

# Evaluation Of the Impact of Climate-Responsive Design Strategies on Thermal Comfort and Student Health in Architecture Buildings at Caleb University, Lagos, Nigeria.

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**Abstract-** This study evaluated the influence of climate-responsive design strategies on thermal comfort and student health in the Architecture Building at Caleb University, Lagos. In Lagos' hot-humid climate, poor ventilation, excessive heat gain, and inadequate shading can create uncomfortable indoor environments that adversely affect students' well-being, concentration, and academic performance. The study examined key passive design elements, including building orientation, natural ventilation, shading devices, and material selection, and assessed their impact on indoor environmental quality. A descriptive survey research design was adopted, and data were collected through the administration of 350 structured questionnaires to undergraduate and postgraduate architecture students. Out of the 350 questionnaires distributed, 217 were successfully returned and found suitable for analysis, representing a response rate of 62.0%. The data were analyzed using descriptive statistical techniques, including frequencies, percentages, mean scores, standard deviations, and ranking. The findings established the relationship between climate-responsive architectural design, thermal comfort, and students' health outcomes. The study provides practical recommendations for improving thermal comfort and promoting healthier learning environments through the application of climate-responsive design strategies in tertiary institutions.

**Keywords:** Architecture Building, Climate-Responsive Design, Performance Evaluation, Student Health, Thermal Comfort.

## I. INTRODUCTION

According to Asaju, O. A., Adedire, C., Onamade, A. O., Adewumi, J. B., Odubanjo, G. A., Williams, G. O., & Oyeleye, E. O. (2025), educational buildings,

particularly architecture studios, are crucial environments where students spend considerable time, making their thermal comfort paramount for enhancing performance and well-being. The design of these spaces directly influences students' learning outcomes and overall health. Recognising the specific needs of occupants, activities, and occupancy patterns in educational settings, greater attention to thermal comfort is required compared to other building types (Lyu et al., 2025). It is essential to investigate the specific thermal environmental conditions that architecture students require to ensure their comfort, performance, and satisfaction (Lyu et al., 2025).

O. Asaju et al. (2022) State that the quality of indoor environments significantly affects occupants, particularly students in academic settings. While considerable attention is often given to climate-responsive design for enhancing indoor environments, this consideration is sometimes overlooked in the architectural designs of buildings (Addy et al., 2026; Ali Sargazi & Tahbaz, 2022). This oversight can lead to suboptimal thermal comfort conditions, which in turn can negatively affect student well-being and health. Previous research, such as a study conducted at Caleb University, Imota, Lagos, has assessed the impact of thermal comfort on students' satisfaction in hostels, indicating the relevance of this issue within the university's context. (Asaju et al., 2025; Dennis et al., 2024). However, there remains a need to specifically evaluate the impact of climate-responsive design strategies on thermal comfort and, more broadly, on student health within the academic

buildings of Caleb University. The lack of adequate climate-responsive design could compromise the learning environment, potentially affecting students' health, well-being, and The primary aim of this research is to evaluate how climate-responsive design strategies affect thermal comfort and student health in architectural buildings at Caleb University, Imota, Lagos, by examining students' perceptions of indoor temperature and heat conditions, the adequacy of ventilation and air movement, daylighting, humidity, and outdoor environmental quality, as well as the effects of these thermal conditions on health and productivity. This focus is consistent with recent studies showing that passive and climate-responsive design can improve indoor thermal conditions, comfort, and user well-being in Nigerian academic buildings. This study is significant because it seeks to deepen understanding of how climate-responsive design strategies influence thermal comfort and student health within the Architecture Building at Caleb University, Lagos. The findings will provide useful information to the university management on the effectiveness of existing design features in creating a comfortable and healthy learning environment for students. The study may also assist in identifying areas requiring improvement to enhance occupants' comfort, well-being, and overall learning experience.

For architects, designers, and built environment professionals, the study will provide empirical evidence on the role of climate-responsive design strategies in improving indoor environmental quality in educational buildings located in warm-humid climatic regions. The findings may serve as a reference for the design, renovation, and management of architecture schools and other educational facilities with similar climatic conditions. Academically, this research will contribute to existing literature on climate-responsive architecture, thermal comfort, and student health. It will also provide a foundation for future studies investigating the relationship between building design, occupant comfort, and well-being in higher educational institutions. Ultimately, the study aims to promote the development of healthier, more sustainable, and environmentally responsive learning environments.

## II. LITERATURE REVIEW

Academic buildings play a crucial role in architectural education by providing environments where students develop design skills, critical thinking, and problem-solving abilities through collaborative learning and practical engagement (Karimi & Farivarsadri, 2025). Due to the extended occupancy of these spaces, the quality of the indoor environment significantly influences occupants' comfort, health, and academic performance (O. Asaju et al., 2024). Thermal comfort refers to a condition in which individuals express satisfaction with the thermal environment surrounding them. In educational settings, excessive indoor temperatures and poor ventilation can lead to discomfort, fatigue, reduced cognitive performance, and decreased learning efficiency. Azli et al. (2022) found that cooler thermal sensations positively influenced students' academic productivity, while Elnaklah et al. (2023) reported that students perform better in environments where indoor temperatures remain within acceptable comfort ranges. Similarly, research conducted at Caleb University established a positive relationship between indoor environmental quality and students' academic performance, emphasising the importance of maintaining thermally comfortable learning spaces (O. Asaju et al., 2024). Student health is closely linked to the thermal conditions of educational environments (Grassie et al., 2025). Prolonged exposure to uncomfortable thermal conditions may result in headaches, dehydration, fatigue, stress, and reduced mental alertness (Orysiak et al., 2025). In warm-humid climates, overheating in academic buildings can adversely affect students' physical and psychological well-being, thereby reducing their ability to effectively participate in academic activities. O. A. Asaju et al. (2025) noted that poor indoor environmental conditions contribute to increased health complaints among students. Therefore, achieving optimal thermal conditions in architectural buildings is essential not only for learning effectiveness but also for safeguarding student health (Grassie et al., 2025).

The effectiveness of climate-responsive design strategies is ultimately reflected in their ability to improve thermal comfort and support occupant health

(Ali Sargazi & Tahbaz, 2022). Studies have shown that buildings incorporating passive cooling measures, natural ventilation, and solar control techniques provide healthier and more comfortable indoor environments than conventional designs (Al-Shamkhee et al., 2022). This suggests that integrating climate-responsive principles into architectural buildings can reduce thermal stress, improve indoor environmental quality, and enhance student well-being. Although several studies have examined thermal comfort in educational buildings and the effectiveness of climate-responsive design strategies, limited research has specifically investigated how these strategies influence both thermal comfort and student health within architecture buildings in Lagos. Furthermore, few studies have focused on the Architecture Building at Caleb University. Therefore, this study seeks to bridge this gap by evaluating the impact of climate-responsive design strategies on thermal comfort and student health in the Architecture Building at Caleb University, Lagos.

### III. METHODOLOGY

This study adopted a descriptive survey research design to evaluate the impact of climate-responsive design strategies on thermal comfort and student health in the Architecture Building at Caleb University, Lagos. The design enabled direct collection of data from students on their perceptions and experiences of the indoor thermal environment. The study was conducted in the Architecture Building at Caleb University, Imota, Lagos State, Nigeria. The building houses design studios, lecture rooms, and other academic spaces used by architecture students, making it suitable for assessing thermal comfort conditions and the effectiveness of climate-responsive design features. The target population comprised undergraduate and postgraduate architecture students of Caleb University who regularly utilised the Architecture Building for academic activities. These students were considered appropriate respondents because they were the facility's primary users. A total of 350 questionnaires were distributed to architecture students across different levels of study. Both primary and secondary data were utilised in this study. Primary data were obtained by administering

350 structured questionnaires to architecture students. The questionnaire employed a five-point Likert scale to collect information on respondents' demographic characteristics, perceptions of thermal comfort, climate-responsive design features, and health-related experiences. Secondary data were obtained from relevant textbooks, journal articles, conference papers, theses, and other scholarly publications related to climate-responsive architecture, thermal comfort, and student health.

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

This chapter presents the analysis and interpretation of data collected from Architecture students at Caleb University regarding their perceptions of thermal comfort and indoor environmental conditions in the architecture studio. A total of 217 valid responses were analysed using descriptive statistical techniques. The findings are presented in tables and figures and discussed in relation to the study objectives and existing literature.

This section shows the number of questionnaires distributed and retrieved.

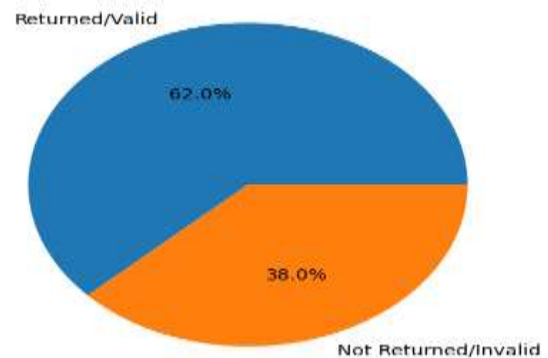
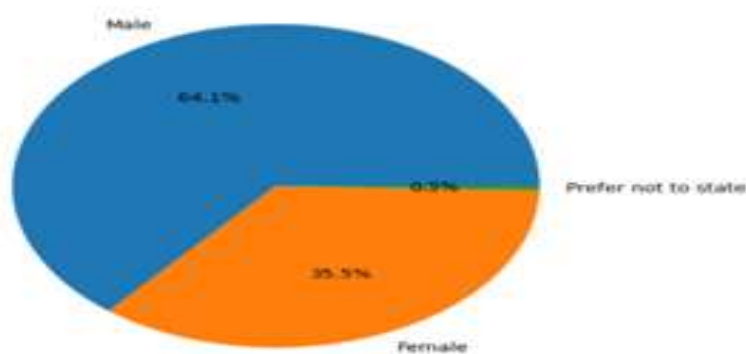


Table 4.1: Response Rate

| Questionnaires       | Frequency | Percentage (%) |
|----------------------|-----------|----------------|
| Distributed          | 350       | 100.0          |
| Returned             | 217       | 62.0           |
| Invalid              | 133       | 38.0           |
| Valid Responses Used | 217       | 62.0           |

350 questionnaires were distributed; 217 were successfully returned and found suitable for analysis, representing a response rate of 62.0%. The remaining 133 questionnaires, representing 38.0%, were either not returned or were unusable. The response rate is

considered adequate for statistical analysis, and the findings can therefore be regarded as representative of the study population.



#### Demographic Characteristics of Respondents

Table 4.2 Gender Distribution

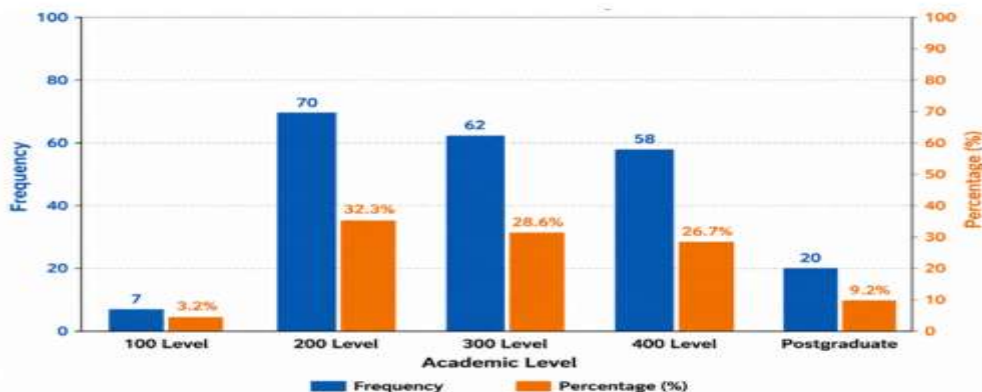
| Gender              | Frequency | Percentage (%) |
|---------------------|-----------|----------------|
| Male                | 139       | 64.1%          |
| Female              | 77        | 35.5%          |
| Prefer not to state | 1         | 0.4%           |
| Total               | 217       | 100            |

The gender distribution of the respondents indicates that male students constituted the majority of the study participants, accounting for 139 respondents (64.1%). Female students represented 77 respondents

(35.5%), while only 1 respondent (0.4%) preferred not to disclose their gender.

Table 4.3 Academic Level of Respondents

| Academic Level | Frequency | Percentage (%) |
|----------------|-----------|----------------|
| 100 Level      | 7         | 3.2            |
| 200 Level      | 70        | 32.3           |
| 300 Level      | 62        | 28.6           |
| 400 Level      | 58        | 26.7           |
| Postgraduate   | 20        | 9.2            |
| Total          | 217       | 100            |



Indicates that 200 Level constituted the largest proportion of respondents, with 70 respondents (32.3%), followed by 300 Level with 62 respondents (28.6%) and 400 Level with 58 respondents (26.7%).

Table 4.4 Studio Location

| Location                 | Frequency | Percentage (%) |
|--------------------------|-----------|----------------|
| Ground Floor             | 0         | 0              |
| First Floor              | 135       | 62.2           |
| Second Floor             | 82        | 37.8           |
| Varies/No Fixed Location | 0         | 0              |
| Total                    | 217       | 100            |

The findings reveal that the First Floor is the most frequently occupied studio location, with 135 respondents representing 62.2% of the total sample.

#### Analysis Based on Research Objectives

Objective One: To evaluate students' perception of indoor temperature and heat conditions.

Table 4.5 Indoor Temperature and Heat Perception

| Responses         | Scale(X) | Frequency (f) | fx  |
|-------------------|----------|---------------|-----|
| Strongly Disagree | 1        | 29            | 29  |
| Disagree          | 2        | 55            | 110 |
| Neutral           | 3        | 88            | 264 |
| Agree             | 4        | 30            | 120 |
| Strongly Agree    | 5        | 15            | 75  |
| Total             |          | 217           | 598 |

$$\text{Mean } \bar{X} = \frac{\sum fX}{N} = 598 / 217 = 2.76$$

Since the mean is 2.76, respondents are generally neutral with the statement.

$$SD = \sqrt{\frac{\sum f(X - \bar{X})^2}{N}}$$

$$SD = \sqrt{\frac{248.156}{217}}$$

$$= 1.07$$

Q2: Are you able to assimilate better in the morning before the weather becomes hot?

| Responses | Scale(X) | Frequency (f) | fx  |
|-----------|----------|---------------|-----|
| Yes       | 1        | 127           | 127 |
| No        | 2        | 59            | 118 |
| Maybe     | 3        | 31            | 93  |
| Total     |          | 217           | 338 |

Mean

$$\bar{X} = \frac{\sum fX}{N} \quad \bar{X} = \frac{338}{217} \quad \bar{X} = 1.56$$

Standard Deviation

$$X - \bar{X}, (X - \bar{X})^2, \text{ and } f(X - \bar{X})^2.$$

| X     | f   | $X - \bar{X}$ | $(X - \bar{X})^2$ | $f(X - \bar{X})^2$ |
|-------|-----|---------------|-------------------|--------------------|
| 1     | 127 | -0.56         | 0.3136            | 39.83              |
| 2     | 59  | 0.44          | 0.1936            | 11.42              |
| 3     | 31  | 1.44          | 2.0736            | 64.28              |
| Total | 217 |               |                   | 115.53             |

$$\sum f(X - \bar{X})^2 = 115.53$$

Using:

$$SD = \sqrt{\frac{\sum f(X - \bar{X})^2}{N}} \quad SD = \sqrt{\frac{115.53}{217}} \quad SD = \sqrt{0.5324} \quad SD = 0.73$$

Q3: Does the afternoon weather have any impact on your assimilation?

| Responses | Scale(X) | Frequency (f) | fx  |
|-----------|----------|---------------|-----|
| Yes       | 1        | 119           | 119 |
| No        | 2        | 70            | 140 |
| Maybe     | 3        | 28            | 85  |
| Total     |          | 217           | 343 |

Mean

$$\bar{X} = \frac{\sum fX}{N} \quad \bar{X} = \frac{343}{217} \quad \bar{X} = 1.58$$

Standard Deviation

First, calculate

$X - \bar{X}$ ,  $(X - \bar{X})^2$ , and  $f(X - \bar{X})^2$ .

| X     | f   | $X - \bar{X}$ | $(X - \bar{X})^2$ | $f(X - \bar{X})^2$ |
|-------|-----|---------------|-------------------|--------------------|
| 1     | 119 | -0.58         | 0.3364            | 40.03              |
| 2     | 70  | 0.42          | 0.1764            | 12.35              |
| 3     | 28  | 1.42          | 2.0164            | 56.46              |
| Total | 217 |               |                   | 108.84             |

$$\sum f(X - \bar{X})^2 = 108.84$$

Using:

$$SD = \sqrt{\frac{\sum f(X - \bar{X})^2}{N}}$$

$$SD = \sqrt{\frac{108.84}{217}} \quad SD = \sqrt{0.5016} \quad SD = 0.71$$

Response

| Statement                                                                        | Mean | SD   | Rank            | Decision          |
|----------------------------------------------------------------------------------|------|------|-----------------|-------------------|
| How do you feel about the temperature in the classroom at the moment?            | 2.76 | 1.07 | 1st             | Neutral           |
| Are you able to assimilate better in the morning before the weather becomes hot? | 1.56 | 0.73 | 2 <sup>nd</sup> | Strongly disagree |
| Does the afternoon weather have any impact on your assimilation?                 | 1.58 | 0.71 | 3rd             | Strongly disagree |

The findings revealed that respondents were neutral about the temperature in the classroom at the time of the survey (Mean = 2.76, SD = 1.07), ranking 1st among the statements. Respondents strongly disagreed that afternoon weather affected their assimilation (Mean = 1.58, SD = 0.71), ranking 2nd.

They also strongly disagreed that they assimilated better in the morning before the weather became hot (Mean = 1.56, SD = 0.73), which ranked 3rd. The low standard deviation values for the latter two statements indicate consistency in respondents' opinions.

Objective Two: To assess the adequacy of ventilation and air movement.

Q1: Is your studio properly ventilated with both natural and artificial ventilation for maximum air quality?

| Responses | Scale(X) | Frequency (f) | fx  |
|-----------|----------|---------------|-----|
| Yes       | 1        | 124           | 124 |
| No        | 2        | 54            | 108 |
| Maybe     | 3        | 39            | 117 |
| Total     |          | 217           | 349 |

Mean

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$= \frac{349}{217} = 1.61$$

Standard Deviation (SD)

| Responses | X | f   | $X - \bar{X}$ | $(X - \bar{X})^2$ | $f(X - \bar{X})^2$ |
|-----------|---|-----|---------------|-------------------|--------------------|
| Yes       | 1 | 124 | -0.608        | 0.370             | 45.88              |
| No        | 2 | 54  | 0.392         | 0.154             | 8.32               |
| Maybe     | 3 | 39  | 1.392         | 1.938             | 75.58              |

$$\sum f(X - \bar{X})^2 = 129.78 \quad SD = \sqrt{\frac{129.78}{217}}$$

$$SD = \sqrt{0.598}$$

$$= 0.77$$

Q2: Are you comfortable when there is no artificial support for ventilation like fans and AC?

| Responses         | Scale(X) | Frequency (f) | fx  |
|-------------------|----------|---------------|-----|
| Strongly Disagree | 1        | 109           | 109 |
| Disagree          | 2        | 43            | 86  |
| Neutral           | 3        | 41            | 123 |
| Agree             | 4        | 17            | 68  |
| Strongly Agree    | 5        | 7             | 35  |
| Total             |          | 217           | 421 |

Mean

$$\bar{X} = \frac{\sum fx}{\sum f}$$

$$\bar{X} = \frac{421}{217}$$

$$\bar{X} = 1.94$$

$$\text{Standard Deviation} = \sqrt{\frac{\sum f(X - \bar{X})^2}{N}}$$

| X | f   | X – Mean | (X – Mean) <sup>2</sup> | f(X – Mean) <sup>2</sup> |
|---|-----|----------|-------------------------|--------------------------|
| 1 | 109 | -0.940   | 0.884                   | 96.34                    |
| 2 | 43  | 0.060    | 0.004                   | 0.15                     |
| 3 | 41  | 1.060    | 1.124                   | 46.08                    |
| 4 | 17  | 2.060    | 4.244                   | 72.15                    |
| 5 | 7   | 3.060    | 9.364                   | 65.55                    |

$$\sum f(X - \bar{X})^2 \approx 280.27$$

$$SD = \sqrt{\frac{280.27}{217}}$$

$$SD = \sqrt{1.292}$$

$$SD = 1.14$$

Table 4.6 Ventilation and Air Movement

| Statements                                                                                   | Mean | SD   | Rank            | Decision |
|----------------------------------------------------------------------------------------------|------|------|-----------------|----------|
| Is your studio properly ventilated with both natural and artificial for maximum air quality? | 1.61 | 0.77 | 1 <sup>st</sup> | Low      |
| Are you comfortable when                                                                     | 1.94 | 1.14 | 2 <sup>nd</sup> | Low      |

|                                                                  |  |  |  |  |
|------------------------------------------------------------------|--|--|--|--|
| there is no artificial support for ventilation like fans and AC? |  |  |  |  |
|------------------------------------------------------------------|--|--|--|--|

The ranking is based on the mean score, where a lower mean indicates a stronger disagreement with the statement under the adopted scale. Table 4.6 shows poor perceptions of ventilation in Caleb University's architecture studios. The item on combined natural and artificial ventilation is the lowest (Mean = 1.61, SD = 0.77), indicating respondents generally view the current system as inadequate for good indoor air quality. The item on comfort without mechanical support (fans/AC) scored 1.94 (SD = 1.14), showing most respondents do not feel comfortable relying on natural ventilation alone. The SDs indicate low-moderate agreement. Overall, results point to reliance on mechanical ventilation and a need for improved passive/climate responsive ventilation and air circulation.

Objective Three: To examine daylighting, humidity and outdoor environmental quality.

Q1: Is your studio lighting good enough for drawing without glare or shadow?

| Responses         | Scale(X) | Frequency (f) | fx  |
|-------------------|----------|---------------|-----|
| Strongly Disagree | 1        | 19            | 19  |
| Disagree          | 2        | 57            | 114 |
| Neutral           | 3        | 55            | 165 |
| Agree             | 4        | 58            | 232 |
| Strongly Agree    | 5        | 27            | 135 |
| Total             |          | 216           | 684 |

$$\text{Mean} = 3.17$$

$$SD \approx 1.18$$

Q2: Do you need additional artificial lighting to work in the studio?

| Responses         | Scale(X) | Frequency (f) | fx  |
|-------------------|----------|---------------|-----|
| Strongly Disagree | 1        | 39            | 39  |
| Disagree          | 2        | 45            | 90  |
| Neutral           | 3        | 48            | 144 |

|                |   |     |     |
|----------------|---|-----|-----|
| Agree          | 4 | 37  | 148 |
| Strongly Agree | 5 | 45  | 225 |
| Total          |   | 214 | 646 |

Mean

$$\bar{X} = 3.02$$

$$SD = 1.40$$

Table 4.7 Daylighting and IEQ

| Variables                                                                | Mean | SD   | Rank            | Decision |
|--------------------------------------------------------------------------|------|------|-----------------|----------|
| Is your studio lighting good enough for drawing without glare or shadow? | 3.17 | 1.18 | 1 <sup>st</sup> | Neutral  |
| Do you need additional artificial lighting to work in the studio?        | 3.02 | 1.40 | 2 <sup>nd</sup> | Neutral  |

The findings indicate that respondents were neutral regarding the adequacy of studio lighting for drawing without glare or shadow (Mean = 3.17, SD = 1.18), ranking 1<sup>st</sup>. Similarly, respondents were also neutral about the need for additional artificial lighting in the studio (Mean = 3.02, SD = 1.40), ranking 2<sup>nd</sup>. The standard deviation values suggest moderate variation in respondents' opinions, indicating differing perceptions of the studio's lighting conditions.

Objective Four: To determine the effects of thermal conditions on health and productivity.

Q1: Do you have access to natural light and outdoor views in your studio space, and do you think this affects your well-being or productivity?

| Responses | Scale(X) | Frequency (f) | fx  |
|-----------|----------|---------------|-----|
| Yes       | 1        | 158           | 158 |
| No        | 2        | 35            | 70  |
| Maybe     | 3        | 20            | 60  |
| Total     |          | 213           | 288 |

How do you feel at this moment in terms of humidity?

| Responses                   | Scale(X) | Frequency (f) | fx  |
|-----------------------------|----------|---------------|-----|
| Not Comfortable             | 1        | 41            | 41  |
| Somewhat Comfortable        | 2        | 52            | 104 |
| Comfortable with assistance | 3        | 84            | 252 |
| Comfortable                 | 4        | 32            | 128 |
| Very Comfortable            | 5        | 8             | 40  |
| Total                       |          | 217           | 565 |

For the two tables shown, the results are:

Table 1: Mean = 288/213=1.35

Table 2: Mean = 565/217=2.60

The standard deviations are:

Table 1: SD ≈ 0.64

Table 2: SD ≈ 0.95

Table 4.8 Health and Productivity

| Variables                                                                                                                                                   | Mean | SD   | Rank            | Decision |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-----------------|----------|
| Do you have access to natural light and views of the outdoors in your studio space? Do you feel that this has any impact on your well-being or productivity | 1.35 | 0.64 | 1 <sup>st</sup> | Low      |
| How do you feel at this moment in terms of humidity?                                                                                                        | 2.60 | 0.95 | 2 <sup>nd</sup> | Moderate |

The low mean score for ventilation suggests that respondents generally disagree that the studio has adequate natural and artificial ventilation. The relatively higher mean score for humidity comfort indicates that respondents are slightly more comfortable with humidity than with ventilation

overall. Therefore, ventilation should be considered the priority area for improvement

The open-ended responses indicate a clear preference for practical thermal-comfort improvements, particularly the provision of more fans, the installation of HVAC systems, and better natural ventilation. Respondents also emphasised the need for additional shading devices, improved window design, roof modifications, and increased landscaping, all of which point to a demand for climate-responsive measures to reduce heat gain and improve indoor comfort in the studio. The findings revealed that respondents were generally neutral about the thermal conditions in the architecture studios, with a mean score of 2.76. However, a substantial proportion reported discomfort during the hotter periods of the day, particularly in the afternoon. The findings further support Lyu et al. that thermal comfort is a critical factor influencing students' satisfaction and effectiveness in educational environments. The study found that respondents perceived ventilation within the architecture studios as inadequate. The mean scores for studio ventilation (1.61) and comfort without mechanical support (1.94) indicate general dissatisfaction with existing air movement conditions. These findings align with the work of Al-Shamkhee et al., who emphasised that effective natural ventilation is essential for maintaining indoor air quality and reducing thermal discomfort in buildings located in warm climates. The results suggest that students rely heavily on fans, air conditioners, and other supplementary cooling devices to achieve acceptable comfort levels. The results showed that respondents were generally neutral regarding the adequacy of daylighting within the studios. While many students considered natural lighting sufficient for studio activities, opinions varied regarding the need for additional artificial lighting. The findings suggest that the existing daylighting strategy performs moderately well but may not provide uniform illumination across all studio spaces. Therefore, improved ventilation and climate-responsive design measures remain necessary for enhancing overall indoor environmental quality. The findings also indicate that thermal conditions significantly influence students' well-being and productivity. Most respondents acknowledged that

access to natural light and outdoor views positively affects their academic performance and overall well-being. At the same time, inadequate ventilation and thermal discomfort were associated with reduced concentration, fatigue, and diminished learning effectiveness. These findings corroborate the studies of Grassie et al. and Asaju et al., which established a strong relationship between indoor environmental quality, health outcomes, and academic performance. Prolonged exposure to uncomfortable thermal conditions may lead to headaches, tiredness, dehydration, and reduced cognitive efficiency. Consequently, improving thermal comfort within architecture studios is essential for supporting students' health, concentration, creativity, and academic achievement. The open-ended responses revealed that students strongly advocate for environmental improvements within the architecture studios. Frequently suggested interventions included installing additional fans, improving VAC systems, enhancing natural ventilation, increasing shading devices, roof modifications, and additional landscaping. These recommendations reflect the need for a more climate-responsive studio environment capable of mitigating heat gain and improving air circulation. The findings imply that future studio designs at Caleb University should prioritise passive cooling strategies such as optimised building orientation, solar shading, cross-ventilation, operable windows, and landscape integration. Such measures would improve thermal comfort, reduce dependence on mechanical cooling, and contribute to healthier and more sustainable learning environments.

## V. CONCLUSION

The study concludes that climate-responsive design strategies are essential for improving thermal comfort and promoting a healthier learning environment. Inadequate ventilation and heat discomfort negatively affect students' comfort and academic performance. Therefore, enhancing climate-responsive features within the architecture studios would improve occupants' overall satisfaction and well-being. Based on the findings, the study recommends enhancing natural ventilation through improved window placement and airflow design, providing and maintaining efficient cooling systems, installing

additional shading devices to reduce heat gain, increasing landscaping around the building to improve the microclimate, and integrating climate-responsive design principles into future educational buildings. It further recommends that future studies incorporate physical measurements of indoor environmental conditions and compare thermal comfort levels across different academic buildings within Caleb University.

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