Assessing the Physical Space for Teaching and Learning in Higher Education-A Study of a Lecture Theatre Complex at the University of Cape Coast, Ghana

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Abstract: Quality education involves three key identifiable components: teaching, student, and the environment within which teaching and learning takes place. Much of the existing literature has been devoted to the first two elements with the last of them being relatively disproportionately represented, particularly in a typical developing country context. The study deployed a mixed-method approach to explore lecturers' views on the adequacy of a frequently-used teaching and learning space (lecture theatre complex) in the University of Cape Coast. A total of 106 respondents were recruited for the study using the convenience sampling approach and data was collected using a questionnaire which had both close and open-ended items.

The findings suggest that the assessment of the facility revealed mixed results. While it was highly ranked on environment and ambiance, it scored poorly in ergonomics and technology. On the balance however, the data generally suggests that the lecture theatre complex largely did not measure up to respondents' expectations as a standard teaching and learning facility. It is recommended that the building be redesigned or air conditioning be installed in the classrooms for more ventilation. Also, regular maintenance of the faculty will be useful to help it meet the exigencies of modern day teaching and learning at the tertiary level.

Keywords: Learning Space, Teaching Environment, Higher Education, Quality Education

1. Introduction

Education is considered the most powerful weapon that can change the world in the 21st century (Thagenda et al., 2016). Before then, the most powerful agents of change were religion and science in the 19th and 20th centuries respectively (Haseena & Mohammed, 2015). But in more recent times, attempts are made to add the phrase 'quality' as a prefix to reflect the desired situation. While it is truism that education is important, emphasis is made on 'quality education'. Sustainable Development Goal Four of the United Nations Development Agenda 2030 advocates for quality education and legitimately so, because quality education is a sine qua non for the advancement of any society.

In the view of Sahek and Nasri (2019), quality education is a necessary condition for the production of high calibre citizens who can lead the process of pursuing developmental goals. In reality, good quality education leads to the provision of intelligent human beings who are adept at organising life and making decisions that benefit humankind (Leiber, 2022). It is therefore not surprising that education (especially higher education) is a major component of every country's budget. This is because, as Licit and Janmere (2019) argue, investment in higher education is an essential prerequisite for economic growth and national competitiveness as well as for achieving a higher level of prosperity.

Haseena and Mohammed (2015) posit that quality education is difficult to define. It is generally accepted that it is multidimensional, elusive and means different things to different people (Schindler et al., 2015). This multiplicity of meanings has created a plethora of definitions with attendant meanings from different perspectives and according to Schindler et al. (2015), this scenario is the outcome of two factors: multiple stakeholders and multiple meanings. Consequently, the literature highlights numerous definitions that have been proffered from various angles. While the existing literature does not offer a firm consensus on the definition, it does provide two broad perspectives which, for the purposes of this paper, are categorised into three domains, namely: functionalist, managerial, and environmentalist. The Functionalist approach defines quality education from the viewpoint of performance and performance-related outcomes. To this end, quality has been defined primarily in terms of performance of students/learners (Philips, 2019; Barbato et al., 2022; Lieber, 2022; Rosa et al., 2022). To these authors, good/high quality can be measured by students' output, and a converse outcome via the same construct.

The managerial approach sees quality from the perspective of the activities of the managers of the educational systems. In this dimension, the role of quality assurance is particularly highlighted and tools such as accreditation, assessment, and audits are used (Kis, 2005; Ryan, 2015; Er et al., 2020; Seyfried & Pohlenz, 2018)

The environmentalist view of quality places emphasis on the nature of the teaching and learning environment and its impact on the quality outcomes in the classroom. Proponents of this domain hold the view that quality of education is only as good as its support systems in terms of the availability and quality of the teaching and learning environment, materials and other resources. Works that portray such an orientation include Ndirangu and Udogo (2011).

Regardless of the ambivalence of the term, there can be no doubt that any measure of quality would and should include the dimension of the physical environment. The Glossary of Education Reform (2014) defines a learning environment as the diverse physical locations, contexts, and cultures in which students learn. This particular definition is of relevance to this paper because it focuses on physical location. Recently, the importance of physical spaces (e.g. buildings, seminar and lecture rooms) has gained widespread acknowledgement in educational research settings (Vercellotti, 2018). An often overlooked but critically important aspect of the debate about quality has to do with the environment. The teaching and learning environment is as equally important as the definitions of what quality entails. Licite and Janmere (2019) identify the quality of the physical environment of an educational institution as playing a critical role in affecting the learning process, determining physical and mental self-feeling and motivation and contributing to emotional and behavioural responses. However, within the higher education space, the discussion and writings about quality have focused mainly on content and little attention has been given

to exploring the teaching and learning environment. While a few studies have looked at it from the students' perspective (Licite & Janmere, 2019), there is no available information on the perspectives of the teachers, or in this case, lecturers, much less, at the tertiary level and the developing country setting where educational facilities are often scarce and overstretched (Fomba et al., 2022).

This study therefore seeks to explore lecturers' views of the quality of the teaching and learning space of a purposively chosen lecture theatre complex in the University of Cape Coast. The findings will add to the dimension of understanding the issues from the viewpoints of lecturers in tertiary institutions in developing countries.

2. Literature Review

Millennial students need experiential and active learning spaces (Fisher, 2019) which involve more participation and collaboration from students and require furniture that enables flexible classroom settings (Asino & Pulay 2019) where students can see and hear one another, and their teacher. Though relatively underrepresented in the broad literature arena, physical location is recently gaining attention (Vercellotti, 2018) in academic enquiries into quality education. The search for so-called 'quality' leads large number of students from developing countries to go abroad each year (Akareem & Hossain, 2016) while governments over the world seek to improve their offerings.

Various approaches have been adopted towards defining a learning environment. In the view of Manninen et al. (2007), a learning environment can be defined from five different perspectives: physical spaces, teaching and learning approaches, social and collaborative aspects supporting learning, technologies used, and contextual learning places outside the campus (e.g. work placements and field visits in biology). Radcliff's Pedagogy–Space–Technology framework (2008) also recognises the importance of physical space in an ideal teaching and learning environment. The quality of the physical location is thus important and plays a crucial role in both formal and informal settings (Beckers et al., 2015). According to Radcliff (2008), pedagogy is enlarged by technology and enabled by space, space encourages pedagogy and embeds the technology, and technology enhances pedagogy and extends the space.

Physical location refers to the tangible physical environment in which teaching and learning takes place. As earlier indicated, this space and its characteristics play an important role in shaping not only the learning experience, but also delivering quality education outcomes. Physical space has been found in the literature to shape the type of pedagogical approaches adopted (Carr & Fraser, 2014). Key attributes of physical spaces the literature identifies include, but not limited to, comfort, lighting and acoustics (Chen et al., 2016), convenience, comfort, and solitude (Morieson et al., 2018), vegetation, furnishing and flexibility, and seating density (Scannell et al., 2016), cleanliness indoor and outdoor cleanliness, and campus security (Kärnä et al., 2013); natural elements, such as outside views and plants (Khan et al., 2020).

A strong relationship has been established between the quality of place of study/instruction and learning outcomes. Alphonse et al. (2019), for instance, found that having a convenient and comfortable place of study was important for successful completion of courses among distance learners. The literature has generally asserted that the settings for education have a direct outcome on outcomes of teaching and learning in both direct and indirect ways (Woolner, 2015; Sigurðardóttir & Hjartson, 2011). As a general

rule of thumb, poor environments cause negative effects on teaching and learning (Woolner, 2015). Factors in the physical location and how they affect learning are numerous and varied but some clearly identifiable dimensions of physical space that have been captured in the literature include noise, room temperature, lightening, and ventilation. These are presented in turn in the ensuing paragraphs.

Studies have identified noise as a key barrier to teaching and learning. Naturally, it is the case that the nosier an ambiance, the less concentration can be achieved, and ultimately, in the context of the ongoing discussion, the less teaching and learning outcomes are met. Noise can impair an individual's concentration and performance (van de Poll & Sörqvist, 2016).

Room temperature has also been found to have an effect on teaching and learning. Temperatures which are too cold or too hot would present less-than-ideal conditions for study. A study by Tanabe et al. (2007) found a positive relationship between room temperature, health and absenteeism. Schneider (2002) describes the relationship between student absenteeism and the relative humidity of buildings.

Lighting is another important attribute of the physical environment which has been found to affect quality of teaching and learning. It is generally the case that well-lighted buildings enhance performance of students. Studies by Evans (2006), Heschong et al. (2002) and Aries et al. (2015) found significant variance between daylight quality and student performance.

Finally, ventilation has been identified in the literature as having an effect on teaching and learning. Schneider (2002), for example, found out that higher ventilation rates increase learning. He suggested that this is so because poor air quality reduces occupant health, thus leading to greater absenteeism and, ultimately, lower student achievement. Similar findings were made by Haverinen-Shaughnessy et al. (2011) who measured carbon dioxide levels from one classroom in each of 87 schools to determine that test scores increased with higher ventilation rates.

In addition, technology is a key factor in educational attainment (Hartman et al., 2019). Generally used technological resources include pre-recorded instructional videos, interactive online lessons, educational television and printed resources (Scully et al., 2021). The literature indicates that success of technology is subject to factors such as the availability of equipment, ease of use and the interest the technology may spark in each student (Porter & Graham, 2016). Technology has not only been found to be a facilitator (e.g. Starkey et al., 2021) but, more importantly, an influencer of learning. A study by Scully et al. (2021) found that the level of technology available and the educational context are important determinants of the pedagogical practices that students and teachers adopt. Their study further found that students with limited access to economic resources and, by extension, technology tended to engage in less learning.

3. Methods

The study adopted a Pragmatist Philosophy and mixed-method descriptive design. The pragmatist philosophy found use in this study because it sought to explore respondents' experiences, which according to Kaushik and Walsh (2019) is a key principle to be followed when conducting pragmatic research. The triangulation method design was chosen because it afforded the researchers the flexibility to compare and contrast quantitative statistical results with qualitative findings or to validate or expand quantitative results with qualitative data (Creswell et al., 2003). Also, pragmatism ensures a better way of understanding a

phenomenon because it offers a hybrid of both the intepretivist and positivist dimensions thereby enhancing the quality of understanding of the phenomenon and perspectives (Kelly, 2020). According to Siedlecki (2020), descriptive studies are non-experimental and are aimed at understanding the nature of a particular phenomenon at a specific time. In this particular instance, the descriptive design suited the purpose of the study because it sought to understand lecturers' views of the facility in terms of certain attributes. The mixed method approach was also useful because of the choice of the lecture theatre complex, choice of respondents, and the analysis of the qualitative and quantitative information gathered. The research used a questionnaire whose items elicited both quantitative information (e.g. ranking of attributes) and qualitative feedback (reasons for various rankings).

The C.A. Ackah lecture complex was chosen purposively because it is the lecture theatre complex which serves the widest range of courses across the various faculties and, more importantly, is the most centrally located and clustered lecture facility within the university's academic area, thereby making it easier for the research team to approach the targeted respondents.

The study identified 135 lecturers who used the target venue. Out of this population, using the convenience method, 106 agreed to partake in the interviews. This choice of sampling was adopted because it served as an automatic filter to help reach the target respondents. Although the number of lecturers is known and for which reason a sampling frame exists, the data is not layered by assignment to lecture spaces, thus using the probabilistic sampling techniques would be time wasting and misleading (Siedlecki, 2020). Rather, the choice of the convenience method afforded the researchers the advantage of directly reaching the lecturers who were teaching in the facility of interest. Such an approach is common place in pragmatic research where researchers are faced with limited resources (Creswell, 2014). The research design was based on a questionnaire survey, where lecturers who used the particular lecture theatre understudied were asked to rate their experiences based on some indicators.

The key attributes were categorized under three key dimensions as proposed by Licite and Janmere (2019), namely: the layout and size of study rooms; ergonomics and technologies; and the informal environment and comfort. These were later modified to suit the local context and the new categories were: ergonomics, technology and environment and ambiance.

Convenience driven by proximity was the primary reason for the choice of University of Cape Coast although, in recent times it has confirmed its well-known pedigree in educational excellence with the release of the Times Higher Education Rankings (2021) where it emerged the best university in Ghana and West Africa and the fourth best in Africa. The University of Cape Coast also ranked first globally in research influence. The lecturers' views were measured on a continuous scale of 0-10 representing lowest and highest scores respectively. The scores represented their ranking of attributes of the physical teaching and learning environment which had been retrieved from the literature. These attributes covered three broad themes of ergonomics (comfort of seating; adequacy of seating for lecturers; adequacy of seating for students; ease of movement in rooms; spaciousness of rooms). Under the technology category, the constructs were: functionality of microphones, overhead projectors and sockets; state and ease of use of electrical fittings. Finally, under the environment and ambiance constructs such as ventilation of rooms, cleanliness of rooms, wall décor, and cleanliness of general environment were measured. Each item had a blank space for respondents to indicate qualitatively their reasons for the ranking. See appendix.

The scale was validated using steps outlined by Boateng et al. (2018) namely, item development, scale development and scale evaluation. Under item development, the various attributes were developed based on pre-existing domains on the various attributes already established in the literature (Schneider, 2002; Akareem & Hossain, 2016; Evans, 2006; Leiber, 2022). To this end, there were six (6) items each under the three broad categories of ergonomics, technology and environment/ambiance. The eighteen (18) questions developed were mostly adaptations of existing items and/or constructs used by previous studies, modified to suit the university setting. The instrument was then pretested at two levels, the first being submitting it to expert lecturers in the discipline and the second level was administering it to 17 purposively selected lecturers in Cape Coast Technical University, another University situated in the town of Cape Coast. Based on feedback from the two levels of pretesting, three items were removed culminating in a final number of 15 items. Such items were either unclear or deemed repetitive by the respondents, in addition to this feedback, a Cronbach's Alpha coefficient of 0.77 suggested that the instrument had enough questions, was properly structured, and, most importantly, demonstrated internal consistency.

The study deployed central tendency (arithmetic Mean (M) and standard deviation (SD) statistics to analyse the survey data. As general rule of thumb, mean scores which were higher than 0.5 were considered acceptable while constructs whose mean scores fell below 0.5 were considered poor (Field, 2009; Boateng et al., 2018). The data acquired from the open-ended portion of the instrument was analysed by identifying frequently occurring themes and was used to provide qualitative insight into the ranking data (Creswell et al., 2003) through quotes and, where relevant, narratives.

4. Findings

Seventy-six (76) out of the respondents were male with the remainder being female. It appeared the respondents were generally middle-aged as most respondents (81%) fell within the ages of 31 and 50. Majority of the respondents were from the arts, humanities and education, and this is due to the proximity of location of the facility which makes it frequently assigned to these disciplines for lectures.

Respondents had a wide range of teaching experience with the least being one year and the most being twenty years. The mean number of years taught was 6.48 but data showed that almost 50% of the respondents had taught between 3 and 4 years with the latter accounting for 39%. Most respondents (70%) had used at least four lecture theatres in the complex and had ever been assigned classrooms in all three floors.

These background characteristics are reflective of the typical university lecturer and lecture theatre and are indicative of the fact that the respondents had a strong working knowledge of the facility in question and were therefore in the position to offer valid responses to questions on the facility.

Table 1: Statistics on ergonomic factors

Variables	Mean	Median	Mode	Standard deviation	Skew	
Ergonomics						
Comfort of seating	3.77	4	5	1.125		negative
Adequacy of seating for lecturer	0.00	0.00	0	0.000	0	
Adequacy of seating for students	3.790	3.000	2.000	2.483	0.427	positive
Ease of movement in rooms	7.350	7.500	8.000	1.167	-0.330	negative
Spaciousness of rooms	3.510	4.000	5.000	1.720	-0.576	negative

4.1 Ergonomics

The seating situation in the lecture theatre complex was generally thought to be below average by lecturers. Almost all the constructs under this category had mean scores below the 0.5 mark. The only exception was in the construct relating to ease of movement.

The mean score of zero (M=0) for adequacy of seating for lecturers is valid because the lecture theatre complex does not have any seating at all for persons teaching. None of the 13 rooms in the lecture complex has seating areas for instructors. The adequacy of seating for students is also ranked low (M=3.790; SD=2.483) because according to the respondents, a great number of the seats are destroyed and unusable. One respondent indicated: "They did not use good and durable seats for the lecture theatres, thus many of them are removed and it is uncommon to see students standing during lectures when the class is large".

The only construct that performed well in this category was the ease of movement (M=7.350; SD=1.196). The high mean score suggests that most respondents ranked it highly and the skew value of (-.330) suggests the distribution was characterized by typically high scores as demonstrated with the modal score being 8 (Table 1). A view of the few comments validates the scores. Comments included: "the rooms are very spacious", "the seats are well spread out", "there are large aisles between the sets of seats and this makes it easy for me to move around during teaching", and "the spacing in the room and the seats allows students to move about freely during group discussions".

4.2 Technology

Table 2: Statistics on Technological factors

Variables	Mean	Median	Mode	Standard deviation	Skew	
Functionality of microphones	3.12	0.000	6.000	2.342	0.000	
Functionality of overhead projectors	0.970	0.000	0.000	1.605	1.412	positive
Functionality of electrical sockets	3.580	4.000	5.000	1.843	-0.752	negative
State of electrical fittings	4.110	5.000	5.000	2.247	0.154	negative
Ease of use of electronic gadgets	4.660	5.000	5.000	1.085	-1.659	negative

The results suggest that the lecture theatre was not perceived as offering adequate technological support. This is because Technology was the single thematic area under which all the constructs scored low mean scores (Table 2). The score for functionality of microphones (M=3.12; SD=2.342) reflects that the respondents generally awarded low marks for this construct. Some comments included "the microphones are always locked" "we never get to use the microphones", "the microphones just don't work" "I once tried using them and there was a fault with it. It has since not been repaired".

Functionality of overhead projectors scored the lowest in the technology category (M=0.970; SD=1.605) and the comments may give an insight into why the poor ranking. One respondent said "I have never seen any overhead projector here", another wrote: "the overhead projectors have not worked in a long time". Yet another indicated: "It would appear that at some point the projectors were installed because I see wall mounts and switches but did not last very long owing to poor maintenance culture and misuse".

The functionality of electrical sockets (M=3.580; SD=1.843), state of electrical fittings (M=4.111; SD=2.247) and ease of use of electronic gadgets (M=4.660; SD=1.085) all scored low and recorded similar reasons. Common reasons for the low scores included: "The sockets are half broken and many do not work" "some of the sockets have exposed wires so I am afraid to use them", "the lighting system and the fans hardly ever work. It is frustrating teaching in such conditions"

4.3 Environment and Ambiance

Table 3: Statistics on environment and ambiance

Variables	Mean	Median	Mode	Standard deviation	Skew	
Wall décor	0.280	0.000	0.000	0.570	1.937	positive
Ventilation of rooms	4.340	5.000	5.000	1.472	-0.726	negative
Cleanliness of rooms	5.940	6.000	5.000	1.369	0.231	positive
Cleanliness of general environment	6.570	6.000	5.000	1.736	0.441	positive
State of washrooms	2.940	3.000	3.000	1.656	-0.188	negative

The environment and ambiance construct were one of uncertain fortunes. On the positive side, it had two constructs which had mean ranks above average- the only one of the three broad categories to achieve this, and on the other hand it had three of its constructs fall below the average scoring mark.

Wall décor scored the lowest in this category (M=0.280; SD=0.570) and the comments such as "the walls do not have any decorations", "the walls could use some nice painting" and "the paint colours do not match" may give insight into the reason for the low scores.

Ventilation of rooms (M=4.34; SD=1.374) also scored the 0.5 threshold. Some interesting comments that accompanied the scoring included "it is not comfortable to teach here, the air is not enough", "there seems to be a design defect. The high walls in these lecture theatres suggest these rooms were designed for air-conditioning but they are not available", "it gets very hot and stuffy especially during the afternoons. I prefer rescheduling my classes for early mornings"

Cleanliness of rooms (M=5.90; SD=1.369) was one of the two constructs which returned positive scores under the environment category and one of the three in all categories in the entire instrument. The reasons for the scoring include "the place is always clean" "the lecture rooms and its environs are always clean" "I have never come to meet a dirty room".

Cleanliness of the general environment ranked the second highest (M=6.500; SD=1.736). The key recurring themes in the numerous reasons adduced for the scores revolved around the following comments: "the lawns are well kept and always neat", "the cleaners do a good job to maintain the grounds and gardens", "on the outside, the place is really neat and clean". "I always see the cleaners sweeping and maintaining the lawns"

The state of washrooms was also nothing worthy of note. The mean value (M=2.90) shows that it was ranked very low by respondents. Again, the reasons varied from 'stinking washrooms' to 'poorly maintained washrooms' another also wrote: "most of the washrooms are not functional and I hardly ever use them when teaching".

5. Discussion

Generally, positive skew shows lower ranking while negative skews show a dominance of higher values (Field, 2009). The respondents were tasked to rank their views of certain attributes of the facilities. As will be noticed from Table 1, adequacy of seating for students, functionality of overhead projectors, cleanliness of rooms, wall décor and cleanliness of the general environment had positive skews, signalling the presence of generally low scores being assigned to such attributes.

The facility scored generally high marks in the areas of sockets, washrooms, electrical fittings, spaciousness, ventilation, and ease of movement in rooms. The results therefore suggest that the respondents ranked the general facilities higher than teaching and learning- specific facilities. Specific facilities are those that are more relevant to the practice of teaching and learning and these include microphones and overhead projector. In both cases, the facility was ranked low. Indeed, it can be gleaned from the comments that the facility does not have any such equipment.

The results suggest that the facility generally did not meet expectations of lecturers, save for three areas where the mean rating as higher than 0.5, the facility scored low in all areas of consideration but this situation is common in many developing countries. Similar findings have been made by Kategeka et al. (2018); Ndinragu and Udoto (2011); Adam and Shakantu (2016); and Oyedeji (2018). Academic facilities in developing countries often end up neglected and in lacking of major rehabilitation after a few years. This neglect has often been attributed to poor design, poor construction, and a poor maintenance culture (Kportofe, 2015). It is instructive to note that the extremely low scores namely, seating area for lecturers (M=0) and wall décor (M=0.280) are design-related. Consequently, issues of building design play an important role in the teaching and learning process (Woolner, 2015). It is often the case that building designs are inadequate because they do not consider future use or local context (Chen et al., 2018).

But it might not be entirely an issue of maintenance or design because in all the constructs where the facility was ranked high, the element of continuity was present. The three attributes which had average ranking above 5, namely, cleanliness of the rooms (M=5.940), cleanliness of the general environment (M=6.570) and ease of movement in rooms (M=7.350) all had something to do with maintenance albeit of a different form. The fact that both the exterior and interior are always kept clean can be attributable to a strong culture of cleanliness adopted by the university.

The data suggests that the C.A. Ackah lecture theatre complex largely did not measure up to expectations as a standard teaching and learning facility. The lecture theatre complex in question fell short in the areas of maintenance and technology but performed very well in terms of constructs related to cleanliness of both the interior and exterior surroundings. The facilities were the antithesis of healthy and secure facilities that can provide a stimulating/inspirational setting for the users, critical measures of quality facilities.

6. Recommendations

1. The university authorities should explore ways to either redesign the building for more ventilation or equip it with air conditioning to ensure better ventilation. As has been noted already, quality of ventilation is a major contributor to effective teaching and learning. Admittedly these options might

not be feasible because of funding constraints, thus, an alternative is to assign very small classes to these places or schedule the use of the building for early mornings or late evenings.

2. It might also be useful to set up a dedicated maintenance fund to be used to continually maintain the facilities, particularly the technology and the sanitary conditions. The typical university students today are members of the Generation Z demographic groups who has very short attention spans and are visual learners (Litice & Janmere, 2018). Such characteristics call for the provision of all relevant facilities such as projectors, projector stands, well-functioning sockets among others.

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