Assessment of the Impact of Lecture Theatre Seat Design on Student Comfort and Academic Engagement at Ladoke Akintola University of Technology Ogbomoso

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Abstract- ***Seat design in lecture theatres plays a crucial, but often overlooked role in shaping students' comfort, focus, and academic performance. This study investigates the impact of lecture theatre seat design on student comfort and engagement at Ladoke Akintola University of Technology (LAUTECH), Ogbomoso. Adopting a deductive, quantitative research approach, data were collected through a set of structured questionnaire, field observations, and seat dimension measurements. Multistage sampling technique was adopted and a total of 376 students were selected for the study. Data collected were analysed through frequency counts, percentages and mean scores to arrive at the ergonomic adequacy of the seats. Findings reveal moderate student comfort (average mean score: 1.99) with varying satisfaction levels for ergonomic features: backrest support (TWV/f: 2.11), seat width/armrest placement (TWV/f: 2.06), lumbar support (TWV/f: 1.94), and seat height (TWV/f: 1.77). Students preferred seat dimensions of 500mm width (30.1%), 500mm height (38.0%), and 500mm legroom (42.8%). The study underscores the urgent need for ergonomic reforms in lecture theatre furniture, recommending adjustable, anthropometrically-informed, and user cantered designs. Regular ergonomic assessments and active student participation in seating selection are also advocated to increase comfort, well-being, and academic success in higher education environments.***

Index Terms- ***Ergonomic seat design, Student comfort, Academic engagement, Lecture theatres, Lautech.***

I. INTRODUCTION

The design of learning environments is a physical reflection of an institution's educational philosophy and its commitment to student success. Ideally, these spaces should be inclusive, promoting active participation from both learners and educators in their design and functionality. However, in reality, decisions concerning educational spaces are often made without sufficient input from the primary user's students and lecturers leading to environments that may not fully support learning needs (Eugene and Melanie, 2013). Among the critical physical elements that shape educational outcomes, the design of lecture theatre seat stands out as a major factor influencing student comfort, cognitive focus, and academic engagement.

Ergonomics, the science of designing spaces to meet human needs effectively (Mohamed, 2010), plays a crucial role in educational settings where students are required to remain seated for extended periods. Proper ergonomic seat design supports good posture, reduces physical discomfort, and sustains attention during lectures and learning sessions (Patron, 2013). Well-designed seats can minimize musculoskeletal problems, such as back pain and neck strain (Ajayi, Joseph, Okanlawon, and Odunjo, 2015), and increase an environment where students are better able to engage with learning materials, participate actively, and maintain cognitive performance over long periods. Conversely, poorly designed seat contributes not only to physical discomfort, but also to mental fatigue, diminished concentration, and a significant drop in academic engagement and productivity (Nse, 2014).

Lecture theatres, as primary venues for formal learning in higher education, must be carefully designed to meet both ergonomic and academic needs. The design of seats in these spaces should accommodate a variety of academic activities including listening, note-taking, and collaborative discussions while also recognizing the diversity of student body sizes and ergonomic requirements. However, in many developing countries, Nigeria inclusive, lecture theatre furniture is often poorly adapted to these demands, leading to discomfort and disengagement among students (Eckelman *et al.,* 2001).

Educational furniture should not only provide durability, but also promote comfort and academic effectiveness (Mohamed, 2010). Anecdotal evidence and preliminary studies (Agha, 2010; Cassar and English, 2018) suggest that inadequate seat design leads to widespread physical discomfort among university students, ultimately disrupting their ability to focus and participate effectively in academic activities. Despite this recognition, there remains a scarcity of research specifically addressing how seat ergonomics impact student engagement and academic performance, particularly within Nigerian higher education institutions.

The lecture environment shares many characteristics with workplace environments, particularly concerning "static work".The musculoskeletal effort required to maintain posture and "force" as well as stability (Nse, 2014). Therefore, the ergonomic design requirements for educational seating are comparable to those established for workplace seat. Occhipinti *et al.,* (1993) identified essential criteria for ergonomic seating, including adaptability, safety, comfort, durability, and practicality principles that must be adopted in university lecture halls to enhance learning outcomes.

Anthropometric considerations such as popliteal height, buttock-popliteal length, knee height, and shoulder height (Ajayi *et al.,* 2015) are fundamental in designing seat that meets the ergonomic needs of students. An environment that prioritizes ergonomic comfort can reduce physical strain, maintain mental alertness, and significantly enhance academic engagement.

This study therefore contributes to the growing body of knowledge on ergonomics in educational environments by examining how lecture theatre seat design impacts student comfort and academic engagement in a Nigerian university context. Focusing specifically on Ladoke Akintola University of Technology lecture theatres, this research provides region specific insights aimed at informing better design practices that can be extended to other institutions. Furthermore, by highlighting the specific ergonomic needs of students especially architecture students, who endure prolonged periods in academic spaces, this study advocates for a broader, human-cantered redesign of educational facilities in higher education.

II. CONCEPTUALIZATION AN REVIEW OF LITERATURE

Ergonomics, often referred to as human factors engineering, is the scientific discipline concerned with understanding the interactions among humans and other system elements. Its principles are applied to optimize human well-being and overall system performance (Ogunwolu, Popoola, Sosimi, and Raheem, 2018). Within architecture, ergonomics focuses on designing spaces and objects that match human physical, cognitive, and emotional capabilities. Properly integrating ergonomic considerations ensures that users experience enhanced comfort, reduced fatigue, and improved functionality within built environments (Koirala and Nepal, 2022). In lecture theatres, ergonomic design directly impacts students' ability to maintain attention, avoid physical discomfort, and optimize cognitive engagement during extended sitting periods. As highlighted by Taifa and Desai (2017), spaces that fail to prioritize ergonomic principles often cause musculoskeletal disorders, diminished focus, and an overall decline in productivity. Thus, ergonomics must inform all aspects of educational space design, from seat configurations to spatial layout and environmental controls.

Lecture theatres, being environments where users often engage in prolonged sedentary activities, present unique ergonomic challenges. The significance of ergonomics in these spaces lies in its capacity to mitigate the negative physical and cognitive effects of extended sitting. Robertson and Hupert (2016) demonstrate that poor seat design is

associated with musculoskeletal discomfort, particularly lower back pain, neck strain, and leg circulation issues. Seats that fail to provide proper lumbar support or match anthropometric standards force students into unnatural postures, resulting in fatigue and reduced academic performance (Ellis and Goodyear, 2016). In contrast, ergonomic seat that accommodates the natural curvature of the spine and allows micro-movements can significantly enhance physical comfort and cognitive alertness (Lee and Kim, 2018). Ansari *et al.,* (2019) confirmed that ergonomically designed chairs improve students' ability to concentrate during lectures, further strengthening the argument that seat design must align with ergonomic best practices to increase educational success. Beyond seat alone, environmental ergonomics plays a crucial role in influencing student comfort and engagement in lecture theatres. Environmental factors such as lighting, acoustics, air quality, and thermal comfort directly affect cognitive performance and physical well-being. Yang and Cho (2015) noted that inadequate lighting contributes to eye strain and decreased attentiveness, while poor acoustics make it difficult for students to hear lectures clearly, resulting in auditory fatigue (Salonen and Lahtinen, 2018). Additionally, extreme temperatures and poor ventilation were identified as key contributors to student discomfort and reduced engagement (Koma *et al.,* 2019; Ansari *et al.,* 2019). Thus, comprehensive ergonomic evaluation must extend beyond seating design to include an assessment of environmental factors that collectively create a conducive learning atmosphere.

III. MATERIALS AND METHODS

Study Area

The research was conducted at Ladoke Akintola University of Technology (LAUTECH), located in Ogbomoso, Oyo State, Nigeria. Established in April 1990, LAUTECH spans a total land area of 9,880.771 hectares, as outlined in its physical planning (Master Plan). (Figure 1) The university's expansive campus supports a diverse range of academic disciplines across multiple faculties and a postgraduate school.

LAUTECH offers programs in various fields, including Pure and Applied Sciences, Agricultural Science, Engineering and Technology, Environmental Sciences, Basic Medical Sciences, Management Sciences, Food and Consumer Sciences, Clinical Sciences, Computing and Informatic as well as Nursing Science among others. Most courses are delivered on a full-time basis, although, some faculties also offer part-time studies and Open Distance Learning (ODL) options. This comprehensive academic environment provides context for evaluating the ergonomic aspects of lecture theatre seat, as it accommodates a broad range of disciplines and student needs.

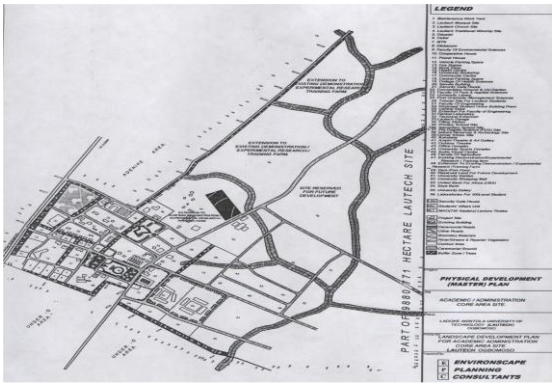

Plate 1: Master Plan of LAUTECH.
Source: Physical Planning Unit, LAUTECH (2014)

The study adopted a deductive, quantitative research design to assess the impact of ergonomic seat design on student comfort and academic engagement within lecture theatres at Ladoke Akintola University of Technology (LAUTECH), Ogbomoso. Both primary and secondary data were utilized and primary data were gathered through structured questionnaires administered to students, direct measurements of seat dimensions including seat height, backrest angles, and legroom and observational assessments of seat arrangements and material quality in selected lecture theatres. Secondary data were obtained from scholarly articles, ergonomic standards, textbooks, and previous studies related to seat design, ergonomics, and their effects on learning environments.

The sampling frame consists of twelve lecture theatres identified from LAUTECH's master plan. From this pool, seven lecture theatres featuring stepped seating platforms and high usage rates were purposively selected for detailed analysis. Multi-stage sampling technique was employed in selecting respondents. The first stage involved the purposive selection of LAUTECH as the case study institution. In the second stage, all lecture theatres within the university were identified. The third stage entailed

the purposive selection of seven theatres based on their size, frequency of use, and seating variety. The fourth stage involved determining the seating capacity of each selected lecture theatre, followed by the fifth stage, which comprised the random selection of students who regularly attended classes in these theatres to participate as respondents. Thus, Using Slovin's formula at a 95% confidence level and a 5% margin of error, a sample size of 376 students was determined from an estimated student population of 6,200, from selected faculties accounting for approximately six percent of the total student body. The collected data were analysed using descriptive statistical methods, including frequency counts, percentages, and mean scores, to evaluate the ergonomic adequacy of the seat and the relationship to student comfort and engagement.

IV. RESULT AND DISCUSSION

(i) Current Ergonomic Features of Seat Design in LAUTECH Lecture Theatres

Table 1 presents the current ergonomic features of seat design in LAUTECH lecture theatres, using students' responses to evaluate how well various aspects of seat ergonomics support comfort and posture. The table utilizes the Total Weighted Value (TWV) and its corresponding average means score (TWV/f) to measure the overall level of agreement or satisfaction with each ergonomic feature. Among the five statements assessed, the highest average mean score TWV/f value of 2.11 was recorded for the statement, "The backrest of the chair supports my posture effectively." This shows that students perceive backrest support as one of the more satisfactory ergonomic elements. The second-highest average mean score TWV/f value of 2.06, were shared by two statements: "The seat width is sufficient for comfortable sitting" and "The armrests (if available) are positioned comfortably." These results reveal that while students are generally contented with seat width and armrest placement, the scores remain relatively modest on the scale, showing these features are adequate, but not exemplary. The seat design's ability to provide "adequate support for the lower back" recorded an average mean score TWV/f of 1.94, falling below the average score of 1.99, which reveals a less favourable evaluation. This points to a need for improved lumbar support to enhance long-term comfort and ergonomic effectiveness. Similarly, the statement, "The seat height is appropriate for my body posture," had the lowest average mean score TWV/f of 1.77, showing that seat height is perceived as the least satisfactory ergonomic feature.

The analysis of Table 1 shows several important implications for the improvement of ergonomic seat in LAUTECH lecture theatres. First, some features like backrest support and armrest positioning received relatively higher satisfaction ratings, the overall average mean score of 1.99 on a 5-point scale reveals only a moderate level of student comfort. The low ratings for lumbar support and seat height show the need for a more inclusive and ergonomic design approach. These findings reveal that the current seats do not fully accommodate students' diverse body types and comfort preferences, which can negatively impact posture, concentration, and learning outcomes during extended lecture periods. To enhance student well-being and academic performance, the institution should consider redesigning or upgrading seats with adjustable height, enhanced lumbar support, and ergonomically aligned components.

Table 1: Current Ergonomic Features of Seat Design in LAUTECH Lecture Theatres

S/N	Statement	Strongly Agree (1)	Agree (2)	Neutral (3)	Disagree (4)	Strongly Disagree (5)	Total Frequency (f)	TWV	TWV/f
1	The seat design provides adequate support for my lower back	149	117	95	15	0	376	728	1.94
2	The seat width is sufficient for	138	102	118	12	6	376	774	2.06

	comfortable sitting								
3	The seat height is appropriate for my body posture	175	122	69	10	0	376	666	1.77
4	The backrest of the chair supports my posture effectively	105	152	95	22	2	376	792	2.11
5	The armrests (if available) are positioned comfortably	98	162	110	6	0	376	776	2.06
	Total								9.94/5
									1.99

Source: Author's Field Survey (2024)

(ii) Impact of Existing Seat Design on Student Comfort and Learning Outcome

Table 2 presents the Impacts of existing seat design on student comfort and learning outcome. The table evaluates various aspects of the existing seat design in LAUTECH lecture theatres based on students responses, using the average mean (μ) and variance (s^2) to assess the perceived adequacy of different seat features. The highest average mean value of 309, corresponding to the statement "The seat design in LAUTECH lecture theatres provides adequate lumbar support for proper posture," shows that many respondents perceive lumbar support as somewhat sufficient. However, with a variance of 0.91, there is a moderate level of disagreement among students, indicating that while some find the lumbar support acceptable, others do not, showing a potential area for improvement.

The statement "The height of the seats is suitable for students of varying heights," recorded an average mean of 286, showing a relatively positive perception. However, the variance of 0.87 shows a level of inconsistency in responses, meaning some students do not find the seat height accommodating their needs. Similarly, the adequacy of "The writing surfaces attached to the seats," with an average mean of 276 and variance of 0.86, shows that while a majority of students find them useful for note-taking or laptop use, a portion of the respondents still experience discomfort or find them inadequate for their needs. The statement "The seat layout ensures that students can comfortably write and engage without feeling cramped," has an average mean of 276 and a variance of 0.86, showing moderate satisfaction among students. However, the level of disagreement reveals that seat arrangements may require adjustments to better support collaborative and individual learning needs.

In contrast, the statement "The armrests (if available) are positioned ergonomically for comfort," has a lower average mean of 261, showing that students generally perceive armrest positioning as less satisfactory. The variance of 0.83 shows a relatively lower dispersion in responses, showing a consensus that improvements are necessary. Another notable concern is reflected in the statement "The seats are adjustable to cater for the individual needs of students," with an average mean of 258, showing a lower level of agreement on this aspect. The variance of 0.83 further emphasizes that a significant number of students find the adjustability of seats insufficient.

The lowest average mean of 256, corresponding to the statement "The backrests of the chairs are designed to support the natural curvature of the spine," shows that this feature is perceived as the least effective among respondents. A variance of 0.83 shows consistent responses, emphasizing that backrest design is a major concern that needs to be addressed to improve ergonomic support.

Table 2: Impacts of Existing Seat Design on Student Comfort and Learning Outcome

S/N	Statement	Yes	No	Average Mean (μ)	Variance $(s^2) = \sqrt{\frac{\mu}{n}}$
1	The seat design in LAUTECH lecture theatres provides adequate lumbar support for proper posture.	241	135	309	0.91
2	The seats offer sufficient width to accommodate different body sizes comfortably.	142	234	259	0.83
3	The height of the seats is suitable for students of varying heights.	195	181	286	0.87
4	The writing surfaces attached to the seats are adequately sized for note-taking or laptop use.	175	201	276	0.86
5	The chairs provide sufficient legroom, ensuring comfort during prolonged lectures.	165	211	271	0.85
6	The seats are adjustable for cater to the individual needs of students.	140	236	258	0.83
7	The backrests of the chairs are designed to support the natural curvature of the spine.	136	240	256	0.83
8	The armrests (if available) are positioned ergonomically for comfort.	145	231	261	0.83
9	The material of the seats is appropriate for preventing discomfort or heat build-up during extended use	160	216	268	0.84
10	The seat layout ensures that students can comfortably write and engage without feeling cramped.	176	200	276	0.86

Source: Author's Field Survey (2024)

(iii) Impacts of Existing Seat Design on Student Comfort and Learning Outcome Index

Table 3 presents the impact of existing seat design on student comfort and learning outcome index. The table evaluates various aspects of the current seat design in LAUTECH lecture theatres and their influence on student comfort and learning outcomes. The statement with the highest average mean score TWV/f of 2.75, "Long hours of sitting on uncomfortable chairs reduce my attention span during lectures," shows that students experience significant discomfort, which directly impacts their focus and engagement in class. This finding reveals the critical need for improved seat to enhance learning outcomes. Similarly, the statement "The current seat design in lecture theatres makes me feel physically uncomfortable during lectures," has a high average mean score TWV/f of 2.67, reinforcing the widespread dissatisfaction with the current seat conditions. The discomfort reported by students will contribute to decreased concentration and productivity during lectures.

The statement regarding "Discomfort caused by seat distracts me from focusing on lectures," with an average mean score TWV/f of 2.49, further emphasizes that poor seat negatively affects students' ability to stay attentive. This shows that ergonomic improvements could significantly enhance students' learning experiences. Another major concern is reflected in the statement "The seat design affects my posture, making me feel tired or fatigued," with an average mean score TWV/f of 2.46, showing that the existing design contributes to physical strain and fatigue, which could have long-term health implications for students.

Conversely, statements such as "My academic performance improves when I am seated comfortably during lectures," with an average mean score TWV/f of 2.41, and "I feel more engaged and alert during lectures when seated comfortably," with an average mean score TWV/f of 2.30, shows that students recognize the potential benefits of improved seat on their academic performance and alertness. This further shows the necessity of ergonomic interventions to foster a more conducive

learning environment. On the other hand, statements evaluating aspects such as "The seat dimensions (width, depth) are appropriate for my comfort," with a lower average mean score TWV/f of 2.04, shows that while some elements of the seat arrangement might be considered satisfactory by a portion of students, they still require adjustments to meet ergonomic standards fully.

The lowest average mean score TWV/f of 1.92 is associated with the statement "The overall seat in LAUTECH lecture theatres is comfortable," which shows a general consensus that the current seats do not provide adequate comfort for prolonged use. This reveals a major area for improvement.

Table 3: Impact of Existing Seat Design on Student Comfort and Learning Outcome Index

S/N	Statement	Strongly Agree (1)	Agree (2)	Neutral (3)	Disagree (4)	Strongly disagree (5)	Total Frequency (f)	TWV	TWV/f
1	The overall seat in LAUTECH lecture theatres is comfortable.	90	160	102	24	0	376	812	2.16
2	The seat design provides adequate back support.	60	180	110	26	0	376	854	2.27
3	The height of the seats is appropriate for my body size.	68	157	109	42	0	376	877	2.33
4	The seats are adjustable to suit my ergonomic needs.	62	165	116	33	0	376	872	2.32
5	I feel comfortable sitting in the lecture theatres for long periods.	57	120	130	69	0	376	963	2.56
6	I frequently experience physical discomfort (e.g., back pain, neck strain) after long lectures.	66	132	110	68	0	376	932	2.48
7	The seat dimensions (width, depth) are appropriate for my comfort.	52	150	114	60	0	376	934	2.48

8	The seat design helps me concentrate better during lectures.	68	135	119	54	0	376	911	2.42
9	The current seat design in lecture theatres makes me feel physically uncomfortable during lectures	95	185	81	15	0	376	768	2.04
10	Discomfort caused by seat distracts me from focusing on lectures.	145	110	89	32	0	376	760	2.02
11	The seat design affects my posture, making me feel tired or fatigued.	75	189	76	36	0	376	825	2.19
12	Poor seat design has contributed to muscle strain or pain.	65	197	68	46	0	376	847	2.25
13	My academic performance improves when I am seated comfortably during lectures.	175	130	61	10	0	376	658	1.75
14	I feel more engaged and alert during lectures when seated comfortably.	148	110	79	39	0	376	761	2.02
15	Long hours of sitting on uncomfortable chairs reduces my attention span during lectures	185	120	60	11	0	376	649	1.73
16	My seat arrangement influences how well I interact with lecturers and other students.	179	135	41	21	0	376	656	1.74

	Total								34.78/16
									2.17

Source: Author's Field Survey (2024)

CONCLUSION

This study assessed the impacts of lecture theatre seat design on student comfort and academic engagement at Ladoke Akintola University of Technology (LAUTECH), Ogbomoso. The findings from both field observations and student responses reveal a strong relationship between the ergonomics of seat and students' ability to maintain comfort, focus, and active participation during lectures. Although, certain features, such as seat arrangement and legroom provision, were rated relatively positively by the students, significant deficiencies were observed in other critical areas such as seat surface comfort, lumbar support, seat height appropriateness, and overall ergonomic adaptability. A substantial number of students experienced physical discomfort, including back pain, neck strain, and posture-related fatigue, as a result of poorly designed seats. These discomforts were found to have a direct impact on students' concentration levels, attention spans, and overall academic engagement. Furthermore, the limited adjustability of the seats meant that they failed to cater for the diverse anthropometric needs of the student body. Thus, it can be concluded that the current lecture theatre seat in LAUTECH does not adequately support the ergonomic needs of students, which in turn, impedes optimal learning outcomes. Addressing these deficiencies through improved seat design and ergonomic planning is essential to enhance both student well-being and academic performance.

RECOMMENDATIONS

Based on the study findings, it is recommended that LAUTECH prioritize the redesign and upgrading of lecture theatre seats to meet modern ergonomic standards. New seats should feature adjustable heights, proper lumbar support, and sufficient seat dimensions to accommodate diverse body sizes. Materials should be selected for both comfort and durability, minimizing discomfort during extended use.

It is also important that future procurement of seat in lecture theatres involve student and staff feedback to ensure that designs reflect actual user needs. Regular ergonomic assessments should be instituted to monitor and maintain furniture standards over time. Furthermore, ergonomic awareness programs should be introduced to educate students and lecturers on good posture practices. Finally, lecture theatre layouts should be optimized to provide sufficient legroom, clear visibility, and ease of movement, thereby promoting greater comfort, engagement, and learning outcomes.

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