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Effective workspace design: imperative in resolving problem of increasing fluidity of knowledge-based academic activities in universities

Adenipekun, M. T., Ajibola, M. O. and Oluwunmi, A. O.

Department of Estate Management, College of Science and Technology, Covenant University, Ota, Nigeria.

martinsadenipekun@yahoo.com

Abstract. *Academic workspace is globally witnessing paradigm shift in designs in the contemporary time. This is as a result of the increasing fluidity of academic work in recent time and the requests emanating from industries for commercialisation of research findings. This has prompted the global attempts to standardize workspace designs particularly in knowledge-based work that contained many different activities. Benefits outlined in this new designs underline activity based work environments with outlined space utilisation and effectiveness. This paper expressed the fact that effectiveness of workers in universities depends on the adequacy and effectiveness of workspace provided. Against this background is this compares of the National University Commission (NUC) workspace standard in Nigeria with the International standards. This is with a view to improving the existing designs of Nigerian academic workspace. Data gathered from literature were used as International Benchmark to compare with the National University Commission (NUC) Benchmark. These data were analysed using tables. Findings showed that design of academic workspace in Nigerian universities is both environmentally and technologically below the contemporary time international requirements. This paper concludes that the situation of academic workspace design in Nigerian universities still leaves gap for improvement to meet international benchmark. It recommends that Federal Government of Nigeria (FGN) should encourage the adoption of minimum standard of academic workspace facilities that will compare favourably with international standard for better effective international research collaboration and job performance in universities. Managers, authorities of universities, academia, facilities managers, real estate managers, planners, designers, developers and investors in academic facilities to synergise and develop user-friendly workspace that can flow with the fluidity of knowledge work in academia.*

Keywords: fluidity, knowledge-base work, academic activities, workspace quality,

work modes, technological facilities.

1. Introduction

Space management especially in academics is currently attracting supports in debates of contemporary issues [6] and would for a long period of time be of relevance. This is because design of workspace is seriously impacted by changing technology and knowledge work requirements. Fundamentally, the purpose of developing many academic facilities is to provide effective workspace to improve user performance and ultimately increase productivity. This often time translates to institutional competency, efficiency, and increased value rating among higher education institutions in the world. Team work and interaction is presently found to encourage and promote innovation and creativity in knowledge work arising from inter-disciplinary needs and knowledge exchange currently common among industry and academia [23] [28] [15]. For this reason and many more, importance is given to collaboration and flexibility in workspace design. Similarly, effective functional workspace undoubtedly requires attributes of satisfaction, comfort, safety, security, wellbeing at work, and current technology. These attributes are contained in physical environmental factors' impact on effectiveness and functionality in academic building workspace [9]. As a measure to efficiency of academic workspaces, measure of space utilisation becomes inevitable.

2. Statement of research problem

Expectation from academics on their job effectiveness is enormous and increases every day as there are new innovations from new discoveries. New trend, method, technology, style, idea, application, and enquiry are required to be known, addressed and understood by academics to impart knowledge. This perhaps provides reasons underlining training and re-training of academics for effectiveness at work. Effectiveness of academics is therefore appraised by measure of performance achieved and the latter by the effectiveness of workspace allocated. Many of academic activities are 'session-time' based and should be accomplished within stipulated time frame. How effective is academic staff to meet up timelines therefore depends on the quality of workplace environment provided to operate. In other word, effectiveness of workspace as enabling environment for execution of academic assignments also becomes inevitable in the consideration of staff effectiveness and performance.

Studies have shown that academic workspaces are changing in recent times due to fluidity of academic activities and the diverse modes of carrying them out. The rate at which these changes occur depends on the rate at which technology in that particular area of discipline is changing. This has a very strong impact on learning environments toward space design for different combination of activity modes, as well as ownership control of space. This impact is well illustrated by Fisher's [13] learning environment matrix. The matrix explains the range and limit of control that can be exercised on spaces between low and high self-directive spaces as against the collaborative spaces for different activities.

For the purpose of achieving universal collaborative space benchmarks in researches and programmes, International Benchmarks have variously been set up by frontline universities across the globe over time [29] [30] [31] [18] [32]. For a similar purpose of setting minimum standard of academic work quality, the National University Commission [19] in Nigeria stipulated guidelines for every programme to meet approval for setting up. Yet, allegations are rife that some universities are rated higher than others among universities in Nigeria. A forum tagged 'CDWRN' Campaign for Democratic and Workers' Rights in Nigeria agitated for the arrest of decay in Nigerian education in

2006 [37]. It has also been read on media that Nigerians in academics overseas whether as students or tutors or researchers perform better outside Nigerian universities as a result of better facilities provided for teaching and research. NUC disqualified eleven Nigerian universities in 2016 for being substandard [26].

This study therefore employed the use of literature survey of the physical environmental condition of workspaces in Nigerian universities; compare the findings with other international universities in other countries of the world and come up with recommendations.

3. Review of literature

Workspace is associated with workplace environment and the later is conceptually adduced to area where work is simply carried out. Workplace environment therefore implies the physical environmental conditions in various facets of its social, psychological, and technical consideration of the total comfort of workers. This term is extensive and includes elements of organizational features, environmental conditions, ergonomic consideration of furniture, quality of work life and well-being at work [10] [25] [12] [33] [36]. Due to variability in meaning of workspace over time period, it cannot be constrained to the physical area (open or enclosed) where work is carried out. Workspace has been changing rapidly in meaning and interpretation as there are changes in office planning needs, economic pressures, and innovations within information and communication technologies [27] [35]. Workspace within the context of this paper examines the physical space provided for work to be carried out with the associated facilities that makes an effective enabling environment for work. This survey considers the physical environmental factors as very important to workers effectiveness at work [8]. Some of the common factors considered include natural lighting quality, room temperature, location of space, circulation layout within the room space, noise level, floor surface finishes, interior beauty, ventilation, room humidity, air quality, odour, air freshness, and electric lighting comfort [2]. Other factors are: cleanliness, overall comfort, physical security, work interaction, and crowding [16]; glare, auditory distraction, drafts and furniture configuration [7] and organisation workplace design, culture and policy [33] [36]. Epistemology of office furniture indicates a strong relationship between workspace and effectiveness at work [8] [18]. Fatigue, stress, physical and mental impairment that leads to slowness reaction, failure to respond to stimuli, incorrect mental actions, inability to concentrate, forgetfulness, decrease in vigilance, and increased tendency to risk taking is associated with inappropriate furniture in workplaces [11]. This in total impacts effectiveness of workspace to accommodate effective academic work.

According to Malcom and Zukas [17], academic work is conventionally divided into three elements: research, teaching and administration. The authors discovered that discipline; research, pedagogy and academic identity are inextricably fused together and are very significant to academic life. Furthermore, a temporal element is also found in academic experience and discipline. This is because specialisms in discipline diverge sometimes and strengthen, or converge sometimes and weaken; hence the workspace that would be required by discipline will change over a period of time as will the user of space. More of the reasons why academic workspace allocations present a peculiar understanding are the spatial aspect of space-time in relation to academic workload. Academic workload is significantly bounded by space and time divided between the classroom, library, laboratory, site, seminar, conference, the office and home. Technological impact on the 'going to work' and 'working' of academics demonstrated the ease of connecting departments, offices and homes together around the globe by 'flows of representations through the disciplinary web' [17].

Summary of some of the studies carried out on physical workplace environmental conditions of academic facilities in Nigerian universities indicated that a lot of issues relating to staff comfort,

ergonomics, well-being, and safety at work are required to be put in place for optimum effectiveness and productivity.

Okolie and Ogunoh's [22] study of academic buildings infrastructure performance in south east Nigerian universities did not meet specific physical environmental criteria used for their assessment and therefore failed to be effective to the institutions' goals. According to Adedeji and Fadamiro [1], all areas of workplace produce significant effect on workers' performance. In the case study, the author showed that there was no satisfactory result from the physical environmental factors assessed. This perhaps translates to imply that the workspace is very ineffective. Similarly, the study carried out by Aderonmu et al [3] involved four universities. None of the universities was found to meet the assessed level of effectiveness in all the environmental workspace effectiveness parameters. Some universities recorded good rating in lighting but very poor in ventilation or safety or security and vice-versa. The study of Animashaun and Odeku [8] concludes that suitable environmental conditions are required for effective working of employees but are not found in all Nigerian universities' workplace environments. Ajala [4] looked at the close office plan, clean and decorative office, lighting, noise in the office, room temperature, ventilation and open office design and recommended that authorities in organization should strive to create conducive workplace environment to be able to attract, keep and motivate workforce. The study carried out by Ajayi et al [5], focused on the suitability of academic staff work environment in the universities within Southwest Nigeria. The study was carried out to discover the truth against the claim that academic staff lack conducive work environment. The factors of assessment used in the study include availability of physical facilities, provision of information services, staff motivation, relationship between authority and staff, involvement in decision making and staff development. The authors recommended that management of the universities should give more attention to staff work environments so that staff can improve on their job performance. Amusa, Iyoro and Olabisi's [7] study investigated the work environments and job performance of librarians working within six Federal universities and six State universities in Southwest Nigeria. The work environment indicators employed for the assessment include availability of required physical facilities, open communication, motivation, participatory management, staff development and personnel emolument. Factors used for the assessment of job performance indicators include professional practice, contribution to development of the library, ability to work with co-workers, punctuality at work, ability to respond promptly to request from clients, communication skills and meeting minimum requirements for promotion (i.e. research/publication). According to the authors, the work environments of librarians are fairly favourable while personnel emolument was considered very unfavourable. The study concludes and recommends improvement on work environments to make them favourable so that job performance of librarians would also be improved. Adedeji and Fadamiro's [1] study explored the post occupancy evaluation (POE) of an academic building with a bid to assessing user's satisfaction of the office spaces. The variables of assessment used for the study were grouped into three categories. The building aspects consisted of 17 variables which are vehicular access, pedestrian access, physically disabled access, exit routes, fire safety, security exterior beauty, interior beauty, stairways location, and interior signage. Others are external appearance, parking, cleanliness, speed and efficiency of maintenance service, water quality, waste removal, and landscaping. The second category is the work environment focusing the layout and the furniture. 27 variables were used in the study. This include distance between other areas, distance between the worker and the immediate supervisor, workplace size and arrangement, space available for material storage, visual privacy at workstation, telephone privacy at workstation, height of partition at workstation, furniture comfort, type of chair, chair possibility of adjustment, ease of adjustment, location of meeting rooms and space for formal meeting/ space for informal meeting. Others are space for file storage, personal storage area, location of printing area, hallway characteristics and location, stairway characteristics and location, access and circulation for physically disabled, distance between worker and equipment making noise, speed and efficiency of technical maintenance cleanliness of the floor, fire safety, security against theft, and distance between worker and the work-mates. The third

category is the environmental comfort and was assessed with nine variables consisting the temperature, humidity, air quality, ventilation, odour, natural lighting quality, air freshness, air movement, and electric lighting comfort. In summary, the study discovered that certain elements of the building design very crucial to effective performance and productivity of users were sacrificed for aesthetics. A satisfactory level of indoor environmental comfort was not achieved. So also, the expected satisfactory level of indoor air quality seemed to have been sacrificed for high value landscaping achieved. The study therefore recommends that suitable balance between the form, functions and aesthetic performance of academic buildings be given prime consideration at the design stage. The work of Ogedengbe [21] further expressed the comfort standard of Nigerian university libraries compared with internationally accepted standard. The study used the air temperature, relative humidity, sound levels and lighting intensities of different locations as variables of measurement to carry out anthropometric measurement of five hundred and twenty six library users to determine the ergonomic support parameters of furniture provided in the library. Findings from the study showed that many of the factors considered fall below the internationally set standard. The authors therefore recommend conduct of ergonomic studies, their application to design of structure and facilities so that users are not affected by musculoskeletal disorder in the use of libraries.

O 'Neill and Wymer [23] illustrated the fluidity and dynamism currently experienced in the breadth and location of both the contemporary and future nature of work. It can be observed that there is diversity of space solution to support the flow of work both within and between locations. Academic activity is caught succinctly within this web and a very lucid example of rapidly evolving modes of work. Gensler [14] presented a model of work modes as consisting collaboration, learning, focusing, and socialising. The model is as shown below:

Figure 1: Model of Activity Modes in Academic Knowledge Work.
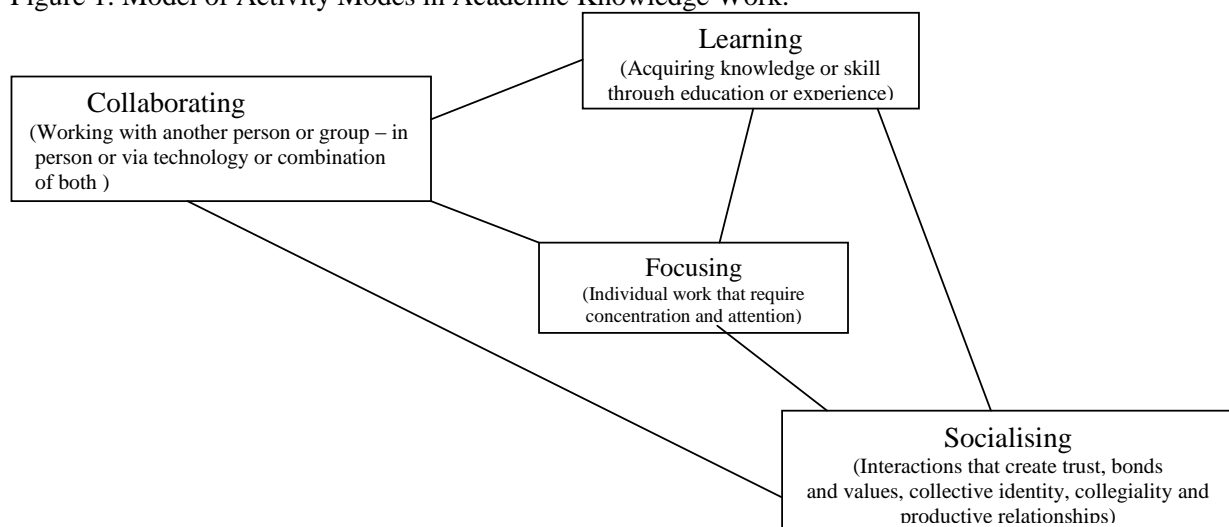
Source: Adapted from Gensler [14]

This model exhibits the interrelationship of academic activity modes which are not created equal. Consequent upon this fact, Gensler attempted getting Workplace Performance Index (WPI) for various work patterns and work environments. Gensler [14] discovered that it was not easy to assign WPI because workplace in its past and current designs of open office, cubicles, cellular or closed private offices, linear workspaces, and bench workplaces are not adept at supporting the fragile balance existing between the various modes (Figure 1). Therefore, the desire for effective allocation of space for knowledge work activities in the contemporary time design of academic building is to endeavour a place that will balance spaces for knowledge workers to engage in extended periods of uninterrupted focus work with ability to seamlessly engage in informal, formal and virtual collaboration.

NUC [20] provides the space requirement in (Table 1) among others to run programmes in Estate Management in Nigeria:

Table 1: Typical Space Allocation Benchmark for Programmes in Nigerian universities.

Items required	Undergraduate Programme	Postgraduate Programme
Physical Facilities: For effective running of each programme, Dean's and HOD's offices must be provided with adequate facilities.	Accommodation: (m^2) Professor's Office 24	Accommodation: (m^2) Professor's Office 18.50
		HOD 18.50
	HOD 24	Tutorial/ Teaching} Staff's office } 13.50
	Senior Lecturer 16	Tech. Staff Space 7.00
		Secretarial Space 7.00
	Lecturer 12	Seminar space} per student } 1.85
	Assistant Lecturer 8	
	Snr. Admin Staff 12	Adequate Classroom Exam. Halls/Theatre with Enough chairs and Tables.
	Junior Tech. Staff 5	
	Studio Space 4 per student	
	Lecture Space 0.5 per student	
	Seminar space 0.5 per student	

Source: NUC, 2007 & 2013.

Table 2: Typical Space Allocation Benchmark for Academic Institution in U.S.

Position	USF	CONFIGURATION
President	400	Private Office
Vice President	300	Private Office
Dean	240	Private Office
Department Chair	160	Private Office
Administrative Manager	100-160	Shared Office or Cubicle
Support Staff	64-100	Shared Office or Cubicle
Student Staff	30-64	Shared Office or Cubicle

Source: AMA [6]

Table 3: Typical Space Allocation Benchmark for Administrative Workspace UND.

Position	Range of	Private

	Primary Workspace (sf)[*]	or Open Space
Members of the Officers' Group and Deans' Council	180-250	Private
Associate/Assistant Dean/Registrar	165-180	Private
Associate/Assistant Provost	165-180	Private
Associate/Assistant Vice President	165-180	Private
Department Chair Endowed Chair at full professor level	165-180	Private
Executive Assistant to an Officer, Executive Director, Head Coach, Senior Advisor to an Officer, Senior Associate Athletic Director, and Senior Director[*] *Depending on work function of Senior Director, this category may fall into the open work category below with the range of 36-120 s.f open space*	150-180	Private
Associate/Assistant Department Chair	150-165	Private
Faculty - Regular Full-Time; Tenure/Tenure Track -SPF (special professional faculty)[***] -Research Faculty[***] -Library Faculty[***] -Visiting Faculty[***]	120-150	Private
Accountant, Administrator, Advisor[***], Analyst, Achivist, Associate Director, Assistant Director, Athletic Trainer, Business Manager, Business Partner, Cataloger, Chief Pilot, Coach, Consultant, Coordinator, Counselor[***], Crew Leader, Librarian, Curator, Developer, Director[*], Editor, Engineer, Manager, Processor, Project Manager, Specialist, Supervisor, Technician, Trainer, Writer, and other similar administrative positions *Depending on work function of the Director, this category may fall into the open work category below with the range of 150-180 s.f private workspace category above*	36-120	Open[**]
Officer Assistant, Administrative Assistant, Senior Administrative Assistant, Senior Staff Assistant, Staff Assistant, Assistant, Clerk, Receptionist, and other similar administrative positions	36-80	Open
Student Worker	20	Open

  Source: Adapted from University of Notre Dame [30].

Table 4: Typical Space Allocation Benchmark for Workspace in University of Cincinnati.

Job Categories			Closed Office	Open Office
Administration	**Academic/Research**	**Athletic**	**NASF**	**NASF**
Executive V.P.	Provost	Athletic Director	300	
Associate V.P.	Vice Provost/ Dean		250	
Assistant V.P.	Associate Dean Associate Provost		220	
	Assistant Dean Faculty Dept. Head Division Chair	Associate Athletic Director	180	
Director		Assist. Athletic Director Head Coach	150	
	Full-time faculty		100-150	
	Part-time faculty		75 (shared	

			150 sq.ft)	
	Emeritus *	*	*	
Professional Assoc. Director Assistant Director	Assistant Coach		96	
Staff	Part-time faculty Research Assistant Teaching Assistant			

Source: Adapted from University of Cincinnati [29]

* Emeritus faculty office space is determined on its merit between department head, campus planning and design and the administrative space committee.

Table 5: Typical Space Allocation Benchmark for Workspace in UNSW, Australia.

Office and Open Plan Standards			
s/n	Position	Type	Size (m^2)
1	Head of school or equivalent	Office	12-18
2	Academic Levels B-E	Office	10-12
3	Research Fellow, Post Doctorate Fellow	Dedicated open-plan	6
4	Research Associate	Open-plan	6
5	Professional and Technical 10+	Open-plan (typically) / Office (demonstrated need)	6 10-12
6	Academic Level A	Open-plan	6
7	Visiting and Emeritus Academics	Dedicated Open Plan	6
8	Professional and Technical Staff Level 1-9	Open-plan	6
9	Research Assistant	Open-plan	6
10	Postgraduate Research Students	Open-plan	3

Assumptions:-

(i) Circulation space is excluded.

(ii) Allocations are based on full time equivalent positions or students.

(iii) Ancillary, support or storage: defined case by case, should be always minimal, centralized and shared.

Source: Adapted from University of New South Wales [31]

Table 6: Typical Space Allocation Benchmark for Workspace in UNSW, Australia.

Laboratory and Studio Standards				
s/n	Position	Type	Size(m^2)	Notes
1	Academic Staff	Laboratory	16	
2	Research Staff	Laboratory	8	
3	HDR Student	Laboratory	4	Only for duration of active experimental work
4	Honours Student	Laboratory	2	Typically allocated for a short period of time during experimental work only.
5	Design and Drawing Studios	Teaching studio	4	
6	All others e.g. Honorary, companies, consultancy work.	Laboratory or Studio	0	Must utilize existing resources with the consent of the Dean. There is no entitlement

Assumptions:- as per Office and Open-plan Standards, plus:

(i) Laboratory space is calculated by adding the allocation for each person using the space e.g. an academic with four PhD students would be allocated $32m^2$ of laboratory space ($16m^2 + 4x4m^2$). This is in addition to the office and open-plan allocations.

(ii) The standards are for high level of space planning. They apply to staff or students who actively need research laboratory space only.

Source: Adapted from University of New South Wales [31]

4 Analysis of Findings from the various field surveys and Discussion

From the results of indigenous studies carried out on workplace environment of higher institutions in Nigeria, it was evident that no single study reported a wholesome comprehensive and excellent environmental and technological adequacy of factors and variables of quality assessment. The reports have always showcased fairly well in some parameters and in some others a poor remark. Even the international benchmarks in academic workspaces vary from one country to another (Table 1 to Table 6). This is to say that there is yet to be a universally accepted benchmark for academic workspaces for reference.

5 Conclusion and recommendations

The impact of technology on knowledge-based work has created distinct diversity of academic activities, operationally grouped into basically four main modes (Figure 1). Academic work is caught up within this knowledge-based work and is therefore fall within collaborative, focus, learning, and social work activities. These academic activities are daily evolving and with new innovations in technology are going fluid naturally. This study therefore recommend that concept of integrated work be applied to design of academic workplace to make it dynamic in meeting the needs of the different work modes. This is in tandem with the submission of O 'Neill and Wymer [23] that successful organisation should create a diversity of space solutions that support the flow of work within and between locations.

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