



OPTIMIZING INDOOR ENVIRONMENTS THROUGH ADEQUATE INTERIOR DESIGN SERVICES

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ABSTRACT

As more and more people become aware of the necessity of eco-friendly construction methods and materials, more and more customers are looking for ways to integrate sustainability concepts into their interior design projects. Environmentally friendly interior design incorporates a number of principles, including the use of low-impact building materials and techniques, energy efficiency, and waste reduction. Interior designers and architects play a crucial role in sustainable interior design by helping customers make environmentally conscious product and material selections and offering guidance on green living practices. In order to better understand the significance of sustainability in interior design and the many ways it may be incorporated into space planning, this project aims to collect as much data as possible on the subject. The study shows that in order to reduce negative impacts on the environment; sustainable design is an essential component of interior architecture. A disastrous and quick change is occurring in the world's ecosystems. The way humans consume food is a major contributor to both these changes and the environmental deterioration. The construction sector is among the most significant contributors to waste and environmental degradation. Interior designers are involved in the sustainable practices industry, which aims to improve both the natural and manmade environments. Sustainable design is an approach to building that takes into account the Earth's life cycles in order to reduce negative consequences and preserve resources for future generations without sacrificing the quality of life for present ones.

Keywords: *Well-being, Indoor air quality, Office, Interior design, Strategic design, Design Builder*

Introduction

Two of the primary global drivers of the current environmental catastrophe are industrialization and technological progress. The researchers need a more profound understanding of the need of sustainable practices since the pace of population growth on Earth has been unsustainable for a long time, putting researchers' limited resources in an unsustainable position. It is the ethical obligation of the architectural and interior design communities to contribute to the preservation of the planet's natural ecosystems (Alfuraty & Basim, 2020). A very linear approach used to be the main goal of interior designers, which was to improve the room's appearance. Overcrowding in a space is more essential than thinking about how to save energy and reduce pollution, according to interior designers who have long held this opinion. Furthermore, the potential detrimental effects of design on consumer health and pollution levels were not considered in this method. On the other hand, sustainable and health-oriented interior design has been all the rage as of late. "Sustainability," which may be defined as "meeting today's needs without compromising those of the future," is a term that has been making huge headlines recently. More and more people are starting to see the value of a sustainable built environment. The demand for eco-friendly home furnishings has skyrocketed as individuals become more aware of their influence on the planet. While other studies examine sustainability from a social, economic, and other perspectives, this one is more ecological in nature. The purpose of this essay is twofold: first, to study sustainability's significance in the field of interior design; and second, to investigate the many ways in which



sustainable practices might be included into the planning of interior areas. Here is the framework of the paper. There, the authors of the study elaborate on the significance of environmental friendliness to the interior design industry. Interior designers play an important part in sustainability efforts, but they also contribute to many environmental problems, including global warming, resource loss, biodiversity loss, trash, and water shortages, which they will address in this session. The researchers also go over some examples of how to implement this idea into interior building design. One goal may be to look at ways that interior design can contribute to environmental sustainability. Researchers would aim to lessen the environmental effect of building materials while simultaneously increasing energy efficiency, water conservation, and better indoor environments.

Background of the study

Concerns about consumption are just one aspect of a larger environmental problem. Two of the most typical results of consumer actions are the use of resources and the subsequent production of trash. As part of its closed-loop mechanism, the natural consumption cycle allows one organism to benefit from the detritus of another. The chemical, synthetic, and hazardous compounds that industrialized civilizations have released into this cycle have had a significant impact on the environment. These pollutants cause linear and fragmented consumption, which breaks the cycle, when they enter it. People in developed nations have "thrown away" their trash without thinking about the effects on the environment and their own health (Yu et al., 2022). Before disposing of garbage, one should always inquire as to its precise position. No matter how far away they are, they will never be really alone—in a dump, on the ocean, in a river, or anywhere else. Over the course of Earth's lifetime, the trash accumulates. The typical American throws out almost a million pounds of valuable resources per year, including energy, materials, and more. Indulgence persisted throughout the new millennium. To aid the interior design industry in its attempts to reduce its negative impact on the environment, the researcher started the study with that goal in mind. Professionals in the field of interior design have an obligation to learn about environmental problems, their origins, and solutions to these problems so that they may help clients and the world around them (Abouelela, 2022). Academics claim that the interior design industry has assessed its environmental effect and acknowledged the need to alter its methods. This shift is being driven by the relatively recent notion of sustainability in design. It seems that many practitioners are either still learning or have had a hard time acquiring these other methods, according to Stieg. To have a real impact, the interior design business requires all parties involved—from students to instructors—to recognize the significance of sustainability. Instead of seeing sustainable design as an afterthought, many experts in the field now consider it the norm. Sustainable design education has been considered by several organizations, including the US Green Building Council (USGBC), the Interior Design Educators Council (IDEA), and numerous others. Teaching people about sustainability has always been an important priority for these groups. Many people involved in the field of interior design are always on the lookout for new studies, product specifics, specs, and other crucial information needed to develop solutions with a longer lifespan. Education in sustainable design has attracted the attention of researchers due to their proven track record. They played crucial roles in the development of interior design as a field. Sustainable design information has to be readily accessible. As a result, individuals were better able to carry their wisdom along over the ages. Also, as time goes on, students learn vital information as part of the processes that make interior design what it is today. In line with fire and life safety regulations, the Americans with Disabilities Act (ADA), and other regulations relevant to interior construction, maybe one



day the United States may educate and utilize ecologically friendly design principles, especially in the field of interior design. However, there are a lot of problems and worries for teachers about the long-term curriculum of interior design degree programs, which includes design. This inquiry is extensive in both breadth and depth (Bullen et al., 2020).

Purpose of the research

Examine how different eco-friendly interior design methods and materials affect IAQ, occupant health, and the environment. Determine if there is any evidence that green building methods benefit the health of building inhabitants, including alleviation of stress and respiratory problems. Maximize the health advantages for people by incorporating sustainability into interior design. Outline all of the rules and recommendations in detail. Advocate for the researchers' cause by presenting them with suggestions for greener, healthier interiors to lawmakers, architects, and designers. The researchers need more people to be aware of the potential benefits of sustainable interior design in creating healthier environments at home and in the workplace.

Literature review

Having people understand how important it is to safeguard the environment is a key part of sustainability. One way that people show they care about the environment is via sustainable design. The focus on preserving resources for the future is a distinguishing trait of this design approach. Numerous examples of sustainable design may be found throughout the world's traditional and vernacular architecture. A dedication to sustainability is an integral part of top-notch design. Evidence of these buildings' climate and environment consciousness is the use of local, natural materials, basic construction techniques, and the expertise of locals. Furthermore, passive design elements were used throughout the construction process. A method to construction known as "sustainable interior design" considers the effects on the environment at each stage of an interior installation's lifecycle. Consequently, interiors have much less of an impact on the environment, if any, at all. Sustainability in interior design mostly refers to minimizing the use of toxic construction materials, preventing pollution, and repurposing existing resources (Darling-Hammond et al., 2020). All of the important interior details, such as the lighting, woodwork, plumbing, equipment, and finishing touches, are decided by the designer. The reality is that improving a project's quality and utility across its entire lifespan—and by extension, the user experience—is the goal of a really sustainable strategy. It is critical to acknowledge that sustainable design has the potential to lessen the environmental impact of projects, and that all projects have an effect on the environment during their lifetime. The application of appropriate techniques by interior designers has the potential to completely alter the process of creating environmentally conscious environments (Licina & Yildirim, 2021). Aware of the numerous sustainable design principles, studying current examples, and using new technology are all potential ways to implement the improvements. The interior designer has significant issues to answer and principles to follow. For the purpose of developing a top-notch, environmentally conscious design, this is crucial. Here, the researchers have a broad approach to problem-solving; it tracks a site's life cycle and pinpoints seven distinct difficulties. All project decisions must prioritize sustainability and environmental friendliness. Also included in the plan are the primary steps that must be taken by the designer to create an environmentally conscious interior. Architects and designers must be able to think on their feet and adapt to different situations at all times. Much has been stated about how interior designers may make a difference by establishing the right



circumstances for eco-friendliness and sustainability. The principles of eco-friendly design include making the most efficient use of space on site, decreasing the use of non-renewable energy sources, and increasing efficiency. The researchers may lessen their negative influence on the environment, save water, improve the quality of life in the building, and maximize resource utilization by opting for environmentally friendly items. Operations and maintenance-related responsibilities. Design philosophy advocates for alternatives while embracing a sustainable approach all through the design process. Come up with ways to lessen the damage to the environment and locals' health without putting the company's bottom line at risk. An integrated and comprehensive plan. A process that enhances a building during its whole lifecycle, from planning and building to operating and repair. Using these materials for construction and decoration might hasten the depletion of resources, pollute the environment during manufacturing, endanger the health of the researchers, hasten global warming, influence the buildup of pollutants, create water shortages, and reduce biodiversity (Obeidat et al., 2022). The most glaring of these effects is the depletion of natural resources, but there are others. The amount of energy required to complete a substance's life cycle makes it obvious that consuming it indirectly contributes to climate change. Indeed, the researcher agree. The embodied energy of a substance is the total amount of energy required for its lifecycle, from acquisition to processing, production, transportation, installation, maintenance, and disposal. A substance's environmental benefit increases as its embodied energy amount rises. As an example, wood has already been through a lot of processing and transportation in nature, therefore it doesn't have as much embodied energy as other materials. Indeed, the multi-phase structure of aluminum results in a high energy consumption. The substance or object goes through many changes as it goes through its life cycle, such as being mined, made, refined, and others (Altamimi et al., 2023).

Research question

- What is the effect of clean air on sustainable interior design practices?

Research methodology

Research design:

The quantitative data analysis was performed with SPSS version 25. The odds ratio and 95% confidence interval were used to determine the degree and direction of the statistical association. The researchers established a statistically significant criteria at $p < 0.05$. A descriptive analysis was conducted to identify the main features of the data. Quantitative methods are often used to assess data acquired via surveys, polls, and questionnaires, together with data altered by computing tools for statistical analysis.

Sampling:

Research participants filled out questionnaires to provide information for the research. Using the Rao-soft programme, researchers determined that there were 534 people in the research population, so researchers sent out 820 questionnaires. The researchers got 813 back, and they excluded 39 due to incompleteness, so the researchers ended up with a sample size of 774.

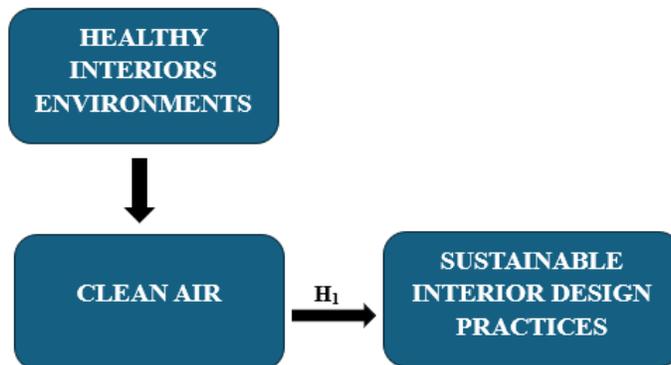


Data and Measurement:

The study's main data was derived from a questionnaire survey, which may have been a one-to-one correspondence survey or a Google Form survey. The survey had two components: (A) a segment soliciting demographic information from all sources (both online and offline), and (B) a segment requesting answers to variables on a 5-point Likert scale. Numerous other sources, mostly available online, supplied the secondary data.

Statistical Software: The statistical analysis was conducted using SPSS 25 and MS-Excel.
Statistical Tools: To grasp the fundamental character of the data, descriptive analysis was used. The researcher is required to analyse the data using ANOVA.

7. CONCEPTUAL FRAMEWORK



Result

- **Factor Analysis**

One typical use of Factor Analysis (FA) is to verify the existence of latent components in observable data. When there are not easily observable visual or diagnostic markers, it is common practice to utilise regression coefficients to produce ratings. In FA, models are essential for success. Finding mistakes, intrusions, and obvious connections are the aims of modelling. One way to assess datasets produced by multiple regression studies is with the use of the Kaiser-Meyer-Olkin (KMO) Test. They verify that the model and sample variables are representative. According to the numbers, there is data duplication. When the proportions are less, the data is easier to understand. For KMO, the output is a number between zero and one. If the KMO value is between 0.8 and 1, then the sample size should be enough. These are the permissible boundaries, according to Kaiser: The following are the acceptance criteria set by Kaiser:

A pitiful 0.050 to 0.059, below average 0.60 to 0.69

Middle grades often fall within the range of 0.70-0.79.

With a quality point score ranging from 0.80 to 0.89.



They marvel at the range of 0.90 to 1.00. Table1: KMO and Bartlett's Test

Testing for KMO and Bartlett's

Sampling Adequacy Measured by Kaiser-Meyer-Olkin .980

The results of Bartlett's test of sphericity are as follows: approx. chi-square

df=190

sig. =.000

This establishes the validity of assertions made only for the purpose of sampling. To ensure the relevance of the correlation matrices, researchers used Bartlett's Test of Sphericity. Kaiser-Meyer-Olkin states that a result of 0.980 indicates that the sample is adequate. The p-value is 0.00, as per Bartlett's sphericity test. A favorable result from Bartlett's sphericity test indicates that the correlation matrix is not an identity matrix.

Table: KMO and Bartlett's

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.980
Bartlett's Test of Sphericity	Approx. Chi-Square	3252.968
	df	190
	Sig.	.000

Bartlett's Test of Sphericity further substantiated the significance of the correlation matrices. The Kaiser-Meyer-Olkin measure of sampling adequacy is 0.980. Researchers determined a p-value of 0.00 via Bartlett's sphericity test. The researcher acknowledges that the correlation matrix is invalid, since Bartlett's sphericity test produced a significant result.

❖ **INDEPENDENT VARIABLE**

- **Healthy Interiors Environments**

Understanding what constitutes a healthy and sustainable indoor environment is crucial because of the profound effect that these spaces have on people's well-being. Data on individual components and their effects is abundant, but information about the interplay between components and the role of people in these interactions is scarce. In order to (i) better understand how various components interact with one another and the dangers of not seeing the whole picture, and (ii) gather the necessary components to conduct study on interior settings, the researchers set out on this mission. This work is the result of interdisciplinary collaboration among academics from



several fields, including those concerned with technology, behavior, and medicine. Workshops and book studies, in addition to conversations with invited experts and members from various stakeholder groups, yielded the findings (Ashour et al., 2021).

❖ FACTOR

• Clean air

Air that is free of dangerous amounts of contaminants, such as dirt and chemicals, is called clean air. People may breathe easier in clean air. Heavy, stale air with an unpleasant odor is common on hot days when there is no breeze. On occasion, the air might even irritate the respiratory system to the point where the researcher cough up a fit. Heart attacks and strokes may be precipitated by air pollution. Air pollution actually exacerbates heart disease, which affects one-third of the US population. When people breathe clean air, they reduce their risk of developing a variety of respiratory ailments, including asthma, heart disease, lung cancer, and stroke. A more comfortable and visually beautiful atmosphere is enhanced by clean air. Improving air visibility and reparability via the reduction of air pollutants including smog, dust, and unpleasant odors may enhance the quality of life in cities as a whole. A healthy lifestyle is supported by clean air since it promotes outdoor activities and leisure interests. The importance of clean air in one's surroundings was mentioned by several responders to the SOER 2023 Your Say poll. Air pollution and the effects of industry's reliance on fossil fuels were worries for several respondents. Weather and climatic phenomena may also have an effect on air quality. Communities in more rural areas are more vulnerable to dust storms as temperatures rise and the air becomes dryer. Particulate matter in the form of rain will wash pollutants from the air, while wind will carry them to other locations (Yan, 2022).

❖ DEPENDENT VARIABLE

• Sustainable Interior Design Practices

The phrase "sustainable interior design practices" refers to a system of rules for making efficient use of resources while avoiding negative impacts on people and the environment during the design and construction of interior spaces. Without compromising on practicality, beauty, or health, these methods may be included into interior design projects to lessen their impact on the environment. Sustainable interior design incorporates things like water-saving fixtures, renewable or recyclable resources, energy-efficient lighting, and eco-friendly materials. It places an emphasis on reducing waste, reusing what the researchers currently own, and discovering products with a little carbon effect. Some examples of practices include using non-toxic paints, reusing wood furniture, and flooring materials that are either recycled or supplied sustainably. In addition, sustainable interior design considers the whole product lifecycle, from production to disposal, to guarantee that choices are in accordance with sustainability standards. In addition, it comprises designing spaces that maximize the use of natural light and ventilation, reduce energy consumption, and enhance the quality of indoor air for the benefit of the occupants. Sustainable interior design practices aim to create environmentally conscious and functional places by integrating economic, social, and environmental aspects. This approach helps to reach sustainability goals in the long term while also being visually beautiful (Kineber et al., 2023).



- **Relationship Between Clean air and Sustainable Interior Design Practices**

To lessen the impact on the environment, sustainable interior design places an emphasis on the use of materials with low volatile organic compound (VOC) emissions that are not poisonous. Additionally, natural materials like stone and wood help improve the air quality within a building, making it a better place to live. By creating environments that promote physical exercise and mental health, as well as by maximizing the use of natural light and outside vistas, sustainable design concepts may improve the quality of life for building inhabitants. Wood and stone, which are naturally occurring materials, may also help improve the air quality within a building. The term "sustainability in design" refers to the practice of incorporating eco-friendly and economically viable products and materials into interior design projects. It entails creating places that are beautiful and ecologically sound by considering the whole material lifetime to minimize negative impacts on the environment. To help the environment, interior designers should use renewable, recyclable, and biodegradable materials wherever possible. One way companies may lessen their impact on the environment is by using bamboo flooring instead of hardwood. By including elements that encourage physical activity and mental wellbeing, as well as by making the most of natural light and vistas, sustainable design has the potential to enhance the health of occupants. Homeowners may enjoy a more pleasant living experience without relying on HVAC systems thanks to this method, which improves air quality influencing human health (Farley & Smith, 2020).

Subsequent to the above debate, the researcher proposed the following hypothesis to analyze the link between Clean air and Sustainable Interior Design Practices.

- ***“H₀: There is no significant relationship between Clean air and Sustainable Interior Design Practices.”***
- ***“H₁: There is a significant relationship between Clean air and Sustainable Interior Design Practices.”***

Table 2: H₁ ANOVA Test

ANOVA					
Sum					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	39588.620	249	5641.436	1060.221	.000
Within Groups	492.770	524	5.321		
Total	40081.390	773			

In this investigation, the results will be substantial. The F value is 1060.221, attaining significance with a p-value of .000, which is below the .05 alpha threshold. This signifies the ***“H₁: There is a significant relationship Clean Air and Sustainable Interior Design Practices”*** is accepted and the null hypothesis is rejected.



Discussion

The research concluded that in order to create healthy interior settings, ventilation systems and windows that let in natural light are essential. Improved air quality and more natural light are two major benefits of using sustainable design principles. Among these strategies are the strategic placement of windows and the use of skylights. Reducing exposure to artificial light has several positive effects, such as improving mood, decreasing eye strain, and encouraging the body's natural circadian cycles. The indoor air quality may be improved by the use of effective ventilation techniques, such as the use of materials with low volatile organic compound (VOC) levels and the operation of appropriate air filtration equipment. Environmentally conscious home design is all about the materials. Improving indoor air quality and decreasing the risk of health concerns associated with off-gassing from conventional chemicals may be achieved via the use of low-impact and non-toxic products. Using natural materials substantially helps to create healthier interior settings, according to research. Among these materials are paints with a low volatile organic compound concentration, bamboo, and recycled wood. Not only can these materials lessen their impact on the environment, but they also provide advantages including longer lifespan and less maintenance needs.

Conclusion

To achieve sustainability in interior architecture, the architect or designer plays a pivotal role. The interior designer has complete creative control over the selection of all materials and finishes used in a project. Designers that embrace sustainable approaches stand to benefit greatly while incurring no negative consequences. Designers should consider the environmental impact of their material choices in order to build eco-friendly interiors. They should also promote the use of recycled materials, reduce the usage of harmful volatile organic compounds (VOCs), and not utilize tropical hardwoods, which are becoming extinct. Toxins found in paints and textiles may be avoided by adopting a healthy lifestyle that includes elements like plants, sunshine, and natural ventilation. By using water- and energy-efficient items, interior designers may improve the water- and energy-efficiency of preexisting buildings. Sustainable techniques should be prioritized when building interior architecture to enhance people's health and decrease the adverse effect on the environment, according to this study's plausible conclusions.

Reference

1. Farley, H. M., & Smith, Z. A. (2020). *Sustainability: if it's everything, is it nothing?*. Routledge.
2. Kineber, A.; Massoud, M.; Hamed, M.; Qaralleh, T. Exploring Sustainable Interior Design Implementation Barriers: A Partial Least Structural Equation Modeling Approach. *Sustainability* 2023, 15, 4663.
3. Yan, L. An Analysis on Sustainable Development of Interior Design. *Advances in Social Science, Education and Humanities Research*. In *Proceedings of the 2022 3rd International Conference on Language, Art and Cultural Exchange (ICLACE 2022)*, Luoyang, China, 27–29 May 2022; Volume 673.
4. Ashour, M.; Mahdiyar, A.; Haron, S.H. A Comprehensive Review of Deterrents to the Practice of Sustainable Interior Architecture and Design. *Sustainability* 2021, 13, 10403.



5. Sakr, D. Sustainable interior design in healthcare facilities: A case study. *Int. J. Sustain. Built Environ.* 2020, 9, 94–105.
6. Altamimi, S.; Iranmanesh, A.; Denerel, S. Exploring the Spatial Dimensions of Social Sustainability in the Workplace through the Lens of Interior Architects in Jordan. *Buildings* 2023, 13, 1448.
7. Obeidat, I.; Obeidat, S.; Rumman, S.; Al-Jubouri, F. The role of sustainable interior design and its impact on customer behavior in commercial environments. *IOP Conf. Ser. Earth Environ. Sci.* 2022, 1026, 012054.
8. Licina, D.; Yildirim, S. Occupant satisfaction with indoor environmental quality, sick building syndrome (SBS) symptoms and self-reported productivity before and after relocation into WELL-certified office buildings. *Build. Environ.* 2021, 204, 108183.
9. Bullen, P.; Love, P.; Sturnieks, D. Upcycling: A review of the state-of-the-art for design researchers. *Des. Stud.* 2020, 70, 1–27.
10. Abouelega, A. The Effectiveness of the Role of Interior Design in Creating Functional and Institutional Happiness for Work Environments: King Faisal University as a Model. *Designs* 2022, 6, 45.
11. Yu, R.; Gu, N.; Ostwald, M.J. Architects' Perceptions about Sustainable Design Practice and the Support Provided for This by Digital Tools: A Study in Australia. *Sustainability* 2022, 14, 13849.
12. Darling-Hammond, L.; Flook, L.; Cook-Harvey, C.; Barron, B.; Osher, D. Implications for educational practice of the science of learning and development. *Appl. Dev. Sci.* 2020, 24, 97–140.