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Gap theory based analysis of user expectation and satisfaction: The case of a hostel building

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Abstract:

The need of satisfying the expectation of building users has been well-recognized. Few studies, however, have scrutinized the expectation and satisfaction of building users in detail. To contribute knowledge to this underexplored area, a study, based on the gap theory and an indicative post-occupancy evaluation approach, was conducted on a large hostel building. Through a walk-through visit and a focus group meeting, six main performance aspects of the hostel's facilities were identified, namely visual comfort, thermal comfort, aural comfort, fire safety, hygiene, and communication via information technology. By interviewing 204 users, their expectations of, and satisfactions with each performance aspect were solicited. While indicating their highest expectation of the performance of the thermal aspect, the users were most satisfied with the visual aspect. Analyzing the rank orders of the expectation and satisfaction levels revealed the existence of strong to perfect positive correlations between the female and male subgroups of users and between user subgroups of different room types. Common to all the performance aspects, the gaps between the levels of expectation and satisfaction diminished with the residence periods of the users. Using regression analyses, performance gap models representing the relations between proportion of users and performance gaps of the main aspects of facilities were developed. The approach of this study may be adopted in similar research on other hostel buildings or where examination of the expectation and satisfaction of building users is needed.

Keywords: expectation, facilities performance, gap analysis, post occupancy evaluation, student hostel, user satisfaction

1. Introduction

Building users are increasingly demanding. Satisfying their needs and expectations, which hinges on the performance of their buildings, has continued to be a challenge to many building managers and operators. To inform how well a building has performed to the satisfaction of its users, a rigorous assessment of the building's performance, referred to as post-occupancy evaluation (POE), is required [1,2]. As reviewed before [3], different POE models have been developed, e.g. System of Building and People model [4], Performance-Based model [1], Merri model [5], and Life-cycle Facility Evaluation Continuum model [3]. Depending on its purpose and available resources, a POE study may take an indicative, investigative or diagnostic approach [6] and different data collection and analysis techniques may be used depending on the nature and focus of the study [7].

The indoor environments of buildings are affected by various environmental factors and their interactions [8]. Over the years, a large volume of studies has been carried out to study the influence of indoor environmental conditions on human comfort in buildings [9]. Whereas the office and home environments were common targets of investigation in such studies, research focussing on the indoor conditions of dormitory (e.g. [10]) has started to grow. In fact, hostel buildings are characterised by their specific type of users, who primarily are boarders staying there for both lodging and studying purposes. Since the living comfort and studying effectiveness of the boarders are largely dependent on the functioning of built facilities such as lighting, ventilation and noise control measures, it is essential to regularly assess their performance by POE studies to identify any improvement needed.

In parallel to the global growth of higher education, many universities have their campuses expanded and, in order to cope with the increase in students, more and more student hostels

have been developed. The number of hostel places for the government-funded universities in Hong Kong, for instance, needs to be increased from 30,500 in year 2007/08 to 39,100 in year 2012/13 [11]. Whereas searching from the open literature could not find any systematic POE studies on student hostels in Hong Kong, this kind of studies have been carried out in other places. For example, an investigation was made into the major technical and functional performance elements of facilities (thermal comfort, acoustical comfort, visual comfort, indoor air quality, fire safety, etc.) in a student housing in Saudi Arabia [12]. In Nigeria, the major technical and functional criteria of a postgraduate hostel were studied [13]. Common to these studies, the analyses were focused on the users' satisfactions with the performance of the hostel facilities.

In theory, the quality of a substance (e.g. service) involves a comparison of its expected performance and actual performance [14,15]. A notable development of this concept was the gap theory [16], based on which the SERVQUAL model [17] was devised to enable assessment of customers' expectation and perception of service quality. An extended development was made to introduce the SERVPERF model [18], which incorporates a performance-based measure of service quality. Originated from marketing research, such models have been adopted to study a wide range of quality issues in the built environment context, e.g. those about building maintenance providers [19] and perception of facilities management service delivery [20].

Given the rising importance of satisfying user expectations, perception studies have continued to expand, covering evaluation of the subjective sensation of building users. Examples in recent years include: a study in which the user perceptions of four major indoor environmental quality attributes (thermal comfort, air cleanliness, odour, noise) in residential

buildings were investigated [21]; and another which covered assessment of the occupants' thermal, visual and acoustics sensations in student hostels [22].

While there have been studies on user expectations and satisfactions in various sectors such as banking [23], education [24], and tourism [25], few have grounded on the gap theory to investigate both the expectation and satisfaction of hostel users. Detailed analysis of the users' perceived performance of hostel facilities is even rare. In order to explore how the gap theory may be applied to reveal the performance of built facilities, an indicative POE study, with the SERVQUAL model adapted for use in measuring the expectation and satisfaction levels of the users of a university student hostel, was conducted. Effects of potential factors that may influence the expectation and satisfaction of the users, particularly their gender, type of boarding room and residence period in the hostel, were examined.

In the next section, the characteristics of the hostel, the process of identifying its main aspects of facilities performance and the design of a questionnaire used for interviewing the hostel users are described. Then a series of analyses, including those made on the demographic data of the users, the levels of their expectation of, and satisfaction with the hostel facilities, and the relations between proportions of users and performance gaps of the various aspects of facilities, are reported. At the end, the conclusions drawn from the findings and the suggested future work are given.

2. Method and Data Collection

2.1 The hostel and its main performance aspects

At the time of the study, the hostel had been occupied for 9 years, housing over 3,000 boarders who were students of a university in Hong Kong. The hostel building was 22-storey high, with most of its area (3-20/F) designated as student accommodations. The usages of the other floors include: warden suites and staff quarters (21-22/F); function rooms (2/F); dining hall (1/F); and reception and lobbies (G/F). Figure 1 shows a typical floor plan (3/F). The three types of boarding rooms, with their typical layouts and interior settings as shown in Figure 2, were: A (double room in a conventional 4-person-suite), B (double room in a 5-person-suite), and C (triple room in a 5-person-suite). The room rates for the whole lodging period in an academic year were: $10,960 (type A), $10,412 (type B), and $7,672 (type C).

To obtain an overview of the facilities in the hostel, the study team walked through the main, typical areas. Built on the experience of a previous study in which a focus group was organized to identify the main aspects of facility management services for housing estates [26], a focus group meeting was convened, during which five voluntary users of the hostel were encouraged to exchange their views and discuss what facilities they considered as influential to their living and activities in the hostel. In order to obtain valid results from the meeting, the study team had taken systematic steps for ensuring the quality of focus group research [27], including moderating the discussions among the participants; seeking clarification on areas of ambiguity; and summarizing the discussion outcomes. At the conclusion of the meeting, the participants were asked to verify the summary. Thus, the main performance aspects of the facilities were identified: visual comfort, thermal comfort, aural comfort, fire safety, hygiene, and communication via information technology. For each aspect, the corresponding facilities can be broadly divided into two systems, each of which comprises various components.

As summarised in Table 1 where an example of system component for each kind of facilities is also given, visual performance depends on both natural and artificial lighting systems. Natural ventilation and mechanical ventilation/air-conditioning systems affect thermal performance. Aural performance is reliant on noise control by exterior devices (e.g. acoustic barriers outside the building) and interior installations (e.g. acoustic insulation for air-conditioners). For ensuring fire safety performance, the essential protection systems belong to two types - 'active' and 'passive'. Flush water supply and drainage discharge facilities, which are indispensable provisions for the boarders, are crucial to the hygiene condition. Efficient communication, which could not be made possible without proper electronic hardware (e.g. fixed network cables installed in the hostel) and user interface (e.g. personal computers of the boarders), is also a critical performance aspect.

2.2 Face-to-face interview survey

As an initial, effective step to reveal the performance of the main categories of facilities in the hostel, an indicative POE study was carried out. For this purpose, a questionnaire survey was designed and, in order to collect trustworthy data, the survey was conducted by way of face-to-face interviews.

The questions at the beginning of the questionnaire enquired into the personal and boarding information of the respondents, including their gender, nationality, room number (based on which the room type can be identified during data analysis), length of residence, typical period residing in the hostel, and typical fraction of time they stayed in their room. Under the subsequent part of the questionnaire, the respondents were asked to indicate, based on a 7-point scale similar to that of the SERVQUAL model, their expectation and satisfaction levels

(1: extremely low; 2: very low; 3: slightly low; 4: fair; 5: slightly high; 6: very high; 7: extremely high) of the six performance aspects of their rooms.

At the main entrance of the hostel, the research team approached the users and invited them to participate in the survey. To safeguard independency of their responses, the participants were interviewed individually. For the questions on the performance aspects, the research team explained the meaning of each question, gave examples of the facilities and system components (see Table 1), and ensured the interviewees were clear about the questions before asking for their answers. Each interview took 10 to 15 minutes to complete.

2.3 Analyzing the gaps between expectation and satisfaction

The difference between the ratings of satisfaction and expectation given by a user for a performance aspect, which is given by Equation (1), represents the performance gap the user perceived about that aspect.

$$G_{i,a} = S_{i,a} - E_{i,a} \tag{1}$$

$$\overline{G}_{a,g} = \frac{\sum_{i=1}^{n_g}(S_{i,a} - E_{i,a})}{n_g} \tag{2}$$

$$P_i = M_i \times W_m \times D_i \times H_i \times R_i \tag{3}$$

$$RI_i = \frac{P_i}{P_{max}} \tag{4}$$

$$G_{a,L} = 6RI - 6 \tag{5}$$

$$G_{a,U} = -6RI + 6 \tag{6}$$

$$CP_a = \beta_1 G_a + \beta_0 + \varepsilon \tag{7}$$

$$CP_a = \beta_2 G_a^{\ 2} + \beta_1 G_a + \beta_0 + \varepsilon \quad (8)$$

$$CP_a = \beta_3 G_a^{\ 3} + \beta_2 G_a^{\ 2} + \beta_1 G + \beta_0 + \varepsilon \quad (9)$$

Where

a = 1, 2, 3, 4, 5, or 6 assigned to the a^{th} aspect

CP_a = cummulative proportion of samples of the a^{th} aspect

D_i = number of days per week of the i^{th} user living in the hostel

$E_{i,a}$ = expectation rating (1, 2, …, or 7) given by the i^{th} user for the a^{th} aspect

G_a = performance gap of the a^{th} aspect

$G_{a,B}$ = performance gap of the a^{th} aspect ($B = L$: lower bound; U: upper bound)

$\overline{G}_{a,g}$ = mean performance gap of the a^{th} aspect associated with group g

$G_{i,a}$ = performance gap pertaining to the i^{th} user for the a^{th} aspect

H_i = number of hours per day of the i^{th} user staying in the hostel

M_i = number of months of the i^{th} user staying in the hostel

n_g = number of samples of group g (g = A, B and C for room types A, B and C respectively; F: female; M: male)

P_i = residence period of the i^{th} user

P_{max}= maximum residence period

R_i = fraction of time of the i^{th} user staying in his/her room during a typical day

RI_i = residence index of the i^{th} user

$S_{i,a}$ = satisfaction rating (1, 2, …, or 7) given by the i^{th} user for the a^{th} aspect

W_m = number of weeks per month (average = 4.33)

Using Equation (2), the mean performance gap of each aspect was determined. Based on the theory of adaptation [28], the longer the period an occupant stays in an environment, the more likely the occupant would get accustomed to the conditions of the environment. On this basis, the effect of the users' residence period on the gap between their satisfaction with and expectation of the facilities was investigated. Using Equation (3), the residence period of each interviewee was calculated. A residence index, defined as the ratio of an individual's residence period to the maximum residence period (Equation (4)), was calculated for each user.

With a longer residence period, i.e. a higher residence index, the perceived performance gaps of the users would diminish. Figure 3 illustrates this concept between performance gap and adaptation, where the upper and lower boundary lines, connecting the maximum residence index and the maximum values of the positive and negative performance gaps, can be represented by Equations (5) and (6).

The calculated performance gap values were plotted against the users' residence indices, which enabled revelation of the relation between the perceived performance gaps of the users and their adaptation over time. Then, regression analysis was carried out in an attempt to model the relation between the proportion of users and the performance gaps the users perceived. This was done by trials using the linear, quadratic and cubic forms of regression equations, i.e. Equations (7), (8) and (9) respectively, where β_3, β_2 and β_1 are the coefficients of the variable G_a, β_0 is the intercept of the regression equation and ε is a random variable.

3. Analysis and Discussion

3.1 Demography of samples

Totally 612 users of the hostel were approached, among them 204 agreed to participate in the interview survey (i.e. a response rate of 33.3%). Of the interviewees, 101 (50.5%) were female and the rest (49.5%) were male. The vast majority (94.6%) were local students; only seven were non-locals. Except 11 interviewees who were visitors of the hostel, the rest were regular boarders and their lengths of residence, varying between one to 12 months, were dominated by those who had stayed there for five months (Figure 4). On average, the boarders resided in the hostel for 5.6 days a week and the mean fraction of time they stayed in their room was 86.7%. The proportions of the interviewees, when classified by room types, were: 47.5% (type A), 31.4% (type B) and 21.1% (type C).

3.2 Expectation and satisfaction of the users

The responses given by the interviewees based on their expectation of each performance aspect were processed, and the distributions of the results are displayed in Figure 5. Apparently the distribution patterns are similar but a closer inspection noted that the peak proportions of response of the aural, hygiene and fire aspects were associated with the fair level, while the counterparts of the thermal, visual and communication aspects appeared at a slightly higher level, with the greatest proportion (35.8%) belonging to the thermal aspect. Common to all the rated aspects, very few respondents (< 5%) indicated an extremely low expectation level.

Similar analyses were carried out for the responses about satisfaction. As the results in Figure 6 show, the distribution patterns of the peak proportions of satisfaction ratings were rather different from those of the expectation ratings. In particular, the peak of the visual aspect was near to the high end of the rating scale. 37.3% of the respondents expressed very high satisfaction with the visual performance; none perceived an extremely low satisfaction level. The most extreme responses were found with the communication aspect as its proportion of extremely dissatisfied respondents was the greatest (11.3%) among the six aspects while its proportion of extremely satisfied respondents was the smallest (1.5%).

The perceived expectation and satisfaction levels were further taken to find out the minimum, maximum and mean values, as summarized in Table 2. Among the aspects, thermal was given the highest mean level of expectation, showing that the users desired this aspect to outperform the remaining ones. The aspect with a lower level of expectation was communication, followed by visual, aural, hygiene, and fire.

The visual aspect, with its mean expectation level between fair and slightly high, was most satisfied by the users. While fire safety was given the lowest level of expectation, its level of satisfaction, which was only second to that of the visual aspect, was rather high. This observation is similar to the finding in an earlier study on some commercial buildings [29] where fire safety was among the aspects which recorded the lowest rate of user dissatisfaction.

The hygiene aspect, with a satisfaction level of 3.86, ranked third. Apart from this aspect which was perceived by the users as lower than the fair level of satisfaction, the remaining aspects falling within this category, in descending order of satisfaction levels, were: thermal, aural, and communication. The comparatively low satisfaction levels of the thermal and aural

aspects echo with the low performance ratings of the same aspects found from a previous research work on some high-rise residential buildings [21].

3.2.1 Effect of gender

The mean expectation levels of the various aspects, grouped by gender of the respondents, were computed. Likewise, the counterparts of the satisfaction levels were calculated. Based on such expectation and satisfaction levels (Table 3), the corresponding rank orders were determined, which show that the thermal aspect recorded the highest order of expectation from both the female and male subgroups. While the male ranked the hygiene aspect the lowest, the female expected its performance to be higher than that of the aural and fire aspects.

Referring to the results about satisfaction, the rank orders of the rated aspects were identical between the female and male subgroups, indicating that there was a perfect positive correlation between them. Yet, the rank orders of expectation of the two subgroups were not entirely the same. To examine the level of correlation between this pair of rankings, the Kendall's tau (τ) was calculated [30]. Ranging between -1 (perfect disagreement) and +1 (perfect agreement), τ is zero if the two rankings are independent. The calculated Kendall's tau was +0.733, significant at the 0.05 level (2-tailed). This reflects the existence of a strong though imperfect positive correlation.

Figure 7 displays a scatter plot of the mean expectation and satisfaction levels of the two subgroups. Clearly the visual aspect pertaining to both subgroups, which was given the highest satisfaction level, outperformed the remaining aspects. Apart from this aspect, the fire

aspect with its satisfaction levels lying above the iso-rating diagonal also exhibited a higher-than-expected performance. While the hygiene aspect rated by the male also belonged to this performance category, its performance was unable to satisfy the expectation of the female. This is not unexpected because female users, when compared to male users, are typically more concerned about cleanliness and thus the hygiene condition of their living environment.

The other aspects with both their ratings given by two subgroups falling onto the region below the iso-rating line were: aural, thermal and communication. Compartively, the users indicated their highest expectation of thermal performance. This is supported by the fact that themal-comfort problems are commonly found in buildings [31]. As to the expectation and satisfaction ratings of the communication aspect, they were both lower than the counterparts of the thermal aspect. Referring to the disparity between the data points, the largest difference in perceived performance between the female and the male was associated with the communication aspect.

3.2.2 Effect of room type

In order to investigate if room type affects the users' perception of the facilities' performance, the mean expectation and satisfaction levels of the users of each room type were calculated for each aspect. Based on the results, the rank orders of the ratings within the same subgroup and those across different subgroups were determined (Tables 4 and 5).

A common finding of the three room types was that the users indicated their highest expectation of the thermal performance while the lowest expectation was associated with the fire aspect. On the other side, all the three types of users were most satisfied with the visual

performance, and the communication aspect was perceived by the users of room types A and B as the most dissatisfied.

To quantify the level of agreement of expectation and satisfaction rank orders among the room types, the Kendall's coefficient of concordance (W), which is a non-parametric statistic and makes no assumptions regarding the nature of the probability distribution of the studied values, was computed [30]. Kendall's W ranges from 0 (no agreement) to 1 (complete agreement). It was found that a significantly high level of agreement ($W = 0.975$) existed in the rank orders among the three subgroups of expectation levels and exactly the same level of agreement was found with the three subgroups of satisfaction levels in Table 5. To examine in more detail the rank correlations between pairs of the room types, the Kendall's tau (τ) was calculated. The calculation results show that a perfect correlation ($\tau = +1.000$) existed between the expectation rank orders of room types B and C and the same observation was noted between the satisfaction rank orders of room types A and B (Table 6). The rest of the results ($\tau = +0.867$) show that a significant, highly positive correlation existed between the remaining pairs of rank orders.

In principle, the higher the lodging fee a boarder has to pay, the higher the perforamance level the boarder would expect of the facilities. From another viewpoint, it should be more difficult to satisfy a boarder who pays a higher lodging fee than to satisfy one who pays less. Along these logics and given that the lodging fees (F) for room types A, B and C were in decending order ($F_A > F_B > F_C$), it is rational to predict that the expectation levels would also be in descending order ($E_A > E_B > E_C$) while the order of satisfaction levels would reverse ($S_A < S_B < S_C$). From the results in Table 4, a descending order of expectation levels was found with the visual, fire and hygiene aspects. With reference to the satisfaction rank orders (Table

5), however, none of the aspects fully complied with the prediction. Although it is beyond the scope of this study to identify the causes for such findings, it deems necessary to carry out further work in future to investigate what factors other than lodging fee are dominant in affecting the expectation and satisfaction levels.

The mean expectation and satisfaction levels grouped by room type were further scrutinized by referring to the scatter plot in Figure 8. Similar to the observations from Figure 7, the performances of the visual and fire aspects were superior to the others, with their satisfaction levels exceeding the levels the users expected. Almost an exact match between the levels of expectation and satisfaction was found with the responses given by the users of room types B and C on the hygiene aspect. Those staying in room type A, however, considered the performance of this aspect slightly lower than expected.

Observations obtained from the remaining data points, corresponding to the aural, thermal and communication aspects, were in line with those noted earlier (Figure 7). Their performances failed to meet the levels the users expected. In particular, those staying in room type C were most dissatisfied with the aural aspect. The fact that there were fewer users in room types A and B should be a reason for their quieter living environment, which resulted in their higher satisfaction with the aural performance. As to the communication aspect, the users of room type C considered its performance level far below their expected level. The user density of this room type was the highest. Whether this was the reason leading to, e.g. electronic communication jam and hence the lowest satisfaction level, needs to be found out in future.

3.3 Gap analysis

Analyzing solely the expectation levels or satisfaction levels of the various aspects could not inform to what extent their actual performance were able to meet with the users' expectations. Figure 9, consolidating the distributions of responses against the performance gaps ($-6 \le G_{i,a} \le +6$) calculated by Equation (1), shows that the peak proportions were all between 20% and 25%. Both the peaks of the thermal and communication aspects occurred at gap '-2' and that of the aural aspect was found with gap '-1'. On the other side, the gap value where the peak proportions of both the fire and visual aspects appeared was +1. The peak of the hygiene aspect was associated with the zero gap point, meaning that the largest proportion of interviewees considered the hygiene condition meet exactly the level they expected.

The mean performance gap of each aspect, computed by Equation (2), was: visual (+0.66), thermal (-1.43), fire (+1.01), aural (-0.87), communication (-1.61), hygiene (-0.09). These results reflect that the visual and fire aspects, both with a positive gap value, were able to satisfy the users' expectation. Nevertheless, the gap values of the remaining four aspects were all negative, indicating that their performance levels failed to meet the levels the users expected.

3.3.1 Effect of residence period

Since there were 11 visitors who were not regular residents of the hostel and the responses of 10 interviewees were without sufficient data for calculating their residence indices, the remaining 183 samples were taken to analyze the effect of residence period on performance gap. Based on these samples, the performance gap values of each aspect were calculated by Equation (1). The residence index of each interviewee was obtained by Equation (4). Given

that the longest residence among the interviewed boarders was 12 months, the maximum residence period (P_{max}) was 8,760 hours.

According to the adaptation theory and as shown in an earlier study on the perceived importance of indoor environmental quality [32], the factor of adaptation would affect the responses of occupants. For those who have stayed in the hostel for a long period, they would have adapted to the performance of the facilities there. While for the new boarders, they would express greater dissatisfactions with the aspects performing at a level lower than that they expected. The model in Figure 3 depicts this proposition and, in order to test its validity, the calculated performance gap values were plotted against the residence indices of individual users, as shown in Figure 10. Same to all the rated aspects, the pattern of the performance gap points converged with increase in the residence index, with most of the data points lying between the lower and upper bounds. For each aspect, the proportion of data points in the bounded region was computed. Similarly, the proportions of those with a zero gap, positive gap and negative gap were obtained, as summarised in Table 7.

The highest proportion (99.5%) of bounded data points was associated with the hygiene aspect. Unlike the other four aspects whose proportions of zero-gap points were comparable, communication and hygiene were the two aspects bearing the lowest and highest proportions, respectively. The proportions of positive-gap points, i.e. those with a satisfaction level exceeding the expectation level, varied widely across the six aspects. Particularly, the highest proportion belonged to the fire aspect while the thermal aspect recorded the lowest proportion of this type of gap points. Although the latter aspect, in reverse, attracted a signficantly large proportion of users who indicated that its performance level was below the level they

expected, the largest proportion of negative-gap points was found with the communication aspect.

3.3.2 Performance gap models

Further examinations were made on the gap points in order to identify changes in cummulative proportion of samples against performance gap. Such variations are depicted by the fitted curves in Figure 11, where the performance gaps refer to the absolute values of differences between the users' satisfaction and expectation ratings. The distribution patterns of the six aspects are similar. The proportions of samples pertaining to the communication aspect, singled out from the rest, were the highest over the entire range of performance gaps. On the other hand, the smallest proportions at the low range of gaps were found with the hygiene aspect while those at the high range were associated with the visual aspect.

The distribution curves show that the proportion of users decreased more rapidly in the middle gap range than at the two ends of the range of gaps. This indicates that there were more users who perceived moderate perforamnce gaps of the rated aspects than those whose perceived perforamance gaps were small or large. A closer inspection on the curves found that for all except the communication aspect, there were negligible proportions of users perceiving a large performance gap (> 5).

Regression analyses were conducted in order to model the relation between the proportion of users and the performance gaps they perceived about the various aspects of facilities. This was done by trying three different forms of regression equations, i.e. Equations (7), (8) and

(9). Table 8 shows a summary of the regression statistics, including the values of coefficient of determination (R^2), F test and significance.

The large values of R^2 (≥ 0.884) across the board indicate that the estimated regression equations explain most of the variability in the cumulative proportions of the six aspects. With a level of significance $\alpha = 0.01$, the significance F values show that a significant relation existed in all the equations. Further inspections found that the R^2 values of the cubic models, ranging from 0.989 (visual) to 0.997 (thermal), were the highest as compared with the counterparts of the quadratic or linear models. This implies that the cubic models, with their equations as listed in Table 8, can better represent the relation between the proportions of users and the performance gaps they perceived.

The established models can serve three purposes. First, when it is necessary to estimate the proportions of users perceiving a certain performance gap level of a particular aspect of facilities, it can be done by inputting the target gap value into the respective model equation. Second, the proportions of users pertaining to the various aspects, which can be determined as mentioned in the first function, can be compared to inform the relative performance between the aspects. Third, the same kind of POE study can be performed in future to establish similar regression models, which in turn can be used to estimate the proportions of users at different levels of performance gaps. The results so obtained can be evaluated against those in the past, enabling performance benchmarking of the hostel facilities.

4. Conclusions

The POE study was formulated based on the gap theory, with the SERVQUAL model adapted for use in measuring the perceptions of the users of a large student hostel. Through a walk-through visit and a focus group meeting, it was found that the main performance aspects of the hostel facilities belonged to six categories, namely visual comfort, thermal comfort, aural comfort, fire safety, hygiene, and communication. The expected performance and perceived satisfaction of the aspects, which were solicited by an interview survey of the users, were analyzed in detail.

The expectation and satisfaction levels the users perceived about the various performance aspects were identified. The users, while expecting the performance of the thermal aspect to be the highest, were most satisfied with the visual aspect. It has been demonstrated how to reveal the effects of gender and room type on the users' expectation and satisfaction. Although lodging fee, from an economic perspective, should affect the levels of expectation and satisfaction of the users, the findings proved that this was only true for their expectation of the visual, fire and hygiene aspects. Further work is needed to investigate what other factors prevail over that economic factor in influencing the users' perceptions.

The effect of residence period on the boarders' perceptions was illustrated by a series of gap analyses, which clearly showed that in line with the theory of adaptation, the perceived performance gaps of the rated aspects diminished with the residence period. The regression analyses carried out based on cumulative proportion of respondents and performance gap have identified suitable equation models for representing their relations. Besides enabling comparisons to be made between the performances of the various aspects, these models can be used as benchmarks to gauge the ongoing performance of the respective aspects.

All in all, the foregoing findings cover the key performance aspects that the users regarded as influential to the quality of their residence in the hostel. To probe into the causes for the varied performances of the facilities, an in-depth POE study is needed to investigate any operational problems with the facilities and diagnose the causes of the problems. The approach of the above research work may be adopted in future studies on other hostel buildings or where it is necessary to examine the expectation and satisfaction of building users.

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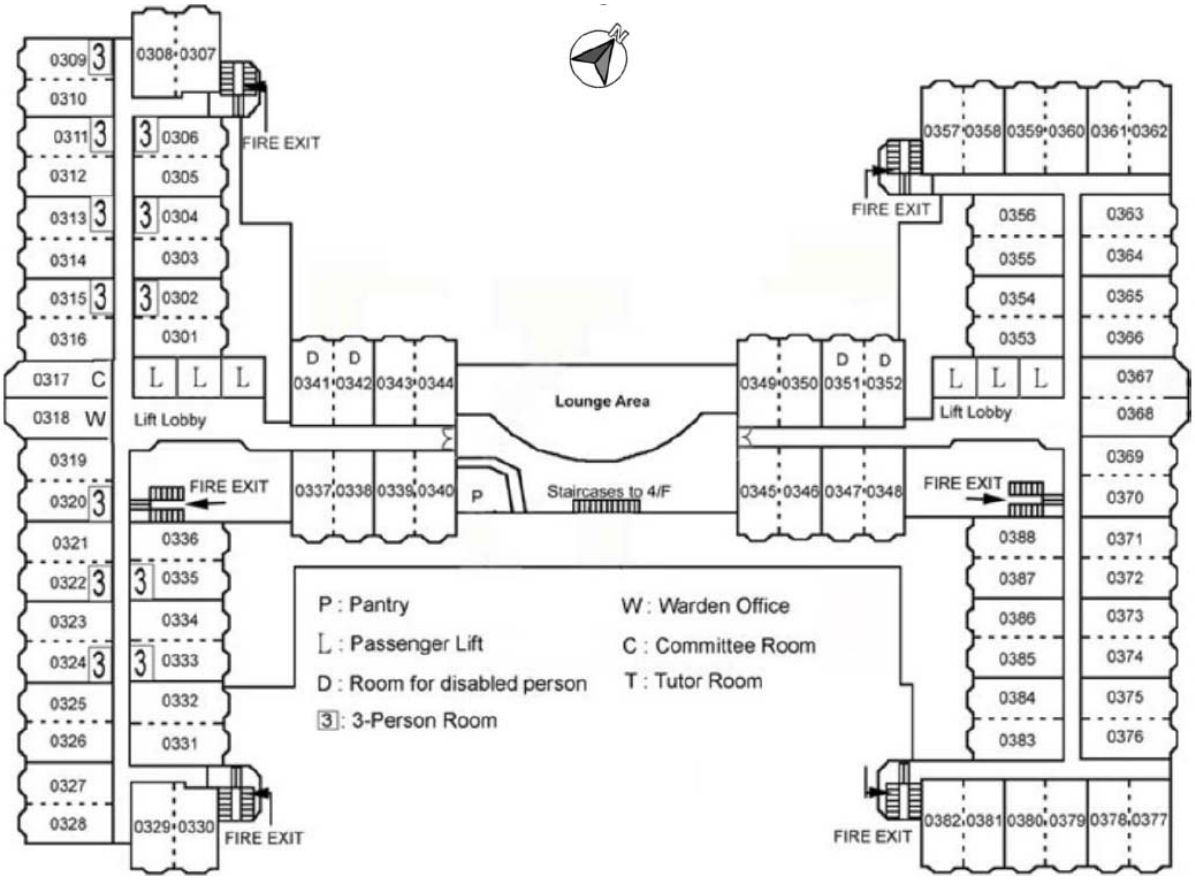
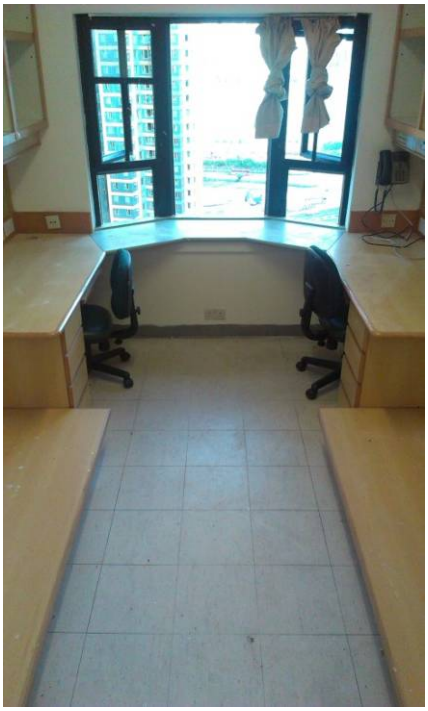
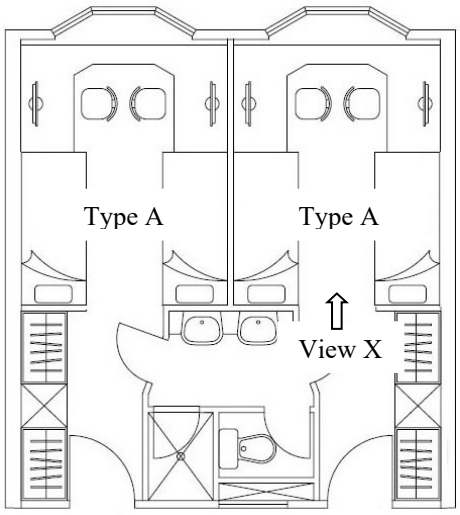


Figure 1 Typical floor plan (3/F) of the hostel

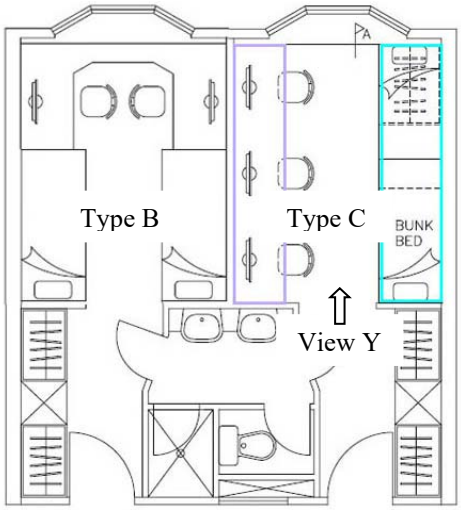


(View X)

(View Y)



(i)



(ii)

Figure 2 Room layouts and photos: (i) Type A; (ii) Types B and C

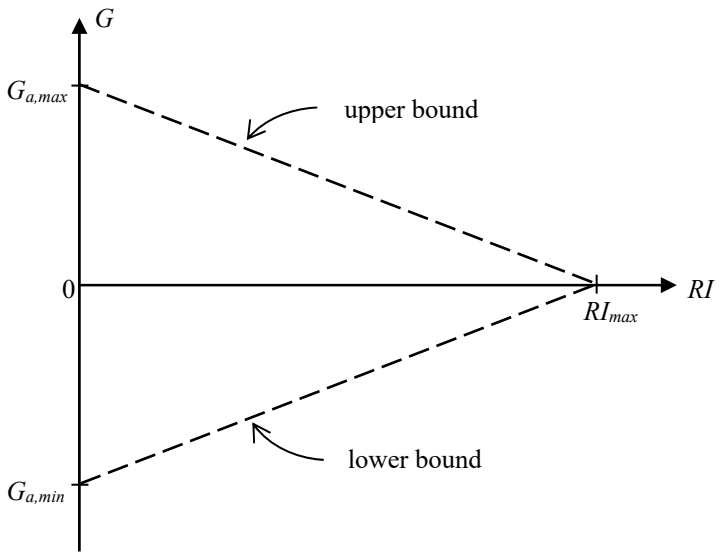


Figure 3 Conceptual model of performance gap and adaptation

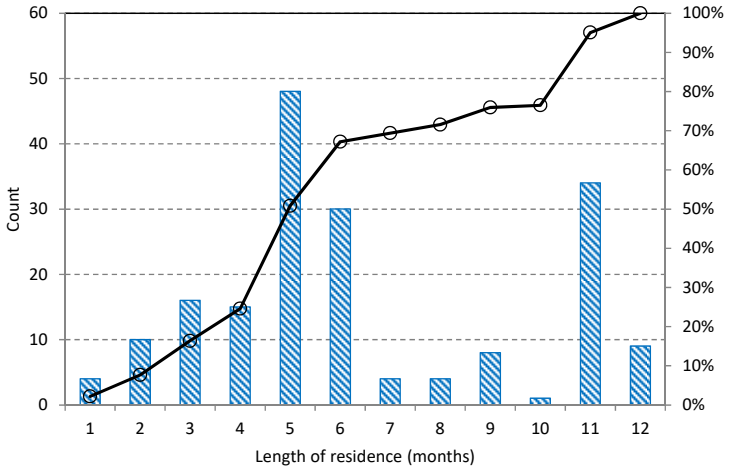


Figure 4 Distribution of length of residence

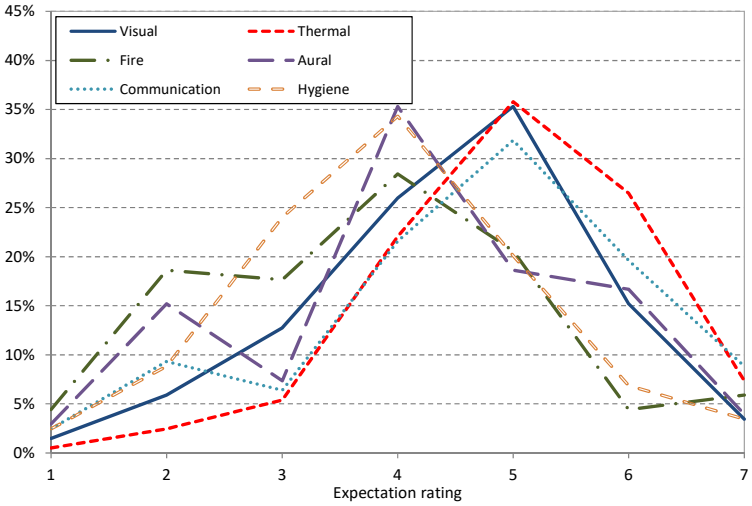


Figure 5 Distributions of expectation ratings

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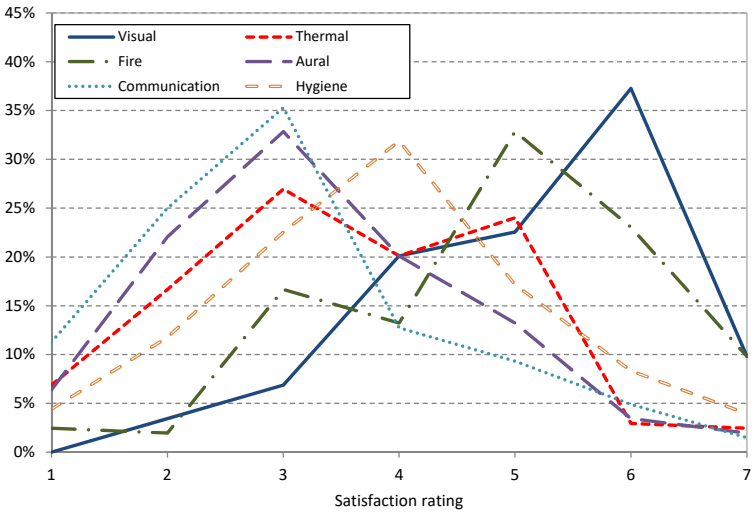

Figure 6 Distributions of satisfaction ratings

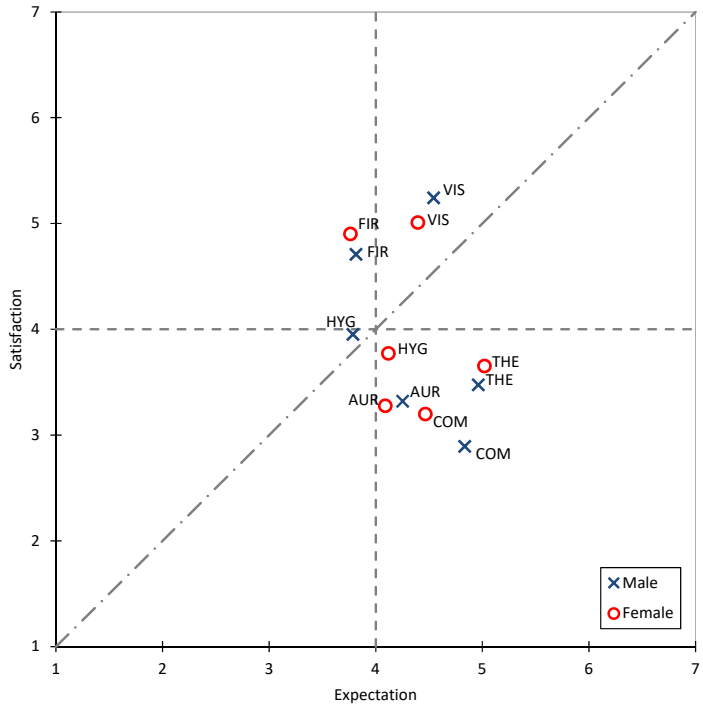

Figure 7 Expectation-satisfaction plot for the female and male subgroups

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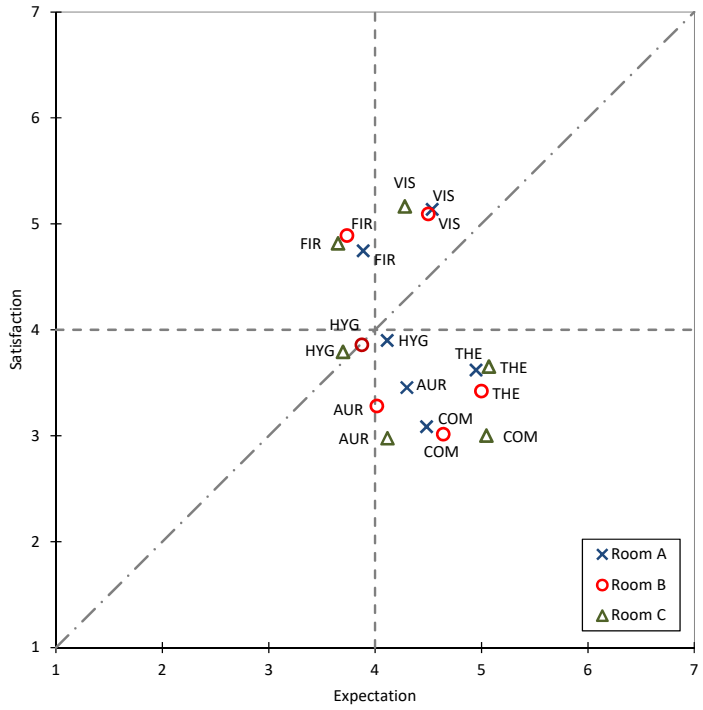

Figure 8 Expectation-satisfaction plot for different room types

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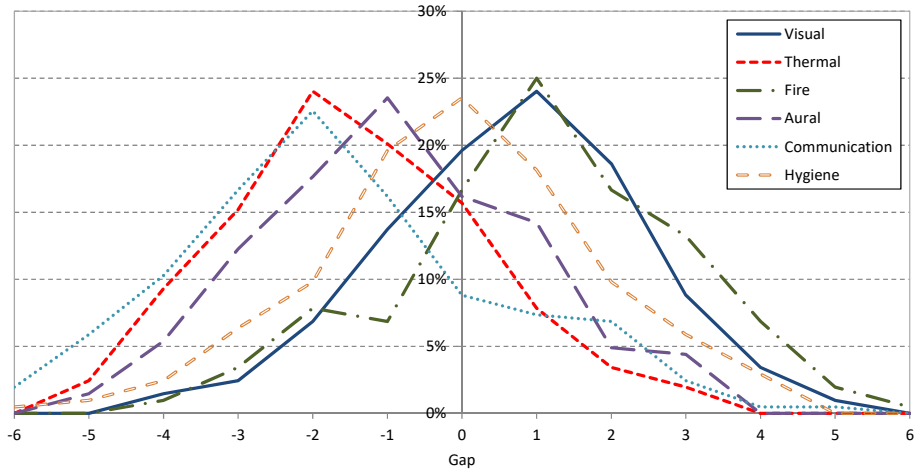

Figure 9 Distributions of performance gaps

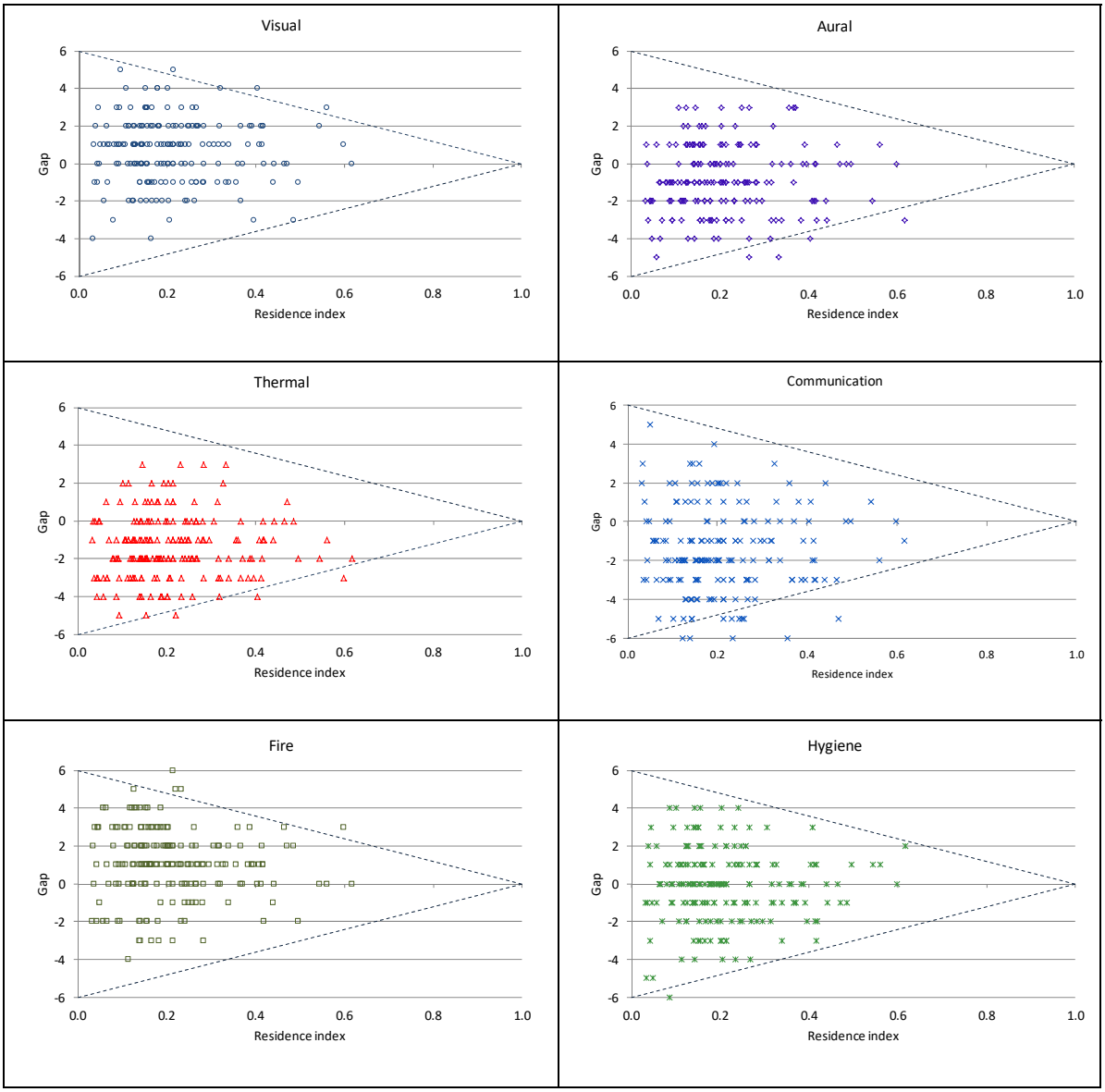

Figure 10 Relations between performance gap and residence index

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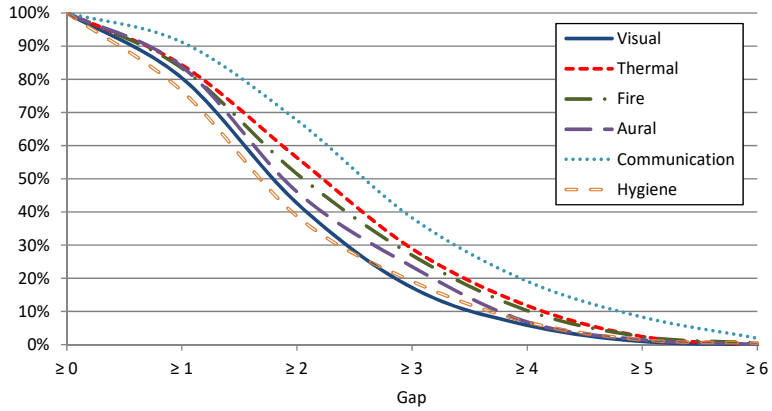

Figure 11 Proportions of users against performance gaps