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COMPARATIVE ANALYSIS OF LECTURE THEATRE PERFORMANCE PARAMETERS' IMPORTANCE TO STUDENTS LEARNING EXPERIENCE

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ABSTRACT

Lecture theatres as integral part of infrastructures required in institutions of higher learning can impact students' learning experience. As part of a broader study, this paper seeks to compare the perception that students from different lecture theatres have with the performance parameters of lecture theatres. A "case study" approach utilising a quantitative research design is adopted for this study. Relevant literature relating to the importance of building performance parameters to learning experience was reviewed. Data was collected by means of a closed ended questionnaire survey. Both descriptive and inferential statistics were used to analyse the data. The study reveals that students from all the three lecture theatres perceived all the performance parameters of the lecture theatres as important to their learning experience. Although there were some differences in the response, the differences demonstrated were not significant. Lighting, structural safety, ventilation and cleanliness appear to have high mean scores across the lecture theatres while aesthetics have the lowest. The result of the research can help maintenance departments to prioritise both the maintenance of different lecture theatres and the different performance parameters of the lecture theatres. The result can also be very helpful when taking decisions at the design stage and renovating lecture theatres. The research adopted a case study approach hence the results is a reflection of one university institution; however, the findings of this study could be applied when taking maintenance decisions in other higher learning institutions.

Keywords: Building performance, Lecture theatre, Maintenance, Performance parameter, Student

1. INTRODUCTION

Universities require infrastructures like buildings (lecture theatres) to promote their activities. Whether new or old, lecture theatres need care to ensure adequate functional performance; Allen (1995 and 2005) expressed that like all living organisms, buildings also go through the fundamental stages in natural cycles—birth, growth, maturity, decline, decay, death, and rebirth—and therefore require maintenance to keep the cycle under control (Arazi, Khamidi, & Olanrewaju, 2009). On the other hand, lecture theatres are an integral part of the physical learning environment in a university and can impact on the whole learning process, well-being, comfort and productivity of students (Lackney, 1999a; Olanrewaju, 2010b). It has been highlighted that well-maintained lecture theatres are required for delivering the core objectives of a university effectively and efficiently (Olanrewaju, 2010a). University lecture theatres consequently require appropriate maintenance to

ensure a performance level which will promote the learning experience of students. The overall performance of a lecture theatre depends on the performance of specific parameters. Several parameters such as indoor air quality, noise control, privacy, lighting comfort, spatial comfort, adaptability, thermal comfort and ergonomics could impact on the overall performance of a lecture theatre (Clatworthy and Convenor, 2001; Department of Treasury and Finance, 2005; and Atkin & Brooks, 2009). Students' perception of these parameters can be valuable to the maintenance department when planning and execution maintenance task.

As part of a main study, this paper presents students' perception of the performance parameters of lecture theatres in relation to their learning experience. Relevant literature in relation to the importance of specific parameters to learning experience was reviewed and questionnaire was distributed to students to collect quantitative data on the subject. Specifically two objectives are addressed in this paper:

- To comparatively assess whether or not lecture theatre performance influence learning experience.
- To determine the level of importance students from different lecture theatres attach to specific building performance parameters of the lecture theatres.

2. IMPORTANCE OF LECTURE THEATRES' PERFORMANCE TO THE LEARNING EXPERIENCE

Students spend a lot of their time in the lecture theatres and could as such be affected by their conditions. Lee and Wordsworth (2001) and Smith, Tucker and Pitt (2011) noted that dilapidated and poorly performing buildings can affect the quality of life, health as well as the engagement of the users. There is enough evidence that, the performance and quality of buildings *does* have a direct impact on the building users (Douglas 1996; Lee and Wordsworth, 2001; Lee and Scott, 2009). Several other research in connection to educational buildings also reveals that the performance of lecture theatres *does* impact on the output and performance of students (Amaratunga and Baldry, 2000; Green and Turrell, 2005; Leung and Fung, 2005; Uline and Tschannen-Moran, 2008; Bishop, 2009; Uline, Tschannen-Moran and Wolsey, 2009; Lavy and Bilbo, 2009; and Uline, Wolsey, Tschannen-Moran, and Lin, 2010). There is indeed a positive relationship between building condition and student achievement and performance (Cash, 1993).

Performance requirements critical for lecture theatre performance

People have different criteria for assessing the performance of their buildings. A number of defined performance measures or standards helps to determine the performance of a building (Watt, 2007). Clatworthy and Convenor (2001), Department of Treasury and Finance (2005) and Atkin & Brooks (2009) were of the opinion that performance requirements such as indoor air quality, noise control, privacy, lighting comfort, spatial comfort, adaptability, thermal comfort and ergonomics aid to measure the performance of buildings. Several performance requirements that are critical for a lecture theatre performance were identified by (Fleming and Storr, 1999; Lackney, 1999a; 1999b; Clatworthy and Convenor 2001; Earthman, 2004; Green and Turrell, 2005; Leung and Fung, 2005; Uline and Tschannen-Moran, 2008; Bishop, 2009; and Uline *et al.*, 2010). This research specifically concentrate on building services and not on teaching and learning materials. Therefore the following performance parameters will be discussed: safety (structural safety and fire safety & exit), thermal comfort, ventilation, acoustic control, lighting, aesthetics (appearance) and cleanliness.

Earthman (2004) expressed how important safety is when determining school building adequacy. Important safety-related elements that need considerations are accessibility, egress, material safety, fire safety, security systems and a communication system to use in emergencies (Lackney, 1999a; Earthman, 2004). The absence of safety measures can lead to accidents and sickness and even limit access for the disabled (Lackney, 1999a). Light is one of the parameters of building design which demands a very important consideration (Polh, 2011). Poor lighting could result in fatigue, eye strain, blurry vision and headaches; and can also affect the mental concentration and productivity of building users (Lackney, 1999; and Leung and Fung, 2005). Certainly, learning cannot conveniently take place in such a condition.

Polh (2011) indicated that environmental temperature is one critical factor that promotes human comfort and survival. The temperature in a building influences thermal comfort, which subsequently affects working performance, health, and social behaviour of the building users (Leung and Fung, 2005). Closely related to temperature is ventilation which impacts on the indoor air quality; Leung and Fung (2005) and Polh (2011) were of the view that a good ventilation system in a room can improve the indoor air quality and the working productivity of end-users. The “sick building syndrome” (SBS) which may lead to respiratory illness is known to be caused by poor indoor air quality (Lackney, 1999a). The SBS is a term used to describe situations in which building occupants experience acute health and comfort effects that are somewhat linked to time spent in a building (United States Environmental Protection Agency, 1999). Any inadequacy of the heating, ventilation, and air conditioning (HVAC) systems can cause unnecessary distractions for students, who may spend more time sweating or shivering instead of learning (Bishop, 2009). Uline and Tschannen-Moran (2008) identified cleanliness of a building as one of the essential indicators of building quality as expressed by building users. Indeed, cleaning is carried out to keep buildings (lecture theatres) in an appropriate condition (Chanter and Swallow, 2007). Also, a lecture theatre’s air quality is partly influenced by dust and dirt (cleanliness) or lack thereof. Cleanliness has a health implication (able to cause SBS) on students, hence, the need to ensure a clean lecture theatre.

Effective communication in a lecture theatre is critical for the success of learning. Polh (2011) actually opined that acoustics are a critical environmental factor essential to the efficient functioning of school buildings (e.g. lecture theatres) because of the need to maintain a conducive hearing condition at all times in a learning situation. Sutherland & Lubman, (2001) also pointed out that the classroom serves as a communication channel for the teaching and learning experience of both teachers and students. The ability to clearly hear in the lecture theatre is not a choice but a necessity for student learning experience. The hearing ability is however dependent on the acoustic conditions in the classroom (Lubman and Sutherland, 2001). Aesthetic i.e. the sense of beauty are determined by colours, shapes, textures, and unique features (Uline *et al.*, 2009). Aesthetics plays a critical role in ensuring a comfortable environment (Leung and Fung, 2005); invariably an appealing lecture theatre has the ability to influence the students learning positively. Attractive building conditions do impact on student learning experiences, even more than structural building conditions (Cash, 1993).

Clearly, all these parameters are very important to learning experience, in terms of their order of importance; Lackney (1999b) opined that the physical comfort of the students is the most important consideration, followed by classroom adaptability, building functionality, then, aesthetics and

appearance. Clatworthy and Convenor (2001), on the other hand, studied academics' and students' perceptions of the effect of the physical environment on learning, a study which revealed that students perceived, sequentially, ventilation, air conditioning, acoustic quality, seating comfort, amount of personal seating and writing space and quality of audio visual equipment as very important to their learning experience. Earthman (2004) in his work entitled "prioritization of 31 criteria for school building adequacy", ranked the first five building features in this order of importance: 1) health and safety; 2) human comfort (i.e. temperatures within the human comfort range as regulated by appropriate HVAC systems); 3) indoor air quality (i.e. appropriate ventilation and filtering systems as regulated by appropriate HVAC systems); 4) lighting; and finally 5) acoustical control.

3. RESEARCH METHODOLOGY

A "case study" approach utilising a quantitative research design is adopted for this study. Cape Peninsula University of Technology in the Western Cape; South Africa was used as the case for the research study. Purposive sampling method was used to select the lecture theatres; in purposive sampling, the researcher chooses people or other units for a particular purpose (Leedy and Ormrod, 2010). Three lecture theatres were selected. The selection was done purposively to include one old (LT2BB), one intermediate (ABCLT) and one new lecture theatre (LT2MB) with the intention of ensuring that all the different classes of lecture theatres were represented. Closed-ended questionnaires were then issued to students by means of a convenient sampling method to collect the required data. Convenience sampling is a type of sampling based on availability and/or convenience of people or other units (Leedy and Ormrod, 2010). 283 questionnaires representing a response rate of 65.8% were duly completed and returned out of a total of 430 questionnaires distributed. Both descriptive and inferential statistics are used to analyse the data. Literature review of past authors on the relating topics also aided the discussion. The questionnaires were issued in the order below:

Table 1: survey response rate

Selected Theatres	Status	Year built	Capacity	N issued	N (%) returned
LT2 Mechanical building	New	2010	173 seats	95	82 (86.3%)
ABC Lecture theatre	Intermediate	1995	232 seats	260	131 (50.4%)
LT2 Business building	Old	1986	104 seats	75	67 (89.3%)

4. FINDINGS AND DISCUSSION

The influence lecture theatres have on students' learning was surveyed by asking them to respond "YES" if their learning experience is influenced by the lectures theatres or "NO" contrariwise. Figure 1 reveals that 174 of the total respondents (representing 62.1%) responded 'Yes', 85 (representing 30.4%) responded 'No', while 21 (representing 7.5%) responded 'Unsure' to the question. The response within each lecture theatre was quite different. For LT2MB the difference between the two opposite responses was very close, 39 (representing 47.6%) responded 'Yes',

while 37 (representing 45.1%) responded 'No'. LT2MB is a new lecture theatre; students were likely influenced by the more pristine state of the lecture theatre. In the case of ABCLT, 85 (representing 64.9%) of the respondents responded 'Yes', while 38 (representing 29%) responded 'No'. LT2BB had the most positive response; 50 (representing 74.6%) responded 'Yes', while 10 (representing 14.9%) responded 'No'. The trend of the response reveals that, the older the lecture theatre the greater students feel its impact on their learning experience. However, the general trend and consensus is conclusive that the performance of a lecture theatre affects learning experience. The findings of the survey are also supported by the studies of Amaratunga and Baldry, 2000; Bishop, 2009; Green and Turrell, 2005; Lavy and Bilbo, 2009; Leung and Fung, 2005; Uline and Tschannen-Moran 2008; Uline, Tschannen-Moran and Wolsey, 2009 and Uline *et al.*, 2010 who revealed that the condition of buildings (e.g. lecture theatres) have an impact on the learning experience of students. Because students are affected by the performance of lecture theatres, it is incumbent on universities to provide stimulating lecture theatre to enhance the whole learning process of students.

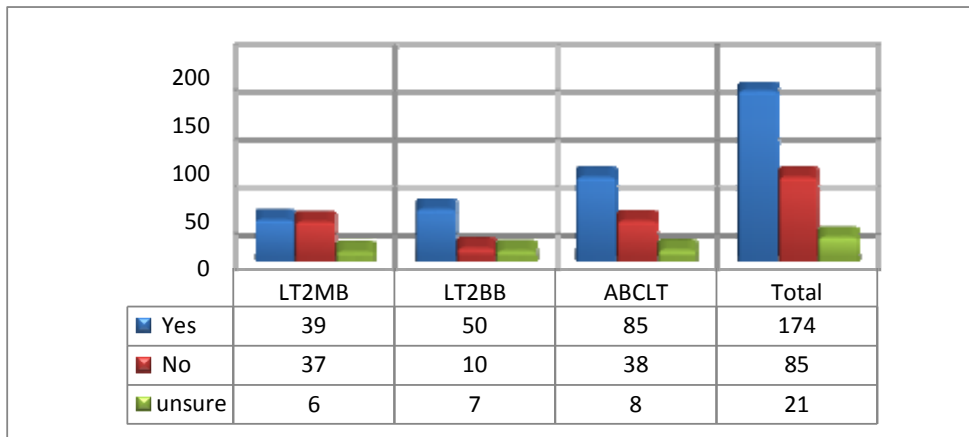


Figure 1: Effect of lecture theatres' performance on learning experience

Importance of performance parameters (compared)

Parameters used in this study are: structural safety, fire safety & exit, temperature, ventilation, lighting, cleanliness, sound control and aesthetics. Students were requested to rate how important these performance parameters of the lecture theatre were to their learning experience using a 5-point Likert scale where 1 = not relevant; 2 = unimportant; 3 = neutral; 4 = important; and 5 = very important.

Respondents from all the lecture theatres as shown in Table 2 perceived all the performance parameters as important to their learning experience. Students in LT2MB perceived lighting as the most important parameter, followed by structural safety, ventilation and temperature, while the least important is aesthetics. The mean scores obtained from ABCLT indicate that lighting is the perceived most important parameter followed by ventilation, cleanliness, structural safety and the least important is aesthetics. It is evident from the mean scores obtained that respondents from

LT2BB perceived all the parameters as important. Structural safety is perceived the most important parameter, followed by cleanliness, lighting and ventilation respectively whereas aesthetics is the perceived least important parameter. The mean scores obtained from the aggregate were in the range of 4.37 (highest) and 3.71 (lowest). Lighting is perceived as the most important parameter, followed by structural safety, cleanliness and ventilation respectively, with same mean score of 4.32. The perceived least important parameter is aesthetics. The mean scores obtained for all the parameters in all the lecture theatres were above 4.0 except aesthetics. The mean scores obtained from this survey and the literature clearly express that all these performance parameters are important and therefore require careful attention.

Table 2: Importance of performance parameters (compared)

Performance parameters	LT2MB (New)			ABCLT			LT2BB (Old)			TOTAL		
	Mean	Std. Dev.	Rank	Mean	Std. Dev.	Rank	Mean	Std. Dev.	Rank	Mean	Std. Dev.	Rank
Lighting	4.39	0.68	1	4.36	0.81	1	4.37	0.77	3	4.37	0.76	1
S. safety	4.27	0.70	2	4.30	0.93	4	4.45	0.76	1	4.32	0.83	2
Ventilation	4.27	0.90	3	4.35	0.88	2	4.34	0.84	4	4.32	0.90	4
Temperature	4.23	0.80	4	4.19	1.00	5	4.18	0.92	6	4.20	0.92	5
Cleanliness	4.21	0.91	5	4.33	0.86	3	4.43	0.78	2	4.32	0.86	3
Sound control	4.20	0.89	6	4.12	0.99	6	4.32	0.82	5	4.19	0.92	6
Fire safety	4.13	1.09	7	4.11	1.10	7	4.04	1.22	7	4.10	1.12	7
Aesthetics	3.62	1.03	8	3.71	1.04	8	3.85	0.82	8	3.71	0.99	8

Undoubtedly, the mean scores obtained for all the parameters in all the lecture theatres as shown in Table 2 and Figure 2 demonstrate a feeling of importance towards very important. Lighting, ventilation and temperature had very close response from all the lecture theatres, while the response for structural safety, cleanliness, sound control and aesthetics were quite varied. Although the responses in the different lecture theatres varied, the variations were of no significance. The significance level of differences obtained as shown in Table 3 (ANOVA analysis) were all above 0.05, confirming that there were no statistically significant differences in the responses. Sarantakos (2007) indicated that a text value is significant if the p-value is below 0.05. Lighting, structural safety, ventilation and cleanliness appears to have high mean scores across the lecture theatres, the standard deviation obtained for these parameters is a confirmation of how concentrated the responses were. Fire safety & exit and aesthetics were ranked seventh and eighth respectively in all the lecture theatres. Contrary to the literature, respondents ranked fire safety & exit very low, likely because it does not have a direct effect on students' learning experience. It is worth noting that respondents ranked cleanliness very high, cleanliness could actually have health implication and deserves critical consideration. Unsurprisingly, sound was ranked subsequent to lighting, ventilation and temperature, while aesthetics (i.e. appearance) was ranked last. Their position in the ranking is consistent with literature review. Clearly, respondents ranked the parameters that have a direct impact on their learning experience more highly than those that do not. Cash (1993) identified a similar trend in his study, and stated that attractive building conditions do impact on student learning experiences, even more than structural building conditions.

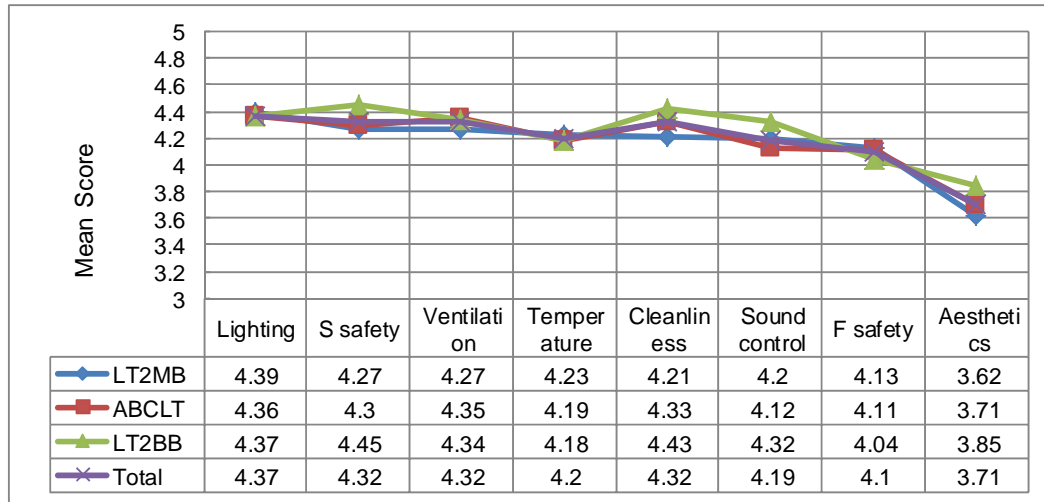


Figure 2: Importance of performance parameters (compared)

Table 3: One way ANOVA test

Performance Parameters		Sum of Squares	df	Mean Square	F	Sig.
Performance parameter importance to your learning experience: fire safety	Between Groups	.308	2	.154	.121	.886
	Within Groups	352.902	278	1.269		
	Total	353.210	280			
Performance parameter importance to your learning experience: structural safety	Between Groups	1.375	2	.687	1.005	.367
	Within Groups	187.383	274	.684		
	Total	188.758	276			
Performance parameter importance to your learning experience: temperature	Between Groups	.101	2	.051	.059	.942
	Within Groups	234.018	275	.851		
	Total	234.119	277			
Performance parameter importance to your learning experience: ventilation	Between Groups	.316	2	.158	.193	.824
	Within Groups	224.548	275	.817		
	Total	224.863	277			
Performance parameter importance to your learning experience: lighting	Between Groups	.036	2	.018	.031	.970
	Within Groups	161.197	276	.584		
	Total	161.233	278			
Performance parameter importance to your learning experience: sound control	Between Groups	1.944	2	.972	1.148	.319
	Within Groups	232.952	275	.847		
	Total	234.896	277			
Performance parameter importance to your learning experience: aesthetics	Between Groups	1.894	2	.947	.973	.379
	Within Groups	266.576	274	.973		
	Total	268.469	276			
Performance parameter importance to your learning experience: cleanliness	Between Groups	1.711	2	.855	1.171	.312
	Within Groups	203.101	278	.731		
	Total	204.811	280			

5. CONCLUSIONS

Lecture theatres are important infrastructure in any university since they form part of the learning environment and can thus affect students learning experience. The need to ensure the maintenance of these theatres aptly is thus crucial. The older the lecture theatre the greater students feel its impact on their learning experience, however, the general trend and consensus is that the performance of a lecture theatre affects learning experience. Consequently, maintenance departments ought to pay critical attention to older lecture theatres but not neglecting the new ones. The total performance of the lecture theatres is dependent on a number of parameters. All the performance parameters are considered important in terms of their effect on learning experience. Although the responses in the different lecture theatres varied, the variations were of no significance. Lighting, structural safety, ventilation and cleanliness appears to have high mean scores across the lecture theatres while fire safety & exit and aesthetics have the lowest. With the exception of fire safety & exit, all the performance parameters obtained mean scores above 4.0. The need for prioritisation therefore becomes imperative to ensure that maintenance funds are utilised judiciously. Students' perception of these parameters can be valuable to the maintenance department when initiating the prioritisation and executing the maintenance task. As part of an on-going study, this paper presented one part of the consideration for the prioritisation. The satisfaction with the performance parameters and the condition of the building is the other factor that is covered in the main study.

6. RECOMMENDATION

A qualitative study to examine how the students learning experience is impacted will be helpful in ensuring proper justification for setting priorities.

This study concentrated specifically on building services parameters, it is recommended that a further study be conducted on the other parameters that also influence learners like teaching and learning materials as well as area of lecture theatre ergonomics.

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