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Post Occupancy Evaluation of the Ahanta Hall of Takoradi Polytechnic, Ghana

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ABSTRACT

Background: Most public tertiary institutions in Ghana are faced with the challenge of providing suitable on-campus accommodation for their large number of students. This paper is a Post Occupancy Evaluation (POE) of the students' residential environment in Takoradi Polytechnic. The objectives of this study were to investigate the physical conditions of the infrastructure and facilities provided in the hall as well as to determine the level of the occupants' satisfaction with the hall of residence.

Methods: The population of the study was the 130 students resident in the Ahanta hall of the main campus of the polytechnic where refurbishment works have been carried out in recent years. Based on the Krejcie and Morgan table for sample size determination, 98 respondents were randomly selected to fill questionnaires. On-site observation and measurement of spaces were also used to collect data.

Results: Findings showed that the hall did not have the following facilities: study rooms, kitchen, laundry and car park. Of those facilities provided, twice the number of the residents (40.48 %) rated their sleeping areas below average as compared to those who ranked them above average conditions (20.23 %). The overall mean score for user-satisfaction was 2.48 which indicate that residents are 'dissatisfied' with the hall.

Conclusions: Some recommendations include the provision of access for persons with disabilities and provision of washrooms and kitchens for the residents on each floor.

Key words: Post Occupancy Evaluation, Hall of Residence, Facilities, User-satisfaction.

INTRODUCTION

In recent times, the trend in vogue in Ghana is for one to acquire some form of tertiary education in order to secure a well-paid white collar job. Due to this, more people are enrolling in Colleges of Education, Polytechnics and Universities, among others, all over the country. With this increase in student population arise the associated problem of providing decent on-campus student accommodation for tertiary institutions. Takoradi Polytechnic, one of Ghana's ten regional polytechnics, is no exception. The institution, initially established in the 1950's to train technicians and crafts people, was elevated to tertiary status by the Polytechnics Act of 1992 (National Council for Tertiary Education (NCTE), 2014). A current problem the school authorities face is that the demand for on-campus accommodation seriously outstrips the supply. That is to say there is limited space available in the existing halls of residence on its campus.

There are three single-sex halls of residence being used by students on the main campus of the Polytechnic. They are Ahanta hall (male), Nzemah Mensah hall (male) and Ghacem hall (female). The structures housing these halls were converted from dormitory blocks and were not purpose-designed and built as halls of residence in a tertiary institution. The Ahanta hall had twelve rooms with two window walls and a veranda running in front with stairwells to the extreme ends. In 2010, the hall underwent renovation works where each room was partitioned into smaller cubicles and students have been using them since. Understandably, it is of importance that refurbishment works are carried out on halls of residence in universities in order to address the problems of old and outmoded buildings vis-à-vis the increasing student population with their current needs (Collins, 2010).

According to Akinluyi (2013), the practice of evaluating buildings in use provides a mechanism for understanding the mutual interaction between buildings and users' expectations as well as the opportunity of proposing ways to improve the environment necessary to accommodate these expectations. Consequently, it became necessary to carry out a Post Occupancy Evaluation (POE) four years after the refurbishment at Ahanta hall.

POE can be defined as any systematic and comprehensive process geared towards determining and improving a building's performance in relation to users' satisfaction and the built environment after it has been occupied and in use (Oladiran, 2013; Ilesanmi, 2010; Meir *et al*., 2009; Khalil and Nawawi, 2008; Preiser and Vischer, 2005; Preiser *et al*., 1988). Carrying out POE leads to a significant accummulation of knowledge based

on user feedback through short term management of existing buildings; medium term improvement of newer designs and long term establishment of databases for better building maintenance standards (Zubairu and Olagunju, 2012; Healthier Buildings, 2010; Meir *et al*., 2009; Preiser and Vischer, 2005).

Previous studies have assessed both on-campus and off-campus student accommodation facilities using the POE approach. Akinluyi (2013), in his assessment of the Obafemi Awolowo Hall, Ile-Ife, discovered that although the design of the building was not flexible and easily adaptable to new use, the occupants were generally satisfied with the hall of residence. He suggested an increase in room sizes and a reduction in the level of room occupancy as ways to enhance the user satisfaction with new halls of residence to be put up. Similarly, Oladiran (2013) investigated students' hostel accommodation at the University of Lagos and their users' satisfaction and found out that there was inadequate supply of hostel accommodation leading to overcrowding in existing ones. Despite this discovery, the overall satisfaction of students with the accommodation and most of the facilities was 'good'.

Other scholars have focused on measuring satisfaction with student housing facilities and establishing correlations between students' satisfaction and their housing (Najib *et al*., 2011; Khozaei *et al*., 2010). Their results indicate that satisfaction levels are 'average' and that the sense of satisfaction with a place can make occupants feel attached to it. However, some studies narrowed the focus to a specific aspect such as the study of Koranteng and Simons (2012) which evaluated natural light in students' hostels in Ayedyuase, Ghana. They concluded that sustainable design principles and occupants' comfort are some of the factors to be considered during the design phase of student accommodation and that incorporating more natural lighting would improve the students' comfort and help reduce energy consumption of the buildings.

The objectives of this study are:

1. To investigate the physical conditions of the infrastructure and facilities provided in the hall and
2. To determine the level of the occupants' satisfaction with the hall of residence.

As the Polytechnic prepares to be upgraded into a Technical University (TU) in September 2016, this POE would bring to light the design strengths and flaws of the current student accommodation and enable management to make informed decisions to improve the designs and performance of new students' halls of residence to be constructed.

MATERIALS AND METHODS

This study made use of two levels from the process model of POE namely the indicative and investigative levels (Preiser *et al*., 1998). A questionnaire survey was used where facilities and performance indicators were identified from literature and summarised to comply with the Ghanaian context. The questionnaire had 3 sections – A, B and C. The first section sought information about the demographic details of respondents. In Section B, respondents were asked about the facilities provided in their hall of residence and were given the opportunity to rank the conditions of these facilities on a five-point Likert scale, where 1 = very bad, 2 = bad, 3 = average, 4 = good and 5 = very good. In Section C, respondents were asked to rate their satisfaction with the facilities in the hall using the codes 1 = very dissatisfied through to 5 = very satisfied. There were a few open-ended questions to allow respondents express their opinions.

Using the Krejcie and Morgan table (1970) in conjunction with Israel's formula (1992), a sample of 98 students was selected from the total population of 130 students resident in the hall and served with questionnaires. Of this number, 84 questionnaires were retrieved indicating a response rate of 85.71 %. Respondents were selected by simple random sampling in order to give all occupants an equal chance of being selected.

On-site observations were also carried out to identify problems including user-devised additions to the building structure. The layout of the hall was studied and the overall structure and cubicle spaces were measured to know their actual sizes. The survey data were then coded and keyed into a database created using Microsoft Office Excel. This database was imported into IBM SPSS Statistics v 21 where it was analysed. Frequency tables were generated and mean scores were also calculated to quantify the level of satisfaction with the facilities provided. The mean values were calculated by summing the number of responses multiplied by the numerical value (weighting) of each option provided and dividing by the total number of respondents.

That is to say;

$$\text{Mean score} = \frac{n(1) + n(2) + n(3) + n(4) + n(5)}{N}$$

Where n = number of responses to an option
1, 2, 3, 4, 5 = weighting of options
N = total number of responses

The Study Area

The Ahanta hall is named after the Ahanta ethnic group on whose land the Polytechnic is situated in the Western Region of Ghana. It is a male-only hall of residence which is managed by a hall warden and an administrator, both of whom are staff members, together with annually-elected student executives. Found situated opposite the Building and Civil Engineering Block at the southern part of the polytechnic campus, the hall has two floors and officially accommodates 130 students (Takoradi Polytechnic, 2014). It has a total of twelve rooms, eleven of which have been subdivided into four cubicles each. The two front cubicles have a floor area of 5.36 m^2 each while every one of the two cubicles at the back measures 10.86 m^2. All the smaller cubicles accommodate two occupants while four students occupy each of the larger cubicles, making a total of twelve students per room (see Figure 2). Found in front of the rooms on each floor is a 1.35 m wide veranda.

The building is of post-and-beam construction and has a gable-end roof. On the extreme left and right are two staircases for vertical circulation. The sanitary facility (washroom), which has eleven water closet cubicles and ten shower cubicles, is linked to the hall by a covered walkway on the ground floor. The walls are painted with yellow and grey oil paint and the floor finish is yellow and grey ceramic tiles. The internal partitions used for the cubicles are light brown plastic tongue-and-groove (T & G) strips. The ceiling is painted white while the doors, door frames and window frames are all grey in colour. The general layout of spaces is illustrated in Figure 1.

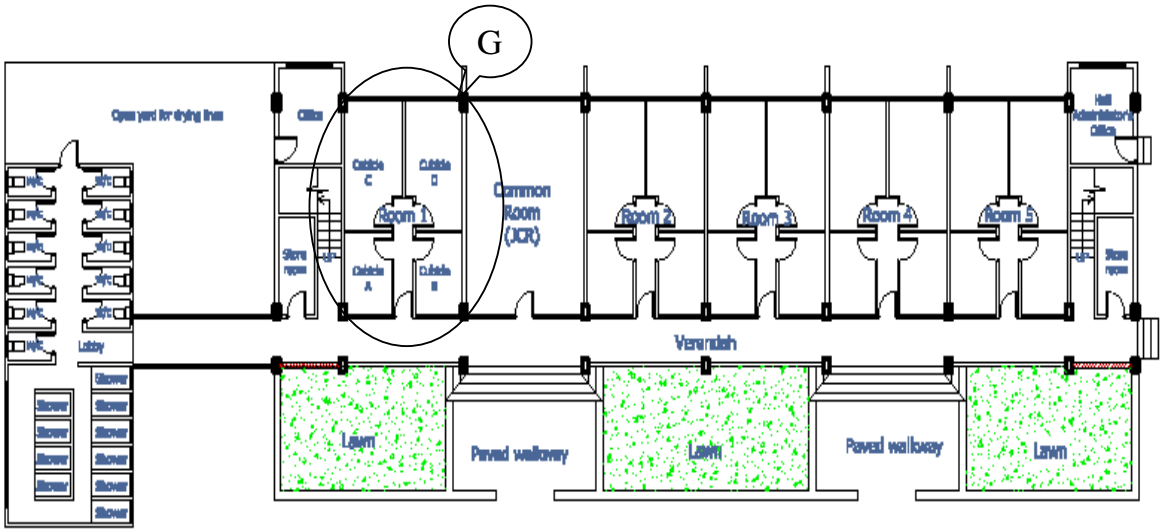

Figure 1: Floor Layout of the Ahanta hall
Source: Author's fieldwork (2015)

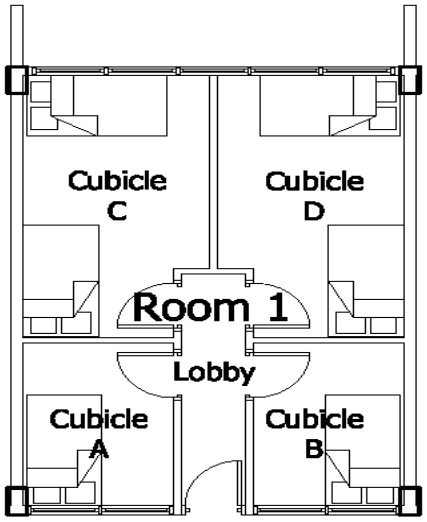

Figure 2: Typical room showing arrangement (A blow up of G)
Source: Author's fieldwork (2015)

RESULTS AND DISCUSSION

Socio-Demographic data

This section describes the background of the respondents who are residents of the hall and thus can give reliable information about the true state-of-affairs. A summary of the data is found in Table 1.

It was discovered from the distribution that the modal age range was between 21 and 25 years with almost 43 % of respondents being within the range. More than half of the respondents (52.40 %) were final year students. Consequently, 46.43 % of the students indicated that they had been resident in the hall for three years. On the question of religion, almost 49 % declared to be Christian followed by Islam (about 24 %) while a little over 27 % professed other faiths including self-discovery. This finding is in line with the 2010 population and housing census which recorded 71.20 % of the Ghanaian population as Christian (Ghana Statistical Service, 2012). It was found out that 75 out of the 84 respondents were single.

Forty-six respondents stated that there were four students in their individual cubicles; twenty-three indicated that they shared their cubicles with a roommate each while two were single occupants. Interestingly, thirteen students said their respective rooms accommodated other numbers aside the one, two or four students officially assigned per room. This indicates that the practice of *"perching"* goes on in Ahanta hall. [*'Perching'* refers to the situation where someone is added to a room's occupancy by the members of the room without the knowledge of the hall authorities. The said illegal occupant is called a '*percher*'].

Table 1: Socio-Demographic data of the respondents

Parameters	Options	Frequency	Percentage (%)
Age	16 – 20 years	14	16.67
	21 – 25 years	36	42.86
	26 – 30 years	22	26.19
	Above 30 years	2	2.38
	No response	10	11.90
	Total	**84**	**100.00**
Class (Level)	1st year	19	22.60
	2nd year	21	25.00
	3rd year	44	52.40
	Other	0	0.00
	Total	**84**	**100.00**
Religion	Christianity	41	48.81
	Islam	20	23.81
	Traditional	17	20.24
	Other	6	7.14
	Total	**84**	**100.00**
Marital Status	Married	9	10.71
	Single	75	89.29
	Total	**84**	**100.00**
Number of years resident in Ahanta hall	One year	21	25.00
	Two years	16	19.05
	Three years	39	46.43
	Other	4	4.76
	No response	4	4.76
	Total	**84**	**100.00**
Number of students in room	One	2	2.4
	Two	23	27.4
	Four	46	54.8
	Other	13	15.5
	Total	**84**	**100.00**

Source: Author's fieldwork (2014)

Facilities and infrastructure provided

A number of facilities and infrastructure were identified from literature as necessary to be incorporated into halls of residence at tertiary institutions. In order to conform to the Ghanaian setting, they were modified and presented in a list. Respondents were asked to indicate which of them had been provided at Ahanta hall. It was discovered that the following were available in the hall: sleeping areas (rooms), sanitary facilities (washrooms), circulation routes in the form of verandas, staircases and corridors; openings (doors and windows) as well as fire fighting equipment and waste disposal units at vantage points. There is electric power supply and water supply for the

use of occupants of Ahanta hall. To augment the water supply from the mains, four overhead storage tanks have been provided. Although not purpose-built, one room had been converted into a common room (JCR) while one office was an improvised porter's lodge.

The hall however lacked the following facilities: study area, kitchen, laundry, car park and special provisions for persons with disabilities (PWDs).

A hall of residence should offer a favourable environment where students can lodge in comfort and socialise easily with one another. The absence of key facilities from the hall compromises on the conduciveness of staying there. For example, in the night, majority of the residents leave their rooms to the various classrooms and the school's library to study and do their assignments because there are no study rooms in the hall. As no kitchens were also provided, students resort to cooking in their cubicles, a situation that generates more heat and discomfort for the occupants. The use of naked flames (gas stoves) is unsafe since there could easily be fire outbreaks.

Physical condition of facilities and infrastructure provided

The hall occupants were asked to rank the condition of the facilities and infrastructure provided at the hall on a scale of 1 to 5, where 1 = very bad and 5 = very good. The rankings are presented in the Table 2. It must be noted that the valid responses used ranged between $N = 50$ to $N = 84$ (where N is the total responses).

Respondents who ranked the condition of their rooms as 'very bad' (15.48 %) were significantly higher than those who rated their rooms as 'very good' (11.90 %). Again, an appreciably higher number of respondents rated the condition of their washrooms (shower and toilet) as below average (34.62 %) than those who ranked the space as above average (15.38 %). A considerable percentage of respondents (36.00 %) said the fire extinguishers provided in the hall were in very good conditions as compared to the 20.00 % who claimed the equipment were in very bad conditions.

Although the majority of respondents ranked the conditions of the facilities as 'average', the on-site (walk-through) observations indicated the following:

- At Ahanta hall, vertical circulation is solely in the form of stairs. Consequently, PWDs find it difficult accessing the hall.
- Due to the location of the porter's lodge, it does not serve its function as the students do not have direct access to the space. It has therefore become a restroom for janitors and porters.
- The limited number of water closets (WCs) and shower cubicles restricts two rooms with a total of 24 occupants to share one WC and one shower cubicle. This compares poorly with international standards which suggest 3 toilets for about 15 users in public accommodation facilities (Neufert and Neufert, n.d.)
- Even though there are fire extinguishers at vantage points, some have expired. With the ones in good condition, the students do not know how to operate them.

Table 2: Condition of facilities and infrastructure provided

Parameters	Frequency					
	VB (%)	BD (%)	AV (%)	GD (%)	VG (%)	N (%)
Sleeping area	13 (15.48)	21 (25.00)	33 (39.29)	7 (8.33)	10 (11.90)	84 (100.00)
Common room	2 (2.56)	2 (2.56)	55 (70.51)	19 (24.37)	0 (0.00)	78 (100.00)
Sanitary areas	10 (10.26)	19 (24.36)	39 (50.00)	8 (12.82)	2 (2.56)	78 (100.00)
Porter's lodge	10 (17.54)	16 (28.07)	20 (35.09)	11 (19.30)	0 (0.00)	57 (100.00)
Openings	14 (16.87)	17 (20.48)	31 (37.35)	8 (9.64)	13 (15.66)	83 (100.00)
Means of circulation	4 (5.30)	12 (15.80)	34 (44.70)	10 (13.15)	16 (21.05)	76 (100.00)
Fire fighting equipment	10 (20.00)	3 (6.00)	11 (22.00)	8 (16.00)	18 (36.00)	50 (100.00)
Room fixtures	10 (12.35)	14 (17.28)	33 (40.74)	11 (13.58)	13 (16.05)	81 (100.00)
Waste disposal units	19 (23.75)	4 (5.00)	36 (45.00)	13 (16.25)	8 (10.00)	80 (100.00)
Electric power supply	9 (13.43)	20 (29.85)	15 (22.39)	18 (26.87)	5 (7.46)	67 (100.00)
Water supply	11 (14.67)	9 (12.00)	31 (41.33)	24 (32.00)	0 (0.00)	75 (100.00)

LEGEND: VB = Very Bad; BD = Bad; AV = Average; GD = Good; VG = Very Good; N = Total number of responses

Source: Author's fieldwork (2014)

User-Satisfaction

Respondents were asked to rate their satisfaction with the facilities in the hall using the scales 1 = very dissatisfied through to 4 = very satisfied. The mean of the rankings are presented in the Table 3. It must be noted that the valid responses used ranged between *N* = 75 to *N* = 80.

Borrowing from Hassanain (2008) as used by Najib *et al*. (2011), the mean scores were interpreted as follows:

Less than 1.49 = Very Dissatisfied
1.50 – 2.49 = Dissatisfied
2.50 – 3.49 = Satisfied
Above 3.50 = Very Satisfied

The results in Table 3 showed that the residents of Ahanta hall were mostly dissatisfied with their room sizes, number of students in the room, level of privacy and room temperature among others. They were, however, satisfied with the type and colour of finishes used for the floors, walls and ceilings of their rooms within the hall. Kaya and Erkip (2001) are of the view that students are highly satisfied when they have wider and brighter rooms with less noise and stress in the sleeping areas. This is because the room (sleeping area) is the most important provision in student accommodation and any discomfort experienced therein gives the general view that the hall of residence is not conducive for habitation.

The indoor environment of a building is said to be comfortable when the occupants do not consider it a necessity to alter the state of the internal atmosphere to suit their individual inclinations (Frontczak and Wargocki, 2011). However, in this survey, residents have had to augment the lighting in their rooms to the point where they were very satisfied with the level of artificial lighting compared to that of natural lighting.

The residents were also very dissatisfied with the number of showers and toilet cubicles available for use. Not only were they few in number, they were all located on the ground floor so that occupants of rooms on the first floor had to carry buckets of water and descend a flight of stairs in order to get access to the washrooms. This is inconvenient especially at night.

Table 3: Satisfaction levels with facilities

Parameters	Frequency (N)	Mean Score	Interpretation
Room size	75	1.79	Dissatisfied
Number of students in room	78	1.67	Dissatisfied
Level of privacy in room	80	1.76	Dissatisfied
Ease of movement within room	80	2.11	Dissatisfied
Level of natural lighting in room	80	3.08	Satisfied
Level of artificial lighting in room	80	3.73	Very satisfied
Level of natural ventilation in room	80	2.95	Satisfied
Level of artificial ventilation in room	75	2.63	Satisfied
Room temperature	80	1.89	Dissatisfied
Sizes of door and windows in room	80	2.76	Satisfied
Ceiling finish in room	80	2.96	Satisfied
Wall finish in room	80	3.04	Satisfied
Floor finish in room	80	3.40	Satisfied
Number of shower and toilet cubicles	80	1.29	Very Dissatisfied
Frequency of maintenance of hall	78	2.27	Dissatisfied

Source: Author's fieldwork (2014)

CONCLUSIONS

The findings revealed that majority of the facilities and infrastructure provided in the hall was in 'average' conditions. However, some basic facilities needed for comfortable student life were lacking. These include study rooms, kitchen and washroom on every floor as well as car park. There were also no special provisions made for PWDs.

It was also discovered that on the whole, residents were 'dissatisfied' with the hall of residence (the total average of means was 2.48). This compares poorly with the works of Najib *et al.* (2011), Amole (2009), and Hassanain (2008) in which their total mean scores of satisfaction levels were 2.61, 2.70 and 2.80 respectively. The difference could be attributed to the fact that the Ahanta hall was not purpose-built as a hall of residence in a tertiary institution.

RECOMMENDATIONS

From the conclusions, it is recommended that subsequent halls of residence should be purpose-designed, purpose-built and fitted with modern-day facilities to enhance user comfort and the total living experience of students on campus. The following should be incorporated in the designs in order to increase user-satisfaction with the hall:

1. Larger sleeping areas to function as study-bedrooms
2. Washrooms to be strategically located between rooms
3. Kitchens, laundry, meeting rooms, study rooms and storage spaces on every floor
4. Car park for both residents and occupants
5. Special provisions for PWDs such as ramps fitted with handrails for access, elevators as well as designated rooms and washrooms.

Furthermore, maintenance of the current halls should be on regular basis to prevent total deterioration of the facilities.

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REFERENCES

Akinluyi, M. L. (2013). Post Occupancy Evaluation of on-Campus Students Hall of Residence: A Case Study of Obafemi Awolowo Hall of Residence Ile-Ife . *Greener Journal of Science, Engineering and Technology Research*, 001-011.

Amole, D. (2008). Residential Satisfaction in Students' Housing. *Journal of Environmental Psychology*, 76-85.

Collins, T. D. (2010). Behavior, Comfort and Energy Consumption in Student Residence Halls. University of Oregon.

Frontczak, M., & Wargocki, P. (2011). Literature survey on how different factors influence human comfort in indoor environments. *Building and Environment, 46*(4), 922-937.

Ghana Statistical Service. (2012). *2010 Population and Housing Census.* Accra: Ghana Statistical Service.

Hassanain, M. A. (2008). On the Performance Evaluation of Sustainable Student Housing Facilities. *Journal of Facilities Management*, 212-225.

Healthier Buildings, Happier People - The Benefits and Challenges of Post Occupancy Evaluation. (2010, May). *e-News*(72).

Ilesanmi, A. O. (2010). Post Occupancy Evaluation and Residents' Satisfaction with Public Housing in Lagos, Nigeria. *Journal of Building Appraisal*, 153-169.

Israel, G. D. (1992, November). Determining Sample Size. *Program Evaluation and Organizational Development, PEOD6*.

Kaya, N., & Erkip, F. (2001). Satisfaction in a Dormitory Building: The Effects of Floor Height on Perception of Room Size and Crowding. *Journal of Environmental Behaviour*, 35-53.

Khalil, N., & Nawawi, A. (2008). Performance Analysis of Government and Public Buildings via Post Occupancy Evaluation. *Asian Social Science*, 103-112.

Khozaei, F., Hassan, A. S., & Khozaei, Z. (2010). Undergraduate Students' Satisfaction with Hostel and Sense of Attachment to place: Case study of University Sains Malaysia. *American Journal of Engineering and Applied Science*, 516-520.

Koranteng, C., & Simons, B. (2012). An evaluation of natural lighting levels in students' hostels in a suburb of Kumasi. *Advances in Applied Science Research*, 548-554.

Krejcie, R. V., & Morgan, D. W. (1970). Determining Sample Size for Research Activities. *Educational and Psychological Measurement*, 607-610.

Meir, I., Garb, Y., Jiao, D., & Cicelsky, A. (2009). Post-Occupancy Evaluation: An Inevitable Step Toward Sustainability. *Advances in Building Energy Research, 3*, 189-220.

Najib, N. U., Yusof, N. A., & Osman, Z. (2011). Measuring Satisfaction with Student Housing Facilities. *American J. of Engineering and Applied Sciences*, 52-60.

National Council for Tertiary Education. (2014). *Report of the Technical Committe on Conversion of the Polytechnics in Ghana to Technical Universities.* Accra: NCTE.

Neufert, E., & Neufert, P. (n.d.). *Architect's Data.* Blackwell Science.

Oladiran, O. (2013). A Post Occupancy Evaluation Of Students' Hostels Accommodation. *Journal of Building Performance*, 33-43.

Preiser, W. F., & Vischer, J. (Eds.). (2005). *Assessing Building Performance.* Oxford: Elsevier.

Preiser, W. F., Rabinowitz, H. Z., & White, E. T. (1988). *Post Occupancy Evaluation.* New York: Van Nostrand Reinhold.

Takoradi Polytechnic Planning Office. (2014). Data on capacity of the halls of residence. [unpl.]

Zubairu, S. N., & Olagunju, R. E. (2012). Post Occupancy Evaluation of Some Selected Secondary Schools in Minna, Nigeria. *Journal of Economics and Sustainable Development*, 112-119.

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