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[Olatunde Babalola](#)^{*}, [Onyedikachukwu Ndimako](#)^{*}, Chidinma Nduka-Kalu

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Article

Daylight Influence on Architecture Studio Culture in Nigerian Universities

Babalola, O. D. *, Ndimako O.O. * and Nduka-Kalu C. I.

Department of Architecture, Covenant University ^{NG}; ije.nduka-kalu@covenantuniversity.edu.ng

* Correspondence: daniel.babalola@covenantuniversity.edu.ng (O.B.);
onyedikachukwundimako@gmail.com (N.O.O.)

Abstract: Productivity levels of architecture students have been ascertained via research to relate strongly to the quality of studio culture in architecture studios. Students' comfort is significantly influenced by the quality of daylight within architecture studios, as demonstrated by research findings. The comfort level in architecture studios is also known to influence the productivity of architecture students significantly. Building on separate research findings that have proven the individual impact of daylighting and studio culture on the performance of architecture students, this research aims to explore the potential connection between daylighting and studio culture. At the commencement of this research, data collection was via a qualitative approach in the form of interviews. At a later stage, we administered structured questionnaires for a quantitative analysis. From observations, many students would instead not work in their studios but elsewhere – at the expense of cultivating a good studio culture. Hence, this research is pertinent in that it would discover the reason(s) behind this trend among architecture students in the sample universities and the contribution of daylighting to studio culture in these universities. The outcome of this research would provide a knowledge base further to improve the design of architecture studios in Nigerian universities.

Keywords: architecture students; daylighting; design studio; student productivity; studio culture

Introduction

Daylight is pivotal as the primary light source in architectural design studios within Nigerian universities. Catina (2020) highlighted the central role of design studios, underscoring their undeniable significance as the core hub for design education. This connection between daylight and design studios is not merely coincidental; by establishing a connection, researchers have discovered that the amount of natural light in these areas significantly impacts architecture students' performance. The reliance on daylight in architectural design studios underscores its vital contribution to Nigerian universities' overall learning environment and educational experience.

There is a decline in the traditional studio culture, as observed by a couple of researchers. It is possible that, among other factors that influence design studio conditions, daylight could have a significant role in developing this trend. Therefore, this research aims to examine the effect of daylight, a significant factor in studio conditions, on studio culture.

In order to realise this aim, this research seeks to achieve the following –

- i. Determine of students' locational preferences while engaging in design work;
- ii. Assess encouragement level (work ethic) by current studio configurations;
- iii. Analyse the quality of daylight in design studios; and
- iv. Analyse the influence of daylight on design output.

The scope of the study is architecture students across undergraduate and graduate levels of learning in a private and public university in Nigeria.

Literature Review

Daylighting

Daylighting is a design strategy beyond simply placing windows and skylights in buildings. It involves a thoughtful approach to effectively utilising natural light to illuminate indoor spaces while minimising the need for artificial daylight during daylight hours. The goal is to enhance visual comfort, reduce energy consumption, and create pleasant and productive environments for occupants (Sanusi et al., 2021).

Strategically positioned windows capture and distribute natural light deep into the building's interior. Window placement considers building orientation, solar path, and local climate to optimise daylight penetration (Chen et al., 2020). Skylights are another vital element, often used in spaces where windows alone may not suffice, such as central atriums or interior rooms.

In addition to openings like windows and skylights, daylighting utilises light transport techniques such as light shelves, tubes, and reflective surfaces (Goharian & Mahdavinejad, 2020; Obradovic & Matusiak, 2020). Light shelves are horizontal surfaces placed above eye level near windows to bounce natural light onto the ceiling, dispersing it deeper into the room. Light tubes or light pipes are cylindrical tubes with reflective interiors that capture sunlight on the roof and channel it into interior spaces, even those far from exterior walls (El-hafeez et al., 2010; Onubogu et al., 2021). Reflective surfaces like light-coloured walls, ceilings, and floors help diffuse natural light into rooms. They can bounce and redirect sunlight more profoundly into the building, reducing glare and creating a more uniform light distribution.

The benefits of effective daylighting extend beyond energy savings (Vandenbogaerde et al., 2023). Studies show that exposure to natural light positively impacts human health and well-being by regulating circadian rhythms and enhancing mood and productivity (Abdelaziz Mahmoud et al., 2023; Schöllhorn et al., 2023; Shishegar & Boubekri, 2022). Architects and engineers can create sustainable and occupant-friendly spaces that foster environmental and human-centric benefits by incorporating daylighting strategies into building design.

Importance of Daylighting

In many building planning projects, elevations, interior decoration, and colour selection depend on natural light availability. The expense depends on window size, shape of the opening, method of construction of the light opening, type of climate and the primary purpose of the building. AL-Ubaidi (2021) reported that natural light is one of the most important architectural elements, helping transform spaces and save energy. It is considered the most essential "building material" and is often the starting point of design.

Daylighting forms the cornerstone of sustainable, high-performance design for schools. Its advantages are higher academic performance, energy savings, better light, connection to nature, improved health, and environmental education (Carroll et al., 2022; Donison & Halsall, 2023). Daylighting uses natural lighting for illumination and reduces energy consumption compared to artificial lighting. Daylight provides the best and most convenient light source for visual tasks. It enhances objects' colour and visual appearance and helps students see small details better. Views provided by windows contribute to eye health by providing frequent changes in focal distance, which helps to relax eye muscles (Altomonte et al., 2020; Golafshan & Shahin, 2017).

For best practices, (Brink et al., 2023; Samiou et al., 2022) reported that recent research has demonstrated significantly higher test scores in classrooms with daylight than those without it, highlighting daylight as one of the best investments for the learning environment. Lighting is essential for human physiological and sanitary well-being because man has to live in an environment of natural lighting. Research in Sweden showed that working in a classroom without daylight may upset basic hormone patterns (Moyano et al., 2020). Before the advent of electric light, architectural techniques designed to maximise sunlight that reached interior spaces were quite common. However,

sunlight tends to improve the quality of life and reduce energy consumption, which is a reason for interest in its use in architecture.

Architecture Design Studio Culture

The architecture design studio is an ample physical space for drawing and designing, where teaching and learning activities occur. It is the home of learning for architecture students. The architectural design studio serves as the epicentre of learning and creativity for architecture students. It is a physical space uniquely tailored to facilitate the multifaceted process of architectural education, where theoretical knowledge meets practical application through design projects and critical discourse.

On the other hand, culture is the social aspect that influences and defines human behaviour and way of life. In an architecture studio, the learning pattern that integrates critical discourse and creative thinking is recognised as studio culture (Folorunso & Ajulo, 2016). The studio environment is carefully crafted to foster a culture that nurtures individual creativity and collaborative learning. Several vital elements shape this culture:

Physical Space and Atmosphere: Architectural design studios are typically spacious, well-lit environments with drafting tables, model-making facilities, and presentation areas. The layout encourages interaction and communication among students and faculty members, fostering community and collective learning (Ata, 2022; Mirmoradi, 2020).

Learning through Design: Students engage in the iterative design process in the studio. Every project stage, from initial sketches to detailed drawings and digital modelling, is explored and refined within this space. This hands-on approach allows students to experiment with different ideas, materials, and techniques under the guidance of experienced mentors (Khan & Sinha, 2023; Milošević, 2021).

Studio Culture: Studio culture encompasses the values, norms, and practices that define how learning and creativity unfold within the space (Milovanovic, 2022). It encourages critical thinking, constructive criticism, and peer review, promoting intellectual rigour and growth. The culture emphasises iterative problem-solving, where students learn from successes and failures, refining their design skills and analytical abilities.

Integration of Theory and Practice: In the studio, students apply academic theories and principles to real-world scenarios (Barnett & Francis, 2023; Moosavi & Bush, 2021). Students learn to balance aesthetic considerations with functional requirements, sustainability principles, and socio-cultural factors. This interdisciplinary approach prepares future architects to address complex challenges and make informed design decisions.

Role of Faculty and Mentors: Faculty members play a pivotal role in shaping studio culture (Haridy et al., 2022). They serve as guides, mentors, and critics, providing feedback that challenges students to think critically and push the boundaries of conventional design. Faculty members impart knowledge and expertise through workshops, lectures, and one-on-one consultations while encouraging independent thought and creative exploration.

Reflective Practice and Continuous Learning: Studio culture promotes reflective practice, where students analyse their design processes, identify strengths and weaknesses, and refine their approach over time. This iterative learning cycle instils resilience and adaptability, essential for architectural professional growth (Rucinski, 2020).

Essentially, the architectural design studio is a dynamic learning environment where theory and practice are combined, where aspiring architects hone their craft, refine their design philosophies, and add to the rich tapestry of architectural discourse and innovation. It is more than just a physical space. It shapes the future of architectural practice and design excellence by embodying the nexus of creativity, critical thinking, and cultural awareness.

Effects of Design Studio Culture

Folorunso & Ajulo (2016) reported that studio culture is an intrinsic part of architectural education, and it goes a long way to determining the type of architect the student becomes. It is a

social part of architecture where students learn to relate among themselves and with lecturers. According to Sidawi (2013), the design studio is the core architecture education that involves several varied activities. A design studio is an essential component of any school of architecture. He concluded that the activities within the studio's walls impact students' performance and confidence in practice after school.

Methodology

Study Area

- The selected areas for the study are –
- Covenant University (CU) is a private university in South Western Nigeria, located on latitude 7°56'60" N and longitude 4°46'60" E and;
 - The University of Nigeria Nsukka (UNN) is a public university in South Eastern Nigeria, located on latitude 6°51'24" N and longitude 7°23'45" E.

Data Collection

Data collected were via structured questionnaires to elicit relevant, valuable information for the study's analysis. The questionnaire distribution medium was the Google Forms online platform for quick recovery and preliminary data analysis. The study employed a sample size of 133 respondents in the analysis. Further Data analysis used SPSS software, Microsoft Excel, and descriptive statistics tools; data visualisation deployed Microsoft PowerBI. In the analysis, all respondents still undergoing undergraduate training were grouped into a single category classified as undergraduate. At the same time, the other higher levels were the postgraduate group.

Results

We developed eight variable parameters to serve as yardsticks for analysing daylight's influence on architecture students' studio culture. Table 1 presents a summary of eight out of the nine parameters.

Table 1. Summary of data analysis of significant variables.

Parameters	Percentages
Institution	CU - Covenant University (43.8) UNN - University of Nigeria (56.2)
Gender	Males (58.9) Females (41.1)
Age	*21-30 (50.3) *16-20 (48.6)
Level of Study	Undergraduates (50.3) Postgraduate (49.7)
Studio Work Preference	CU - Collaborative Work (73.5) UNN - Collaborative Work (26.5)
Daylight Quality Perception	Adequately Bright (79.5)
Encouragement Level	Encouraged (57.3)
Daylight Influence on Design Output	Positively (59.5) Negatively (34.6)

*Dominant Categories; Gender Scale – 1. Male 2. Female; Age Scale – 1. Below 16 2. 16-20 3. 21-30 4. 31-40 5. 41-50; Level of Study Scale – 1. Undergraduate 2. Postgraduate; Studio Work Preference Scale – 1. Collaborative work (working among other students and sharing ideas) 2. Isolated work (working independently); Daylight Quality Perception – 1. Too bright 2. Adequately bright 3. Not certain 4. Dull 5. Too dull. Encouragement Level - 1. Highly encouraged 2. Encouraged; 3. Not certain 4.

Discouraged 5. Highly discouraged; Daylight Influence on Design Output - 1. Highly positive 2. Positive
3. Not certain 4. Negatively 5. Highly negative.

According to the data analysis, a little over half of the students at both colleges are encouraged to work on design projects in the studio. However, When examined separately, it becomes clear that Covenant University students are far more motivated to complete their design work in their studios than their University of Nigeria peers. Similarly, a comparable situation occurs when examining the proportion of students favour group projects over individual ones.

The responses from most of Covenant University's students depict that the daylight quality perceived within their studios is adequately bright. In contrast, most respondents from the University of Nigeria were somewhat displeased with the daylight quality within their studios.

Closer inspection revealed that most University of Nigeria respondents were either postgraduate students who claimed their studios were mainly dark most of the day or undergraduate students whose designated areas within their studios were far from the available windows. The inspection also revealed that the postgraduate studios at the University of Nigeria could only be sufficiently lighted by artificial light, which is not always accessible, and had very little daylight access.

This scenario is in contrast to reports from Covenant University's students, given that their studios are primarily lit by daylight owing to large window openings on their walls and high-level windows.

Discussion of Findings

Daylight Quality Perception versus Encouragement Level

In line with the research objective, we have discovered that architecture students' preferences for studio work locations primarily stem from the daylighting conditions within their studios. Previous research has already established that daylight conditions significantly influence the use and productivity of students in architectural studios.

This research has revealed two scenarios. On the one hand, Covenant University encourages its students to carry out design work within adequately daylight-lit studios primarily. In contrast, most students at the University of Nigeria are somewhat discouraged from using their studios due to poor daylight conditions.

As a result, good daylight conditions readily encourage students to work in their studios. Furthermore, researchers observed a pattern: students' preferences for studio work directly correlate with daylight quality within their studios.

Students who perceived and experienced better daylight conditions within their workstations in their studios were favourable towards collaborative work. In contrast, those discouraged by the quality of daylight conditions they experienced within their work area (station) in the studio would instead engage in isolated work – in the bit to maximise whatever little time they had to spend in their studios.

Daylight Quality Perception Versus Influence on Design Output

Further analysis reveals a ripple effect among the respondents: a significant percentage of students who lack the enthusiasm to work on their designs in the studio attribute their sentiment to poor daylight conditions, which they believe negatively affects their work ethic and design output.

Additionally, most Covenant University respondents believed that the daylight quality they received within their studios enhanced their design work output. There were a few exceptions, but these were in the minority.

These results confirm earlier research findings, which have independently established that daylighting influences the quality of work output among architecture students. Furthermore, previous research has already established that students' studio culture also impacts their performance in undertaking design tasks. This research has established that the influences of studio culture and daylighting on the performance of architecture students in executing design work within the studio are interconnected, with daylighting identified as the primary determining factor.

Conclusions

Daylighting plays a crucial role in designing architectural studios because it influences the studio culture of architecture students, which in turn affects the quality of their design solutions. Facilitating idea-sharing among students would undoubtedly broaden their horizons and influence their thought processes in creating design solutions. However, creating the right environment is essential to foster such interactions.

Hence, it would be pertinent for accreditation bodies, which includes the Nigerian Institute of Architects (NIA) as well as the Architects Registration Council of Nigeria (ARCON), to include in their parameters for assessing universities and other tertiary institutions of learning offering architecture programs, the quality of daylight received within design studios.

References

1. Abdelaziz Mahmoud, N. S., El Samanoudy, G., & Jung, C. (2023). Simulating the natural lighting for a physical and mental Well-being in residential building in Dubai, UAE. *Ain Shams Engineering Journal*, 14(1), 101810. <https://doi.org/10.1016/j.asej.2022.101810>
2. AL-Ubaidi, S. (2021). Architectural elements & their Functional and aesthetic role in Arabic architecture in the Islamic era. *Kufa Journal of Arts*, 1(48), 695–724. <https://doi.org/10.36317/kaj/2021/v1.i48.550>
3. Altomonte, S., Allen, J., Bluysen, P. M., Brager, G., Hescong, L., Loder, A., Schiavon, S., Veitch, J. A., Wang, L., & Wargocki, P. (2020). Ten questions concerning well-being in the built environment. *Building and Environment*, 180, 106949. <https://doi.org/10.1016/j.buildenv.2020.106949>
4. Ata, F. Z. (2022, May 27). Architectural design studio as an 'extended problem space'. *Learn X Design Conference Series*. https://doi.org/10.21606/drs_lxd2021.05.159
5. Barnett, S., & Francis, H. D. (2023). The four studio structures and deep learning. *PDS Partners: Bridging Research to Practice*, 18(1), 34–42. <https://doi.org/10.1108/PDSP-01-2023-0007>
6. Brink, H. W., Krijnen, W. P., Loomans, M. G. L. C., Mobach, M. P., & Kort, H. S. M. (2023). Positive effects of indoor environmental conditions on students and their performance in higher education classrooms: A between-groups experiment. *Science of the Total Environment*, 869, 161813. <https://doi.org/10.1016/j.scitotenv.2023.161813>
7. Carroll, M. K., Anderson, A. M., Mangu, S. T., Hajjaj, Z., & Capron, M. (2022). Aesthetic Aerogel Window Design for Sustainable Buildings. *Sustainability (Switzerland)*, 14(5), 2887. <https://doi.org/10.3390/su14052887>
8. Catina, A. (2020). Dialogue and studio space: the architectural design studio as the setting for continuous reflection. *Journal of Applied Learning and Teaching*, 3(1), 98–107. <https://doi.org/10.37074/jalt.2020.3.1.12>
9. Chen, Z., Hammad, A. W. A., Kamardeen, I., & Haddad, A. (2020). Optimising window design on residential building facades by considering heat transfer and natural lighting in nontropical regions of Australia. *Buildings*, 10(11), 1–27. <https://doi.org/10.3390/buildings10110206>
10. Donison, L., & Halsall, T. (2023). 'I'd rather learn outside because nature can teach you so many more things than being inside': Outdoor learning experiences of young children and educators. *Journal of Childhood, Education and Society*, 4(3), 373–390. <https://doi.org/10.37291/2717638X.202343281>
11. El-hafeez, M. A., Youssef, W. F., & El-enein, U. A. (2010). Daylight Transportation: A Green Lighting Technology to Save Energy. In *Port-said Engineering research Journal* (Vol. 14).
12. Folorunso, C. O., & Ajulo, M. O. (2016). Effect of Studio Culture on Architecture Pedagogy in Nigerian Universities. *International Journal of Arts & Sciences*, 09(01), 1944–6934.
13. Goharian, A., & Mahdavejad, M. (2020). A novel approach to multi-apertures and multi-aspects ratio light pipe. *Journal of Daylighting*, 7(2), 186–200. <https://doi.org/10.15627/jd.2020.17>
14. Golafshan, S., & Shahin, M. S. (2017). The Impact of Tilting Northern Open Space Wall on Daylight Performance of Residential Buildings. *Armanshahr Architecture & Urban Development*, 10(18), 83–97. http://www.armanshahrjournal.com/article_49205.html%0Ahttp://www.armanshahrjournal.com/pdf_49205_4854a465b4a1cd07cac23a2c31974a59.html

15. Haridy, N. M., Khalil, M. H., & Bakir, R. (2022). The Dynamics of Design-Knowledge Construction: The Case of a Freshman Architectural-Design Studio in Egypt. *International Journal of Learning, Teaching and Educational Research*, 21(1), 157–178. <https://doi.org/10.26803/IJLTER.21.1.10>
16. Khan, Y., & Sinha, S. (2023). An Exploratory Study on the Changing Modes of Imparting Design Education and Its Effect on Communication Design Outcomes of Students. In *Designing in the Era of Industry 4.0* (pp. 1023–1031). Springer, Singapore. https://doi.org/10.1007/978-981-99-0428-0_83
17. Milošević, J. (2021). Blended design studio in teaching architectural students about spatial structures. *Proceedings of the IASS Annual Symposium 2020/21 and the 7th International Conference on Spatial Structures*, 1–12.
18. Milovanovic, J. (2022). Learning patterns in architectural design studios. *Learn X Design Conference Series*, 24–26. https://doi.org/10.21606/drs_lxd2021.07.186
19. Mirmoradi, S. S. (2020). The Effect of the Relationship between Indoor Architectural Design Studios and Outdoor Landscape on Increasing Students' Satisfaction Level. *International Journal of Built Environment and Sustainability*, 8(1), 47–56. <https://doi.org/10.11113/ijbes.v8.n1.585>
20. Moosavi, S., & Bush, J. (2021). Embedding Sustainability in Interdisciplinary Pedagogy for Planning and Design Studios. *Journal of Planning Education and Research*. <https://doi.org/10.1177/0739456X211003639>
21. Moyano, D. B., Fernández, M. S. J., & Lezcano, R. A. G. (2020). Towards a sustainable indoor lighting design: Effects of artificial light on the emotional state of adolescents in the classroom. *Sustainability (Switzerland)*, 12(10), 4263. <https://doi.org/10.3390/su12104263>
22. Obradovic, B., & Matusiak, B. S. (2020). Daylight autonomy improvement in buildings at high latitudes using horizontal light pipes and light-deflecting panels. *Solar Energy*, 208, 493–514. <https://doi.org/10.1016/j.solener.2020.07.074>
23. Onubogu, N. O., Chong, K. K., & Tan, M. H. (2021). Review of Active and Passive Daylighting Technologies for Sustainable Building. In *International Journal of Photoenergy* (Vol. 2021, Issue 1, p. 8802691). John Wiley & Sons, Ltd. <https://doi.org/10.1155/2021/8802691>
24. Rucinski, D. A. (2020). Standards of Reflective Practice. In *Standards for Instructional* (pp. 77–90). Routledge. <https://doi.org/10.4324/9781315855301-8>
25. Samiou, A. I., Doulos, L. T., & Zerefos, S. (2022). Daylighting and artificial lighting criteria that promote performance and optical comfort in preschool classrooms. *Energy and Buildings*, 258. <https://doi.org/10.1016/j.enbuild.2021.111819>
26. Sanusi, A. N. Z., Abdul Jamil, A. F., Abdullah, F., & Othman, R. (2021). Effective Daylight Design Strategies of Colonial Mosques in Malaysia. *Asian Journal of Environment-Behaviour Studies*, 6(18), 27–45. <https://doi.org/10.21834/ajebs.v6i18.381>
27. Schöllhorn, I., Deuring, G., Stefani, O., Strumberger, M. A., Rosburg, T., Lemoine, P., Pross, A., Wingert, B., Mager, R., & Cajochen, C. (2023). Effects of nature-adapted lighting solutions ("Virtual Sky") on subjective and objective correlates of sleepiness, well-being, visual and cognitive performance at the workplace. *PLOS ONE*, 18(8), e0288690. <https://doi.org/10.1371/JOURNAL.PONE.0288690>
28. Shishegar, N., & Boubekri, M. (2022). Lighting up living spaces to improve mood and cognitive performance in older adults. *Journal of Environmental Psychology*, 82, 101845. <https://doi.org/10.1016/j.jenvp.2022.101845>
29. Sidawi, B. (2013). Design Studio Education To Foster Creativity: Influential Factors Revealed by a Case Study of the University of Dammam. *International Journal of Architecture, Engineering and Construction*, 2(4), 280–291. <https://doi.org/10.7492/ijaec.2013.025>
30. Vandenbogaerde, L., Verbeke, S., & Audenaert, A. (2023). Optimising building energy consumption in office buildings: A review of building automation and control systems and factors influencing energy savings. In *Journal of Building Engineering* (Vol. 76, p. 107233). Elsevier. <https://doi.org/10.1016/j.jobe.2023.107233>

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