



# EFFECTS OF ERGONOMICS ON PERFORMANCE OF ACADEMIC STAFF IN SELECTED TERTIARY INSTITUTIONS IN LAGOS STATE

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## I.INTRODUCTION

The performance of human resources in organisation mainly depends in the global technology and external environment system as an employee being one of the most important assets of any organisation ( Azam, 2023; Walters and Rodriguez, 2017 & Gabčanová, 2011) and the quality of output of the organisation depends mostly on the efforts of the human resources (International Labour Organisation, 2011; Kenny, 2019). With positive and creative contributions from employees, the quality of the output of an organisation has an immense competitive advantage over its competitors. But the physically uncomfortable workplace and environment, most workers are exposed to mental stress that affects their productivity in the short or long period as identified by Exemplis Corp. (2014), especially within the academic system. It was also stressed that such a working environment can lead to the development of health-related issues like musculoskeletal disorders (MSDs) among staff in the organisation.

To improve such an uncomfortable workplace and environment and meet up with the present day competitive environment, management will need to take some strategic decisions to improve the performance of its human assets (Gabčanová, 2011). One of these decisions is to develop a working system that will fit the job to an employee, rather than the employee to the job (Computer/Electronic Accommodations Program-CAP, 2012). This strategic innovative management decision is a Human Factor Engineering concept known as Ergonomics. This is to improve the well-being, safety, and efficiency of workers by fitting the environment to them and not the other way around (Ergo Squad, 2012). It also improves the flow of work within an organisation. However, this study observed that the implementation of ergonomics policies in many organisations shows some deficiencies. For example, most organisations like Lagos State University order furniture fittings with uniform size without regard for the anthropomorphic data of individual employees of the organisation. This may have adverse effects on some of the employees who sometimes have to adjust their sitting positions to reduce stress. Thus, stakeholders as identified by Exemplis Corp (2014) advocated for employee input whenever office furniture fittings are to be replaced or whenever any physical environmental changes are needed. This is because a working environment without ergonomic inputs can lead to the development of Musculoskeletal Disorders (MSDs) among staff in an organisation. This disorder was recognized as the most prevalent of all safety issues in the Nigerian agriculture sector (Obi, 2015). This could invariably reduce the efficiency and performance of employees.

In ergonomics, the workplace or work environment of the human factor is designed to satisfy the goals of well-being, safety, and profitability (International Ergonomics Association-IEA, 2017). It involves the scientific use of human data to design a workstation, work center, or working environment to create a job-friendly environment for an individual employee in terms of improving the well-being, safety, and efficiency of workers that fit the environment and not the otherwise (Ergo Squad, 2012).

Ergonomics focuses on three broad domains: physical, cognitive, and organisational (Institute of Industrial and Systems Engineer, 2021). Werezak (2021) believes that when examining the physical nature of employees in physical ergonomics the focus should be on how to prevent injuries, increase productivity, reduce errors, and invariably improve quality. Werezak further states that:

*“This can be accomplished by evaluating and designing workplaces to make safety a top priority while ensuring jobs and tasks are completed as efficiently as possible. This includes assessment of physical*



*activities such as repetitive movements, postures and body positions, and manual tasks performed. It also includes examining how people use their bodies to work with the equipment, tools, and other people to perform daily tasks”.*

Thus, just like many researchers-Liravi and Baradaran (2019) and policymakers in the field of ergonomic study shall examining physical ergonomics in terms of workplace design since the desire is to improve the visible workplace and environment. For example, within organisations like the academic’ system in Nigeria, the National Universities Commission (NUC), an advisory agency established by the Federal Government in 1962 carry out periodic accreditation exercises to assess the state, the quality of the academics’ workplace and its environment. To determine if each University under observation provides the minimum standard required for learning during the accreditation exercises, the management policies are more on physical ergonomics, as the commitment towards improving the structural design and furniture of the employees’ workplace and its environments suitability for academic activities. Hence, most ergonomic products and services fall into the field of physical ergonomics. However, just as Amit, Nancy, and Laurel (2012) noticed in other organisations, the focus during the accreditation exercise does not take into consideration the interaction of humans with their workplace which may consist of identifying the relationship between job physical risk factors and physiological responses-cognitive ergonomics. But, the rapid migration to the automated workplace and project-based systems in the fields of cognitive ergonomics and organisational ergonomics (OE) is recently gaining prominence. Others issue and challenges that are peculiar to the performance of academic staff in tertiary institution in Nigeria.

Public universities are owned by the government and it was established by the act of parliament to serve the interest of the general public, with the provision for teaching, research work and community services (Ogunode, (2020). According to Ogunode and Adah (2022) revealed that public universities in Nigeria are grouped into federal and state-owned universities. The federal universities are owned by the federal government of Nigeria while the state universities are owned by the state government.

The federal government of Nigeria established the National Universities Commission (NUC) to oversee the external administration work and supervision of all universities in Nigeria. The NUC is empowered by law to lay down Minimum Academic standards (MAS) for universities in the Federation and to accredit their degree programs. This led to the preparation, with the use of experts, of the Minimum Academic Standards for the 13 disciplines taught in Nigerian Universities in 1989 (NUC). Accreditation of degree programs by the NUC is a system of evaluating academic programs in Nigerian universities to ensure that they meet the provisions of the MAS documents. The objectives of accreditation of academic programs are to, ensure that the provisions of the MAS are attained, maintained and enhanced by the institutions.

The main objectives of accreditation of higher institutions programs as outlined by the NUC include:

- i. To ensure that at least the minimum academic standards documents are attained, maintained and enhanced,
- ii. To assure employers and other members of the community that Nigerian graduates of all academic programs have attained an acceptable level of competency in their areas of specialization,
- iii. To certify to the international community that the programs offered in Nigerian universities are of a high standard and their graduates are adequate for employment and further studies.

Ogunode and Adah (2022) examine the various challenges that affect the academic programme during the accreditation exercises in the public universities in Nigeria. Some of the challenges are inadequate funding, poor preparation, inadequate academic staff, shortage of infrastructure facilities, insecurity problems, strike actions and corruption in Nigerian public universities. Ogunode and Adah (2022) concluded that solving these issue and challenges, the government should provide sufficient funded to the public universities, prepare for academic programme accreditation exercise, employment of adequate academic staff, provision more infrastructure facilities, adequate security in the universities, government should implement the agreement signed with various union groups in the universities and corruption within the universities should be addressed through the use of anti-corruption agencies.

The rules and regulation that guides the academic system and administrative activities of the university is based on the NUC guidelines with the domicile and an operating within the university. In spite of the arrangement for effective administration work in Nigeria universities by the government and management and public universities institutions remain pose and enormous challenge to the government. This situation concerns both the policymakers and academicians in any institutions.



Hence, the aim of this study is to examine how ergonomics affects the performance of academic staff in selected tertiary institutions in Lagos State.

The study thus, tested the hypothesis:

What is the effect of workplace design ergonomics on work-related disorders, and ergonomics on performance of academic staff in selected tertiary institutions in Lagos State, in other to shed light on the study research questions?

H<sub>1</sub>: Workplace design ergonomics does not have a significant effect on work-related disorders of academic staff in selected tertiary institutions in Lagos State?

H<sub>2</sub>: Ergonomics does not have a significant effect on performance of academic staff in selected tertiary institutions in Lagos State? Should be a statement so as to be proven positive or otherwise and not a questions.

## II. CONCEPTUAL CLARIFICATIONS

Let have a conceptual framework instead of this which should come after the theoretical framework and rename this area as literature review.

The study variables – ergonomics, performance, workplace design and work-related disorders are critically examined in this section;

### 2.1. Ergonomics

According to Phesant (as cited in Terek, Sajfert, Zorić, and Isakov, 2014), ergonomics was derived from two words “*ergo*” which means work and “*normia*” which means laws. To Occupational Safety and Health Academy (OSHA) (2017), ergonomics involves the designing of workstations, work practices, and workflow to fit the employees’ capabilities. It also involves a design that reduces risk factors that may contribute to common work-related injuries and illnesses, such as sprains and strains and cumulative trauma disorders (CTDs). These are common employees’ safety issues that occur as a result of accumulated strain on the employee for some time (Grainger, Forest, and Hamilton, 2013). For example, the design of workspaces that make employees work in awkward postures or portions at all times may result in the excessive effort, fatigue, and discomfort for the employee. These conditions may cause damage to some of the body components such as muscles, tendons, ligaments, nerves and blood vessels. Such Injuries are known as musculoskeletal disorders (MSDs) (Occupational Safety and Health Academy, 2017).

Ismaila (2010) adopted the International Ergonomics Association (IEA) (2000) concept of ergonomics. The concept expressed ergonomics as:

*a scientific discipline concerned with understanding of the interaction among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.*

Ergonomics is also expressed as a holistic approach in which considerations of physical, cognitive, organisational, environmental, and other relevant factors are taken into account to enhance the design and evaluation of tasks, jobs, products, environments, and systems to make them compatible with the needs, abilities, and limitations of employees (International Ergonomics Association, 2017). This new concept also shows that ergonomics is not limited to the improvement of the individual employees alone but an improvement in organisational performance.

### 2.2. Physical/ workplace Ergonomics

According to Khayal (2019), Physical Ergonomics examines the anatomical, anthropometric, physiological and biomechanical parameters in static and dynamic physical work. This includes the design for physical postures of the worker during work, and the possible health related issues that can arise in terms of fatigue and musculoskeletal disorder. That is, the study of a workplace system design which is the physical industrial system that a person(s) perceives and controls through the mediating interaction to identify the challenges that can impede performance and productivity for improvement.

### 2.3. Performance

In Management Sciences, usage of the term and its conceptualisation is a very fragile action. This is because individual stakeholder has his/her own perception that is peculiar to their own area/field of management. For example, while medical personnel may view performance in term of rate of patients attended to, others may view it in terms of number of patients that have recovered to an acceptable healthy condition.

Âta et al.(2017) from the oxford English dictionary considered the linguistic form of performance, to be as how well or badly something is done or how well or badly something works, it is also defined as the act or process of performing a task or an action. while the verb perform means to work or function well or badly.



## 2.4. Work-Related Disorders

Work often exposes employees to physical and mental health risks that could be both immediate and longer-term. And organisations, even the academics need to manage such exposure to health risks created by work (e.g. ensuring the long term standing posture of lecturers during lecture does not lead to ill-health), and the possible outside environmental factors that possess the likelihood to impede an employee's ability to safety at work (Hayley *et al.* 2018). Hayley *et al.* (2018) also noted that the effects of work on health, and health on work, are interrelated. An academic that is regularly exposed to students' noise at workplace may be exposed to physiological and emotional stress leading to a potential fatigue. Fabrizio *et al.* (2020) stressed that work-related disorder affected about a third of the worldwide population representing one of the most important causes of health challenges that reduced productivity and quality of life.

## 2.5. Theoretical Framework

The hypotheses based on the Kumar's Theories of Work-Related Disorders theories involved in each domain of ergonomics development and human well-being, that was used to evaluate the effect between workplace design and work-related disorders of academic staff. The Kumar (2001) as cited by Karsh, (2006) identified four theories of work-related disorder in the ergonomics design of the workplace, namely multi-variate interaction theory, differential fatigue theory, cumulative load theory, and the over-exertion theory. Though he noted that, what leads up health related risk or impede employee wellbeing may originate from any of the theories. An examination of multi-variate interaction theory shows that the interactions among elements that impede on employee's wellbeing such as genetic, morphological, psychosocial and biomechanical could result in strain, structural changes and invariably pain.

The differential fatigue theory is the critique of the tasks loading on different parts of individual worker's joint(s) and muscles as a result of the workplace environment design. This may be because the allowable adjustment in the workplace design may be inadequate to cause a loading that is not proportional to the body capacity. Such scenario in the short run may lead to fatigue while in the long run, if the workplace design is not replaced, it may lead to a more serious work-related health issue(s).

The cumulative load theory also seen in the model of the popular wear and tear injury model, of which body tissue is capable of self-repairing. However, Kumar (2001) noted that repeated loading as a result of anything like level of allowable adjustment of the workplace, overtime may degenerate to serious work-related health issues.

The last of the theories is the '*over-exertion theory*'. Simply put, this theory of work-related disorder denotes an exertion mechanism, which was defined as a function of force, duration, posture and motion that exceeds the limits of tissue, could cause the tissue to fail

## III. RESEARCH METHODS

This study adopted descriptive research designs. The study population is four thousand two hundred and sixty-nine (4,269) academic staff in selected tertiary institutions in Lagos State. While using Yamane (1969 as cited by Anokye, 2020), a sample size of three hundred and sixty-seven (367) was drawn. The sample was stratified as shown in Table 3.1 such selected institution was represented. As identified earlier in the study, scope and limitation, convenience sampling technique was used to choose Lagos State because of accessibility and proximity, cost, and time constraints. While purposive sampling techniques was used in each stratum to elicit information from those willing, relevant to the objectives of the study, and will return the questionnaire within an acceptable time.

A five-point Likert scaled questionnaire was designed for data collection to establish how employees' performance and health are affected by ergonomics in the academic environment. Copies of the questionnaire was taken to the office and distributed to the staff with minimal persuasion or posted online through emails and other relevant social media within four weeks.

Descriptive statistics and inferential statistics with the aid of a statistical software called IBM SPSS (Statistical Product and Service Solution) was used to analysed the data collected.

Yamane Formula.

$$n = \frac{N}{1 + N(e)^2}$$

Where **n** is the sample size,

**N** is the population size which is 4,269 and



e is the level of precision. Taken to be 5% in this study  
 Applying this formula, we get  $n = 4269 / (1 + 4269(.05)^2)$   
 $= 4269 / (1 + 4269(.0025))$   
 $n = 365.73 = 366$

The result is approximated to the nearest whole number. For example, for Lagos State University, the sample was  $(712/4269) * 366 = 61.04$  this is approximate to 61.  
 The final summation of the sample size column resulted in 367. Since this figure is higher than the 366 from the Yamane formula it can represent the system adequately.

**Table 3.1: Distribution of Samples in Strata**

S/N	Institution	Number of Academic Staff		Sample
		N	Source	N
1	Lagos State University	712	Registry office	61
2	Lagos State University of Science and Technology	738	Ministry of Education	63
3	Lagos State University of Education	358	Registry office	31
4	Yaba College of Technology	713	Registry office	61
5	Caleb University	79	Ministry of Education	07
6	Anchor University	43	Ministry of Education	04
7	University of Lagos	1627	Ministry of Education	140
<b>TOTAL</b>		<b>4269</b>		<b>367</b>

Source: Researcher (July,2022).

#### IV. DATA ANALYSIS AND DISCUSSION OF FINDINGS.

##### Test of Reliability

The reliability of the research instrument –the questionnaire was tested for internal consistency using Kaiser-Meyer-Olkin (KMO) and Bartlett. The KMO value of 0.719 and a significance level for the Bartlett’s test is 0.05 suggests a substantial correlation in the data. Variable collinearity indicates how strongly a single variable is correlated with other variables. The result of the Bartlett’s Test of Sphericity Approximation Chi-Square value of 232.764 implies that the sample size used for the population is sufficient for the study.

**Table 3.2: KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.719
Bartlett's Test of Sphericity	Approx. Chi-Square	232.764
	Df	28
	Sig.	.000

Source: Researcher’s Computation (July,2022)

##### Analysis of Hypothesis One

**Hypothesis one: Workplace design ergonomics does not have a significant effect on work -related disorder among academic staff in selected tertiary institutions in Lagos State.**

**Table 3.3: Model Summary of Workplace Design Ergonomics and Work-Related Disorder among Academic Staff in Selected Tertiary Institutions in Lagos State.**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1		.730 <sup>a</sup>	.533	.574651375856

a. Predictors: (Constant), PE<sub>3</sub>, PE<sub>2</sub>, PE<sub>1</sub>

b. Dependent variable (DV): Work-Related Disorder

Source: Survey (2022)



**Table 3.4: Analysis of Variance Result for Hypothesis One**

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	130.757	3	43.586	131.988	.000 <sup>b</sup>
	Residual	114.588	347	.330		
	Total	245.345	350			

a. Dependent Variable: WRD

b. Predictors: (Constant), PE<sub>3</sub>, PE<sub>2</sub>, PE<sub>1</sub>

Source: Survey (2022)

The model summary of the regression analysis model for hypothesis one depicted in the table 3.3 above shows that there is a positive relationship between the workplace design ergonomics and work-related disorder among academic staff in the selected tertiary institutions in Lagos State ( $R = 0.730$ ), and the Adjusted R-squared is 0.529 which means that, 52.9% of the variability of work-related disorder is accounted for the model, considering the number of predictor variables design flexibility of workstations to fit into height, weight and body type in the model. This result is statistically significant because the p-value of the result (0.000) was less than 0.05 level of significance used for the study. Therefore, the research hypothesis one rejected. This implies that workplace design ergonomics has a significant effect on work-related disorder among academic staff in selected tertiary institutions in Lagos State.

The ANOVA table shows that the computed F statistic is 131.988 with an observed statistical significance level of 0.000 which is less than 0.05. The regression model statistically significantly predicts the outcome variable. This, therefore, further strengthens the rejections of the research hypothesis one, which implies that workplace design ergonomics does not have significant effect on work-related disorder among academic staff in selected tertiary institutions in Lagos State.

**Table 3.4: Coefficient Table between the Independent-Physical Ergonomics/Workplace Design- and Dependent Variable- Work-related Disorder**

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.153	.090		12.797	.000
	PE <sub>1</sub>	.220	.055	.276	4.014	.000
	PE <sub>2</sub>	.124	.045	.175	2.781	.006
	PE <sub>3</sub>	.286	.034	.386	8.323	.000

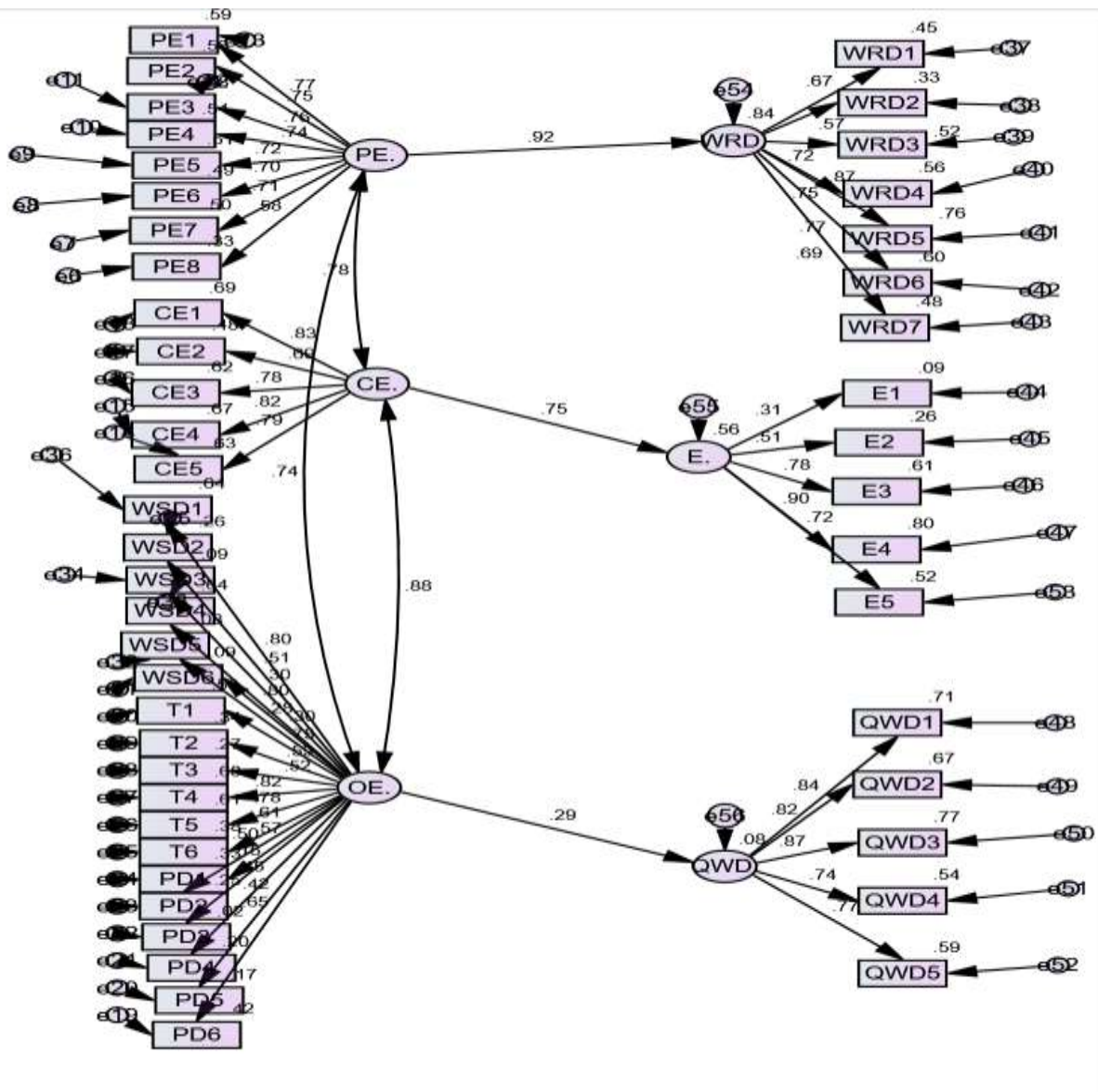
a. Dependent Variable: WRD

Source: Survey (2022)

The Beta **Coefficients** table presents the standardized between the independent variable and the dependent variable. An evaluation of the standardized coefficients of design flexibility of workstations to fit into height, weight and body type in the coefficient table and its associated p-values show that the design flexibility of workstations to fit into height, weight and body type ( $\beta_{PE1} = .276$ ,  $\beta_{PE2} = .175$ , and  $\beta_{PE3} = .386$ ,  $p = 0.000$  and  $0.006$ ) are statistically significant and this can be used in predicting Level of Reduction in Work-related Disorder among academic in the selected institution in Lagos state, Nigeria.

### A Structural Model

To test the hypotheses two, it requires the structural model linking the constructs together to test the influence of workplace design ergonomics on work related disorders, cognitive ergonomics on effectiveness and organisational ergonomics on quality of work delivery of academic staff in selected tertiary institution in Lagos State. The structural model is displayed in figure 4.1.



**Figure 4.1: Structural model on hypothesis two**

Source: Survey (2022)

The structural model results show in the figure above that the standardized effect linking workplace design ergonomics on work-related disorders, cognitive ergonomics on effectiveness and organisational ergonomics on quality of delivery was ( $\beta = 0.92$ ,  $\beta = 0.75$ , and  $\beta = 0.29$ ,  $p < 0.05$ ) and the outcome is statistically significant but the direct influence of organisational ergonomics on quality of work delivery is not statistically significant.

### V. DISCUSSIONS OF FINDINGS

The results from testing the hypothesis above shows that there a positive relationship (73%) between workplace design ergonomics and work-related disorder among academic staff in selected tertiary institutions in Lagos State. This result agrees with the outcome of the study of Lennart *et al* (2015); and Anne and Karl (2017) as identified that provide scientific based evidence to convince management of organisations on the need to key ergo-friendly furniture and equipment in the design of the workstation, i.e., adjustable furniture and equipment to fit the working comfort of the employees. It can be noted that some of the recently supplied furniture to the selected institutions exhibit some level of adjustment and flexibility to height, and body types.

The hypothesis two was tested using the structural model. The results indicate that ergonomics has a direct influence on performance ( $\beta = 0.18$ ,  $\beta = 0.49$  and  $\beta = 0.17$ ,  $p < 0.05$ ) and the outcome results is statistically significant. This study therefore rejected the null hypothesis four and the alternative hypothesis which states that



there is a significant effect on ergonomics and performance of academic staff in selected tertiary institutions in Lagos State is accepted and supported by the outcome of the findings.

## CONCLUSION AND RECOMMENDATION

This study assessed ergonomics and the performance of the academic staff of selected tertiary institutions in Lagos State.

The study concluded that the main focus of the policies implemented by the management of the institutions in Nigeria is on the workplace design to meet the NUC minimum required standard. With relatively low attention given to cognitive and organisational ergonomics in present policies implementation, the ergonomics initiative does not have a strategic balance to optimise the performance of academics. This means that the management of the knowledge-based institution should implement more ergo-friendly policies to have the strategic balance to drive the optimal performance from their human resources.

Thus, management of the institutions should strategically balance their ergonomics decision policy by identifying which indicators will cause a significant change in the performance of academic staff in Nigeria.

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