and 25% of the users are between 40-60 years. After age, the working hours of each and every user group is taken into account. Research scholars use the building more than any others, for about 144 hrs/week, as compared to 6 hours, 8 hours and 40 hrs/week by others. Because of this reason, research scholars constitute in high sample.

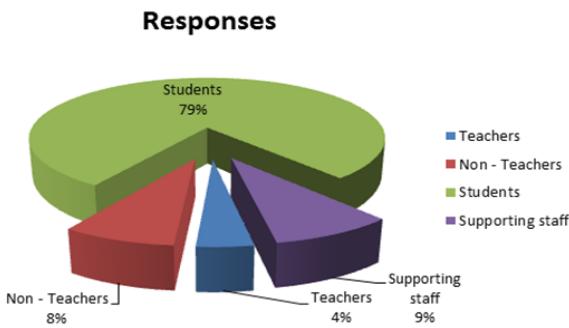


Figure08: Percentage of user responses; Source: author

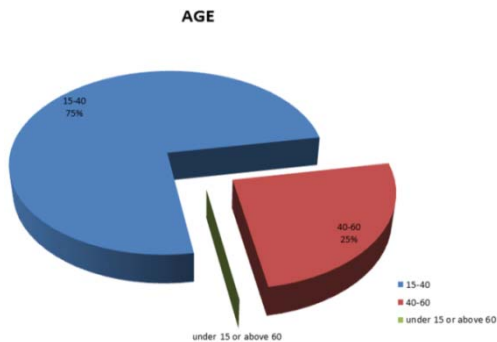


Figure 09: Percentage of users by age; Source: author

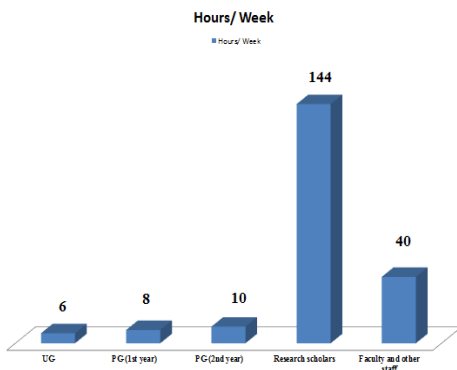


Figure 10: User groups working hours; Source: author

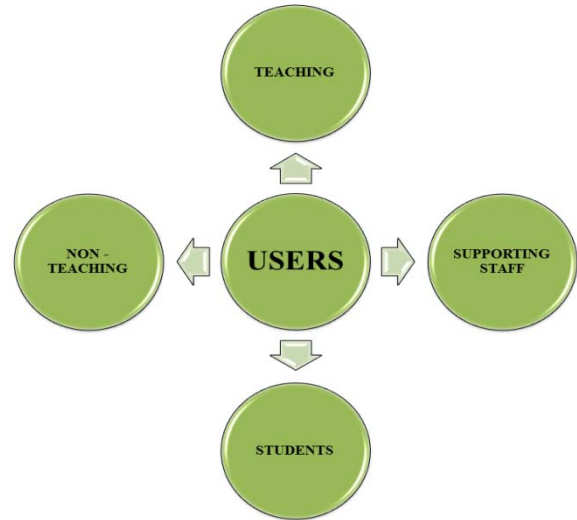


Figure 11: Classification of user groups; Source: author

3.1 Calculating Satisfaction Index

Table 02: Satisfaction Index; Source: [1]

S. No	Rate of Satisfaction	Satisfaction Index
1	>85%	Strongly Satisfied - SS
2	70.1% - 85%	Satisfied - S
3	55.1% - 70%	Dissatisfied - DS
4	<55%	Strongly Dissatisfied - SD

The satisfaction indices were calculated as follows [1].

$$\text{Satisfaction Index}(I) = \frac{\sum_{i=1}^5 (a_i)(x_i)}{5 \sum_{i=1}^5 x_i} \times 100\%$$

Where a is the constant representing the weight assigned to i and X_i is the variable representing the frequency assigned to i. The response for i is 1,2,3,4,5. In order to achieve higher levels of user satisfaction any building element whose rate of satisfaction is less than 70% is considered to be the defective element in performance.

3.2 Analysis of responses given by Students

The students are asked about the physical and psychological aspects of the building. The responses of the students to various questions along with the list of aspects are given in Annexure 01. The following are the findings after the assessment of responses from students about the physical & psychological aspects of the building.

Physical aspects - Students

- The “Strongly Satisfied” (>85%) aspects are, Space for lunch & refreshments, Overall building layout, Overall functional quality, Access to toilets, Number of toilets, Access to staircase and lifts and Location of ramps.

- The “Satisfied” (70.1% to 85%) aspects are, Space at your desk, Does the building meet your needs, Access to spaces, Safety problems, Entrance to the building, Toilet equipment.
- The “Dissatisfied” (55.1% to 70%) aspects are, Space for personal storage, Access to equipment, Comfort of furniture, Universal access, Seating in common spaces, Approach way to the building.
- The “Strongly Dissatisfied” (<55%) aspects are, Communication system, Furniture layout, covered parking, Alarm systems, Lockers and video surveillance and Pedestrian access to building.

Psychological aspects - Students

- The “Strongly Satisfied” (>85%) aspect is Feeling of safety in building.
- The “Satisfied” (70.1% to 85%) aspects are, Comfort of spaces, Building and productivity and Is building a pleasure.
- The “Dissatisfied” (55.1% to 70%) aspects are, Privacy at work space and Awareness about cleanliness.

3.3 Analysis of responses given by Teachers

The teachers are asked about the physical, and psychological aspects of the building. The responses of the teachers to various questions along with the list of aspects are given in Annexure 01. The following are the findings after the assessment of responses from teachers about the physical & psychological aspects of the building.

Physical aspects - Teachers

- The “Strongly Satisfied” (>85%) aspects are, Space at your desk, space for personal storage, access to spaces and number of toilets.
- The “Satisfied” (70.1% to 85%) aspects are, Overall building layout, does the building meet your needs, overall functional quality, access to equipment, access to toilets, furniture layout, comfort of furniture, universal access, safety problems, entrance to the building, access to staircase and lifts, location of ramps, approach way to the building and pedestrian access to building.
- The “Dissatisfied” (55.1% to 70%) aspects are, Space for lunch & refreshments and alarm systems.
- The “Strongly Dissatisfied” (<55%) aspects are, Communication system, covered parking, lockers and video surveillance, toilet equipment and seating in common spaces.

Psychological aspects - Teachers

- The “Satisfied” (70.1% to 85%) aspects are, Space Feeling of safety in building, privacy at work space and Is building a pleasure.

- The “Dissatisfied” (55.1% to 70%) aspects are, Building and productivity.
- The “Strongly Dissatisfied” (<55%) aspects are, Comfort of spaces and awareness about cleanliness.

3.4 Analysis of responses given by Non-teachers

The non-teachers are asked about the physical & psychological aspects of the building. The responses of the Non-teachers to various questions along with the list of aspects are given in Annexure 01. The following are the findings after the assessment of responses from non-teachers about the physical & psychological aspects of the building.

Physical aspects – Non-teachers

- The “Strongly Satisfied” (>85%) aspects are, Space for lunch & refreshments, overall building layout, does the building meet your needs, overall functional quality, access to spaces, access to equipment, access to toilets, furniture layout, comfort of furniture, safety problems, entrance to the building, number of toilets, toilet equipment, access to staircase and lifts, location of ramps, seating in common spaces, approach way to the building, pedestrian access to building.
- The “Satisfied” (70.1% to 85%) aspects are, Space at your desk, space for personal storage, communication system and lockers and video surveillance.
- The “Dissatisfied” (55.1% to 70%) aspects are, Covered parking and universal access.
- The “Strongly Dissatisfied” (<55%) aspects are, Alarm systems.

Psychological aspects – Non-teachers

- The “Strongly Satisfied” (>85%) aspects are, Space Feeling of safety in building, comfort of spaces, privacy at work space, building and productivity and Is building a pleasure.
- The “Dissatisfied” (55.1% to 70%) aspects are, Awareness about cleanliness.

3.5 Analysis of responses given by Supporting Staff

The supporting staff are asked about the physical and psychological aspects of the building. The responses of the Non-teachers to various questions along with the list of aspects are given in Annexure 01. The following are the findings after the assessment of responses from non-teachers about the physical & psychological aspects of the building.

Physical aspects – Support staff

- The “Strongly Satisfied” (>85%) aspects are, Space Accessibility to other spaces, Access to toilets, Number of toilets and Access to staircases and lifts.
- The “Satisfied” (70.1% to 85%) aspects are, Space Toilet equipment.

- The “Dissatisfied” (55.1% to 70%) aspects are, Space for personal storage, communication systems, Alarm systems and Lockers & Video surveillance.

Psychological aspects – Support staff

- The “Strongly Satisfied” (>85%) aspects are, Space Feeling of safety in the building, safety in the building and Do you like this building.
- The “Dissatisfied” (55.1% to 70%) aspects are, Comfort of spaces in the building.
- The “Strongly Dissatisfied” (<55%) aspects are, Privacy at your work space.

4. RESULTS & DISCUSSION

The overall analysis of physical & psychological aspects is categorized with respect to satisfaction index and is shown in figure 12.

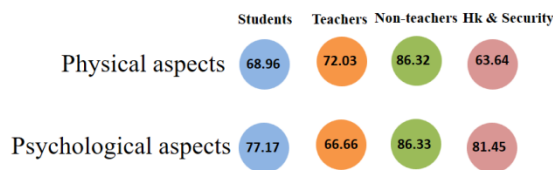


Figure 12: User satisfaction percentages; Source; author

4.1 Comparison of physical aspects of occupant survey based on satisfaction Index

The physical dimension has a total of twenty-five aspects. Students are equally spread across various rates of satisfaction, this can be due to their higher number, less freedom and their general dislike towards formal environments, the provision of access to communication systems, security of belongings and the non-motorized nature of transport. Whereas non-teachers and teachers are highly satisfied with physical aspects, this can be because of age, less association of movement within in the building, more autonomy and less numbers.

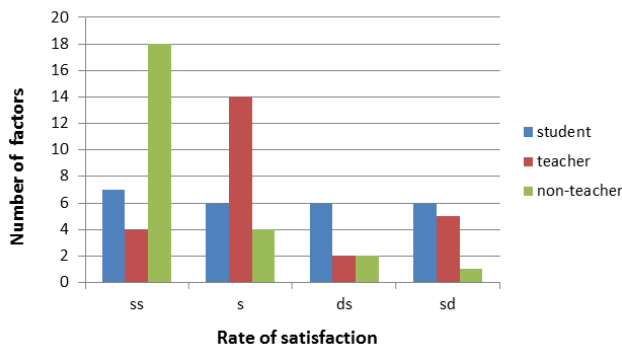


Figure 13: Physical aspects & User groups; Source: author

4.2 Comparison of psychological aspects of occupant survey based on satisfaction Index

The psychological dimension has a total of six aspects. Students are satisfied but not strongly dissatisfied also, this is the only aspect where student user group is high in rate of satisfaction, this is because of location of building (secured campus) productivity of work and architecture of the building – this indicates that architecture of a building can negate the physical and mental fatigue. Teachers are not strongly satisfied with any psychological aspect, whereas non teachers are strongly satisfied, this is because of location, type of building and nature of work.

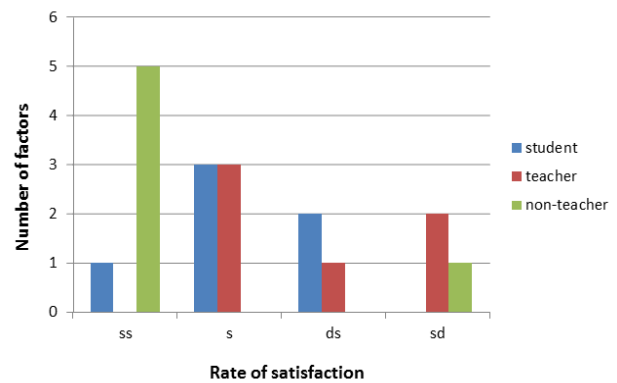


Figure 14: Psychological aspects & User groups; Source: author

4.3 Comparison of User group satisfaction index

There is a need to assess the overall performance of the building so the satisfaction index of the various factors of the building is selected for the entire user group. Some commonality is found between the users in assessing the overall design and performance of the building. They are listed and they are compared between different user groups. Factors that need attention are, utility and service aspects for students; operation & maintenance and signage for teachers and non-teachers; provision of designated spaces for security guards and housekeeping.

5. CONCLUSIONS & RECOMMENDATIONS

In India very few POE studies are conducted for institutional buildings of higher learning and this study is one of them. Even though focused on four user groups the limitations of the study are in terms of time of the year and the sample size. As a recommendation for the overall performance of the building, much care and concentration should be taken with respect to operation and maintenance of the building and improvise the communication systems.

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ANNEXURE 01

Physical aspects of occupant survey
1. Space at your desk
2. Space for personal storage
3. Space for lunch & refreshments
4. Overall building layout
5. Does the building meet your needs
6. Overall functional quality
7. Access to spaces
8. Access to equipment
9. Communication system
10. Access to toilets
11. Furniture layout
12. Comfort of furniture
13. Covered parking
14. Universal access
15. Safety problems
16. Alarm systems
17. Entrance to the building
18. Lockers and video surveillance
19. Number of toilets
20. Toilet Equipment
21. Access to staircase and lifts
22. Location of ramps
23. Seating in common spaces
24. Approach way to the building
25. Pedestrian access to building
Psychological aspects of occupant survey
1. Feeling of safety in building
2. Comfort of spaces
3. Privacy at work space
4. Building and productivity
5. Is building a pleasure
6. Awareness about cleanliness