Post-occupancy evaluation based on occupant behavior aspect

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Abstract. Building performance can be improved by investigating and evaluating previews of occupant behavior. Post-occupancy evaluation (POE) is a design analysis method used to direct and evaluate the physical and social elements of inhabited buildings. In recent years, the Ministry of Public Works and Public Housing grants student dormitory building to several Indonesian universities. In 2017, Institut Teknologi Sumatera (ITERA) Bandar Lampung Indonesia has been granted two of those student facilities. The building has been operated for three years. The student dormitory considered has one type of building that has a high capacity occupation. This research aims to measure user satisfaction and evaluate building facility and its implication to student learning effectively using the POE method, specifically human behavior aspects. During this time, POE is more focused on building physical behavior that includes energy and thermal aspects. In this study, the author tries to raise aspects of human behavior as an essential element supporting the sustainability of the building. The survey conducted using eight variables: territoriality, privacy, interaction, perception, crowdedness, adaptability, durability, and comfortability. This research focuses on measuring only female student dormitories. One hundred eighty-two respondents were involved in the survey. The result shows that the majority of respondents feel quite satisfied with all the variable measure. This finding can be a reference to improve the design consideration for future student dormitory design.

1. Introduction

In order to improve the facility for students in the state universities, the minister of public works and housing (PUPR) grants student dormitory to the selected university each year. Institut Teknologi Sumatera (ITERA) Bandar Lampung, Indonesia has been granted 2 dormitory towers in 2017. Several studies have argued that this kind of public housing have lack of facility and features to support student daily activity due to its building design for all occupants. What is more, the campus regulates each room to be inhabited by three students, which raised pros and cons among stakeholders. The Female dormitory ITERA, which has four floors and each floor covers around 1152 square meters’ area, has been chosen as a case study.

This study investigates the satisfaction level of the occupants using post occupancy evaluation (POE) approach specifically based on occupant behavior. During this time, POE is more focused on building physical behavior that includes energy and thermal aspects. In this study, the authors George Evans try to raise aspects of human behavior as an essential element supporting the sustainability of the building.
The findings of this research furthermore can be a precedence and lesson learned to improve the student dormitory design for the future project.

2. Literature review

POE is a process that measures users' requirements and satisfaction levels to enhance the spatial satisfaction of the users [1]. By using occupants as a benchmark in evaluating, POE provides enormous potential for improving the performance of a building [2]. This approach learned about a systematic evaluation of opinions about the buildings used. This aims to find out whenever the building suits user needs, as well as the identified ways to improve the quality of the building design [3]. Behavioral performance elements create a link between occupants’ activities and the physical environment. Windley and Scheidt [4] said that there are 11 environmental attributes that reflect the interaction between humans and the environment, including sensory stimulation, comfort, activity, crowdedness, sociality, privacy, control, accessibility, adaptability, legibility, and meaning [4]. However, in this study, the authors develop environmental attributes based on guidelines from the concept of environmental behavior attribute theory [5], so that the behavior attributes used in this study refer to the behavioral aspects of building occupants using eight question variables, namely; territoriality, privacy [6], interaction, perception [7], crowdedness [8,9], adaptability [10], durability, comfortability.

3. Methods

Data to collect are the figure of each level of measured variables. The primary data collected from the questionnaire and the secondary data gained from observation to the site and from technical drawing. This research was conducted on 21-26 October 2019. By distributing 200 questionnaires. The primary data collected from the questionnaire spread out of 182 female dormitory occupants (students). Furthermore, data being analyzed using Likert scale and be concluded.

The first step was the actual observation of the buildings. The observation meant to have a direct experience regarding the real condition of the research object. The observation conducted with direct visitation to the building and through the technical construction drawing to see the zoning and the facility of the dormitory since the early design process. Furthermore, the information obtained from the observation becomes the reference to formulate the research variable related to occupant’s behavior.

4. Results and discussion

The variables from this research are territoriality, privacy, interaction, perception, crowdedness, adaptability, durability, and comfortability. The primary data collected from questionnaire targeting 200 respondents which is the students. However, the questionnaire only reaches 182 respondents (91%). The use of variables was intended to measure the level of satisfaction of the occupants regarding what they feel and think about the facility. The results of this project, whether the shortcomings or the strength points, furthermore, are expected to contribute to the improvement of the design process of dormitory as a recommendation.
| No | Variable | Result |
|----|----------|--------|
| 1  | Territoriality | From the aspect of territoriality, from the question of what they think and feel of “the limitation of the occupant’s territory inside the room shared with three people”, slightly more than half of respondent (52%) think that they don’t feel that the room intimidating with very limited area for each students and they feel they can share the space among them fairly. However, 41% of them agree that the space is small, and they feel the territory of each person are limited. |
| 2  | Privacy | From the aspect of Privacy, from the questions being asked, “Is your privacy compromised or disturbed?” 51% people strongly disagree and feel they are fine, 33% people said that they disagree and only 15% people said that they felt disturbed. From the question of “Have you ever feel disturbed by the people from the next room?” 60% respondents said that they have no experience of disturbed by the occupants next door. However, 13% respondents feel that they still have disturbance. In the second variable of the question about privacy, the researcher asked about “Are you often annoyed by your colleague next to your room?”. From the results of these questions, 60% of respondents answered strongly disagree. This shows that the need for privacy space for each occupant is well maintained and not disturbed by each other. |
| 3  | Interaction | From the aspect of interaction, “Are the gathering space provided in the building?” 83 % respondents state that they strongly agree with availability of gathering space. The second question is “Do you often socialize with your friends in the gathering room?” 48 % said that they usually spent time with friends in the gathering room. From the questionnaires distributed, the researcher asked additional questions, “what activities were often done together?” Most of the respondents answered that activities that are often carried out together include; study groups, social gatherings, and mutual cooperation (cleaning up). The duration that they usually do together in terms of interactions averages around 1-2 hours. This shows that interaction activities are important enough to socialize among residents. |
| No | Variable | Result |
|----|----------|--------|
| 4  | Perception | In the aspect of perceptions, when the respondents being asked about “Is the building has adequate facility?”, The majority of despondences 68% thinks that the building has lack of facility. Small number of respondents agrees that there is enough facility in that building. |
| 5  | Crowdedness | From the aspect of crowdedness, the respondents being asked about “Do you feel cramped inside the room?”, Most despondences said that they don’t feel cramped, which are 69%. “Is the room enough to be shared with three people?” 54% student said that they are agreeing with the question means that the room is still enough, even though shared with three people inside. |
| 6  | Adaptability | In this aspect, adaptability, the student being asked “Are you quick to adapt to the situation of the room and the building?”, The percentage shared 48% student said that the quick enough to adapt, especially for the room, and 45% they strongly agree that they adapt to it so quick. However, some factors affect the level of adaptability, such as a facility that broken and not properly working, the problem of different personality among occupants, the stationary, store and market that far away from the dormitory. |
| 7  | Durability | From the aspect of durability, the question being asked is “do you feel at home to stay inside the room?” And the most students (67%) feeling at home or feel that they are comfortable to stay inside the room. 2% people strongly disagree with this question. Then “How long you spent time inside the room?” The occupants spent time around ten until twelve hours every day, that do some activities such as take a rest, pray, and self-study. |

![Graph of Perception](image1)

![Graph of Crowdedness](image2)

![Graph of Adaptability](image3)

![Graph of Durability](image4)
Table 1. Cont.

| No | Variable     | Result |
|----|--------------|--------|
| 8  | Comfortability | In the aspect of comfortability, “do you think that the room in this building is comfortable?”, Most of the students think that they feel comfortable enough (67% agree) to stay at the dorm. 29% feel very agree that the building is comfortable. Only 3% students feel that the room is not comfortable. Although there were several complaints expressed by respondents, such as unsanitary water facilities, less spacious drying places, or some personality mismatches with roommates which caused inconvenience in the room. |

Here are an average table of the highest and lowest variable values obtained from the overall variable results discussed above.

Table 2. (a) Average of all variables; (b) Range of value.

| Variable | Statement | Frequency | Valid Percent | Average |
|----------|-----------|-----------|---------------|---------|
| Territoriality | Disagree | 89 | 51.7 | 51.7 |
| Privacy | Strongly Disagree | 89 | 50.6 | 55.15 |
| | Strongly Agree | 105 | 59.7 | |
| Interaction | Strongly Agree | 147 | 83.5 | 66.05 |
| | Strongly Disagree | 85 | 48.6 | |
| Perception | Disagree | 116 | 67.4 | 67.4 |
| Crowdedness | Disagree | 121 | 69.1 | |
| | Agree | 95 | 54.3 | 61.7 |
| Adaptability | Agree | 84 | 48.3 | 48.3 |
| Durability | Agree | 116 | 67.4 | 67.4 |
| Comfortability | Agree | 118 | 67.4 | 67.4 |

Perception, durability, and comfortability are the variables with highest percentage which occupied 67.4%. It means that the average occupants or the students feel satisfied with that mentioned aspect. They think that the building has enough facility, comfortable and feel like home when staying. The lowest level of satisfaction is resulted in the aspect of adaptability which occupied 48%. With the questions asked about the adaptation felt by residents both in terms of the personality characteristics of each occupant, facilities, and campus activities. This considered as normal phenomena considering the dormitory is a residence inhabited by various characteristics of the inhabitants of different ethnicity, race, and culture. The level of adaptation depends on the efforts of each student in terms of their interaction to get to know the environment in the dormitory.

5. Conclusion
From the analysis of the result, it can be concluded that:

- Perception, durability, and comfortability are the variables with highest percentage which occupied 67.4% It means that the average occupants or the students feel satisfied with that mentioned aspect. The lowest level of satisfaction is resulted in the aspect of adaptability which occupied 48%. It means the occupant feel dissatisfied with the aspect.
• The use of the POE is considered effective enough to test and measure the aspects of behavior of the building occupants. From the results, we can see some evaluations of the strengths and weaknesses of this dormitory. Especially the facilities that support the performance and productivity of students in the learning process on campus as a means of studying, resting and socializing.

• The authors hope that the results of this study can become a reference for the improvement of dormitory facilities and infrastructure in the future and can be used as a role model as a dormitory facility that implements high social relations among the residents.

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