



UNIVERSITI
TEKNOLOGI
MARA

Cawangan Perak

ISCU 2025

17TH RISM INTERNATIONAL SURVEYING CONFERENCE FOR UNDERGRADUATES

Embracing Construction Revolution 4.0 (CR4.0): Transforming Malaysia's Built Environment

16th - 17th May 2025 | Friday - Saturday

E-ISBN PROCEEDING VOLUME I



©Royal Institution of Surveyors Malaysia

Published by
Royal Institution of Surveyors Malaysia
3rd Floor, Bangunan Juurukur
64 & 66, Jalan 52/4
46200 Petaling Jaya
Selangor

E- PROCEEDING 17th RISM ISCU 2025 Volume 1

Editors: Lizawati Abdullah, Nor Suzila Lop, Nor Nazihah Chuweni, Suriani Ngah Abdul Wahab,
Hasnan Hashim

All Rights Reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher, except in the case of brief quotations embodied in critical reviews and certain other non-commercial uses permitted by copyright law.

eISBN 978-629-94789-0-4



(online)

WELCOME SPEECH FROM THE CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

بسم الله الرحمن الرحيم السلام

عليكم ورحمة الله وبركاته

Greetings to all,

It is with great pleasure that I welcome you to the 17th RISM International Surveying Conference for Undergraduates (ISCU 2025), themed “*Embracing Construction Revolution 4.0: Transforming Malaysia’s Built Environment.*” On behalf of the Royal Institution of Surveyors Malaysia (RISM), I also wish to express our sincere appreciation to Universiti Teknologi MARA (UiTM), Perak Campus, for graciously hosting this significant event.

As we navigate the era of the Fourth Industrial Revolution (IR4.0)—or in our context, Construction Revolution 4.0 (CR4.0)—we are witnessing transformative advancements across the global construction sector. Technologies such as Building Information Modelling (BIM), the Internet of Things (IoT), artificial intelligence (AI), robotics, big data analytics, and cloud computing are redefining the way we build, manage, and interact with our built environment. For Malaysia, embracing CR4.0 is a strategic imperative to achieve our socio-economic and environmental goals.

This conference serves as a vital platform to unite surveying undergraduates from various disciplines, fostering critical dialogue on industry challenges, enhancing professional networking, and preparing a new generation of talent for the rapidly evolving construction landscape. It is also an opportunity for employers to engage with and inspire our future professionals.

I would like to extend my heartfelt thanks to all industry speakers, paper presenters, judges, and participants for their time, contributions, and support in making ISCU 2025 a success. I also commend the organising committee for curating a meaningful and dynamic conference experience.

May the knowledge gained, connections formed, and ideas exchanged during this event inspire all participants to lead and innovate in their future endeavours.

Wishing everyone a productive and memorable conference.

Prof. Ts Sr Dr. Adi Irfan Bin Che Ani'

Chairman, Universities' Partnering Committee

RISM Session 2024/2025

May 2025

WELCOME SPEECH FROM CO-CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

Bismillahirrahmanirrahim.

السلام عليكم ورحمة الله وبركاته and greetings to all.

It is my great pleasure to welcome everyone to the 17th International Surveyor Conference for Undergraduates (ISCU 2025), proudly hosted by Universiti Teknologi MARA (UiTM) Perak Branch in collaboration with the Royal Institution of Surveyors Malaysia (RISM). This event is a meaningful platform for students in the built environment to share ideas, showcase innovations, and build professional networks. We are honoured by your presence and enthusiastic participation, with 135 accepted papers and 78 poster presentations this year.

UiTM Perak, home to the College of Built Environment, has long been a hub for academic excellence in architecture, planning, and surveying. Our commitment remains strong in nurturing competent graduates who meet industry demands and contribute to nation-building.

While you're here, we invite you to experience the heritage and culture of Perak Tengah from the architectural richness of Rumah Kutai to the historical towns of Pasir Salak, Bota, and Kampung Gajah.

To all presenters and winners, congratulations on your achievements. Let your work today be a catalyst for future success and academic growth. We hope this conference will inspire you to explore new ideas, foster collaboration, and make lasting memories.

My deepest thanks to the Royal Institution of Surveyors Malaysia (RISM) and the organising committee for making this event a success.

We hope your experience here will be rewarding and unforgettable.

Thank you. Selamat datang dan selamat berjaya.

Associates Professor Dr. Nur Hisham Ibrahim, *PMP*
Co-Chairman, Universities' Partnering Committee
RISM Session 2024/2025
May 2025

WELCOME SPEECH FROM THE PROJECT DIRECTOR

RISM 17th International Surveying Conference for Undergraduates 2025

Alhamdulillah, all praise to Allah S.W.T. for His guidance and blessings in making the RISM 17th International Surveying Conference for Undergraduates (ISCU) 2025 a reality.

It is with great honour and gratitude that I welcome all participants, guests, academicians, and industry professionals to this prestigious event, proudly organized under the Royal Institution of Surveyors Malaysia (RISM). This 17th edition of ISCU stands as a proud testament to our collective dedication toward academic excellence, professional collaboration, and youth empowerment in the field of surveying.

I extend my heartfelt appreciation to RISM for its unwavering support, to the hardworking ISCU 2025 Organising Committee, and to all 16 partnering universities across Malaysia for their commitment and contributions. Your efforts have shaped this conference into a dynamic platform for knowledge exchange, innovation, and professional growth.

To the academicians and practitioners present, your insights are invaluable in bridging the gap between academic theory and real-world practice. To our undergraduate participants, your passion, curiosity, and commitment are the very foundation of our future. May this conference not only deepen your academic journey but also ignite a spirit of leadership, integrity, and sustainable thinking.

Let this gathering serve as more than an academic milestone. May it foster lifelong networks, inspire transformative ideas, and chart new directions in our shared professional journey.

Wishing everyone a rewarding and inspiring conference experience.

Sr Dr. Nurul Fadzila Zahari

Project Director

RISM 17th ISCU 2025

CREATING A HEALTHIER LEARNING SPACE: EVALUATING INDOOR ENVIRONMENTAL QUALITY (IEQ) CHALLENGES IN UITM SERI ISKANDAR LIBRARY

Muhammad Aidin Bin Mazzeri¹, Suriani Ngah Abdul Wahab^{2*},

^{1,2*}Programme of Building Surveying,
Department of Environment Studies and Technology, Faculty of Built Environment,
Universiti Teknologi Mara, Perak Branch, MALAYSIA.

Email: Suria275@uitm.edu.my

*Corresponding Author

ABSTRACT

The Tun Abdul Razak Library (PTAR) of UiTM Seri Iskandar has the potential to face challenges related to Indoor Environmental Quality (IEQ), which may affect user comfort, health, and the maintenance of library assets. Elements including illumination, ventilation, thermal conditions, and general air quality impact the functionality of library environments, influencing student focus, staff productivity, and the durability of both printed and digital materials. Insufficient indoor environmental quality (IEQ) conditions have been linked to adverse health impacts, such as fatigue, headaches, and respiratory problems, while also leading to the deterioration of materials in library collections. Despite the global focus on enhancing Indoor Environmental Quality (IEQ) in academic libraries, there has been limited research on the specific environmental conditions of PTAR. This study aims to evaluate the effects of insufficient indoor environmental quality on the general health of consumers and personnel, along with preserving of collections within PTAR. The research objectives are to evaluate the impact of essential indoor environmental quality parameters and to identify areas for improvement to enhance user satisfaction and promote a healthier, positive learning environment. A mixed-methods approach applies, integrating Post-Occupancy Evaluation (POE) surveys and on-site environmental monitoring with scientific instruments such as thermometers, hygrometers, lux meters, and sound level meters. The POE questionnaire gathers subjective feedback from students and staff concerning their perceptions of indoor environmental quality elements, health symptoms encountered, and proposed enhancements. Initial findings are anticipated to demonstrate a correlation between indoor environmental quality factors and user-reported discomfort, with insufficient temperature regulation, ventilation, and noise levels identified as principal problems. Results may also suggest a necessity for improved heat regulation, greater airflow management, and optimised lighting conditions to facilitate academic pursuits. The study's findings will offer evidence-based recommendations to enhance indoor environmental quality, thereby promoting user well-being, resource conservation, and sustainable library operations.

Keywords: Indoor Environmental Quality, Academic Library, Post-Occupancy Evaluation, User Satisfaction, Library Collection Preservation

I. INTRODUCTION

This chapter presents a comprehensive review of the literature on Indoor Environmental Quality (IEQ) and its significance in library environments. IEQ, encompassing factors such as air quality, thermal comfort, lighting, and acoustics, directly impacts the health, comfort, and productivity of building occupants. Libraries, as spaces for extended academic activities, require optimal IEQ conditions to support user focus and well-being. Research by Fisk (2000) and Sundell (2004) highlights the role of IEQ in preventing health issues such as fatigue and respiratory problems while enhancing cognitive performance and user satisfaction.

Key factors influencing IEQ in libraries include air quality, thermal comfort, lighting, and acoustics. Poor indoor air quality (IAQ), resulting from pollutants like carbon dioxide and volatile organic compounds (VOCs), has been linked to reduced productivity and adverse health effects (Azuma et al., 2012; Daisey et al., 2003). Thermal comfort and indoor air quality (IAQ) are critical components of Indoor Environmental Quality (IEQ) in library settings. Maintaining appropriate temperature and humidity levels is essential to ensure user comfort and preserve library materials. However, many libraries face challenges in achieving optimal thermal conditions, which can negatively impact user satisfaction and the longevity of resources (Buildings, 2023). Similarly, IAQ is

vital, as libraries may harbor pollutants that pose health risks to users and staff while also accelerating the deterioration of collections. Poor air quality can compromise the well-being of library patrons and the sustainability of its resources (PurpleAir, n.d.).

Lighting and acoustic conditions also play significant roles in shaping the IEQ of libraries. Insufficient lighting can lead to eye strain and reduce study efficiency, whereas human-centric and integrative lighting strategies have been shown to enhance user experiences by addressing both visual and non-visual needs (Lighting Research, 2023). On the other hand, excessive noise levels disrupt focus and hinder academic performance, emphasizing the importance of effective noise management through thoughtful design and policies (Library Atmospherics, 2023). This review also examines relevant international and local standards, such as ASHRAE 62.1-2017, WHO guidelines, and Malaysia's MS 1525, which provide benchmarks for acceptable IEQ levels (ASHRAE, 2017; WHO, 2010; Department of Standards Malaysia, 2007). However, while global research on IEQ in libraries is extensive, studies specific to Malaysian academic libraries remain limited. The findings from this review highlight critical research gaps and emphasize the importance of localized studies to address IEQ challenges in libraries like Perpustakaan Tun Abdul Razak (PTAR) at UiTM Seri Iskandar.

A. Problem Statement

The first problem, based on observed conditions at Perpustakaan Tun Abdul Razak (PTAR), UiTM Seri Iskandar, is the potential inadequacy of Indoor Environmental Quality (IEQ), particularly in areas such as air quality, thermal comfort, lighting, and noise levels. These factors can negatively affect students' health, concentration, and academic performance (Rahman et al., 2023; Zulkefli et al., 2022). Despite the global recognition of IEQ's importance in learning spaces, there is limited research specifically addressing the IEQ conditions within PTAR (Mokhtar et al., 2023). Although international studies have widely addressed the significance of IEQ in learning spaces, many local academic libraries—especially in developing regions—continue to face similar environmental challenges. Within the Malaysian context, recent findings reveal dissatisfaction among library users due to issues like excessive noise, uncomfortable temperature fluctuations, and insufficient lighting, which collectively disrupt users' focus and learning efficiency (Mokhtar et al., 2023). Moreover, older university buildings often struggle to meet modern environmental standards due to aging ventilation systems and inefficient building designs, which further contribute to poor IEQ conditions (Rahman et al., 2023). Despite these concerns, limited localized data is available to clarify the current environmental conditions experienced by users at PTAR.

B. Objectives And Scopes of Study

The aim of this research is to evaluate the impact of inadequate indoor environmental quality (IEQ) on the health of patrons and staff, as well as the preservation of collections, at the Library of UiTM Seri Iskandar. This research focuses on evaluating the impact of inadequate Indoor Environmental Quality (IEQ) on the health and comfort of library patrons and staff, as well as the preservation of collections at the Library of UiTM Seri Iskandar. The study will examine key IEQ factors, including lighting, ventilation, temperature, and air quality, to determine their influence on user productivity and well-being. Poor environmental conditions can lead to discomfort, fatigue, headaches, and reduced concentration, affecting both students and staff who rely on the library as a learning and working space.

Additionally, the study will assess how environmental factors contribute to the deterioration of library collections, such as books, manuscripts, and digital resources, which require stable conditions for long-term preservation. By identifying areas within the library where IEQ issues are most prevalent, this research aims to highlight critical concerns that require immediate attention. The findings will serve as the basis for practical recommendations to improve the library's indoor environment, ensuring a healthier and more conducive space for academic activities while also protecting valuable resources. The study will primarily focus on key areas within the main library building, including reading zones, study areas, and staff workspaces, providing a comprehensive evaluation of IEQ conditions at UiTM Seri Iskandar.

II. LITERATURE REVIEW

Indoor Environmental Quality (IEQ) refers to the physical conditions inside a building that affect people's health, comfort, and productivity. Important factors include air quality, temperature, lighting, acoustics, and ventilation. These elements are especially important in libraries, where students and staff spend long hours studying and working. A good indoor environment helps improve focus, learning, and overall well-being, while poor conditions can cause discomfort, fatigue, and health issues (Fisk, 2000; Sundell, 2004).

Poor air quality, such as high carbon dioxide (CO₂) levels, can make people feel tired and reduce concentration (Allen et al., 2016). Uncomfortable temperatures, whether too hot or too cold, can also affect focus and productivity (Lan et al., 2011). Similarly, poor lighting can strain the eyes and cause headaches, making studying more difficult (Smolders et al., 2012). Noise is another key factor, as loud or distracting sounds can make it harder

for students to concentrate (Banbury & Berry, 2005). Libraries need proper sound control to maintain a quiet and productive environment.

Maintaining good IEQ in libraries is essential for both health and academic success. Poor indoor conditions can cause headaches, tiredness, and breathing problems, making it harder for students to learn (Wargocki et al., 2002). On the other hand, a well-maintained library environment improves comfort, focus, and productivity. By ensuring good air quality, comfortable temperatures, proper lighting, and low noise levels, libraries can create a better space for learning and research.

A. Air Quality in Libraries

Air quality is a key factor in maintaining a healthy and comfortable library environment. Poor Indoor Air Quality (IAQ) can affect both library users and staff, as well as the preservation of books and materials. Libraries with high foot traffic and poor ventilation are more likely to experience a buildup of pollutants such as carbon dioxide (CO₂), particulate matter (PM), and volatile organic compounds (VOCs). When ventilation systems are inadequate or poorly maintained, these pollutants can accumulate, leading to health issues such as headaches, fatigue, respiratory problems, and reduced concentration (Azuma et al., 2012). The World Health Organization (WHO, 2010) stresses the importance of clean air and proper ventilation, as poor IAQ can worsen health conditions and make learning spaces less effective.

Good ventilation is essential to maintaining healthy IAQ in libraries. However, many libraries struggle with outdated or inefficient ventilation systems that fail to remove indoor pollutants effectively (Daisey et al., 2003). In tropical climates like Malaysia, high humidity adds to the challenge, as it promotes mold growth and damages books, paper, and electronic equipment. To preserve both air quality and library collections, it is important to control both temperature and humidity levels.

B. Thermal Comfort and Its Impact on Users

Thermal comfort is crucial in libraries as it directly affects users' ability to focus and study. Factors such as temperature, humidity, and airflow determine how comfortable an environment feels. If a library is too hot or too cold, users may experience discomfort, fatigue, and difficulty concentrating, which can lower productivity and academic performance (Lan et al., 2011). In Malaysia's tropical climate, maintaining thermal comfort is more challenging due to high temperatures and humidity. The Malaysian Standard MS 1525 recommends indoor temperatures between 24°C and 26°C, with humidity levels between 50% and 70%, to ensure both comfort and energy efficiency (Department of Standards Malaysia, 2007). Poor thermal conditions can also damage library materials, as excessive humidity can cause mold growth and deterioration of books and equipment.

C. Lighting Quality in Library Environments

Lighting plays a crucial role in libraries, directly impacting user comfort, concentration, and productivity. Proper lighting reduces eye strain, enhances focus, and supports cognitive tasks, while poor lighting can cause fatigue, headaches, and decreased efficiency (Cajochen, 2007). A balance between natural and artificial lighting is essential; natural daylight boosts mood and alertness, while well-designed artificial lighting ensures consistent illumination during low-light hours. To maintain energy efficiency and user comfort, libraries should follow lighting standards like the Malaysian Standard MS 1525 and incorporate LED lighting and smart systems that adjust brightness based on occupancy and daylight levels. By optimizing lighting quality, libraries can create a more comfortable, productive, and sustainable learning environment.

D. Acoustic Comfort in Learning Spaces

Acoustic comfort is essential in libraries as noise can disrupt concentration, reduce productivity, and increase stress levels among users. Excessive noise from occupants, mechanical systems, or external sources can interfere with cognitive functions and negatively impact academic performance (Kang & Bradley, 2010). Poor acoustic conditions force users to exert more effort to focus, leading to fatigue and frustration (Al Horr et al., 2016). To create a conducive learning environment, libraries should implement noise control measures such as acoustic panels, carpeting, and sound-absorbing materials. These strategies help minimize sound reflection, reduce background noise, and enhance overall comfort.

Designing libraries with quiet zones and soundproofed study rooms is another effective way to improve acoustic comfort. Separating areas for group discussions and individual study ensures that noise from collaborative activities does not disturb those requiring silence. Additionally, architectural features such as double-glazed windows, insulated walls, and acoustic ceilings can help block external noise and maintain a peaceful indoor atmosphere (Al Horr et al., 2016). By integrating these design strategies, libraries can provide an environment that supports learning, boosts productivity, and enhances user satisfaction.

E. IEQ Standards and Guidelines

Indoor Environmental Quality (IEQ) is essential for maintaining comfort, health, and productivity in buildings, particularly in libraries where users spend long hours studying. International and local standards, such as ASHRAE 62.1-2017, WHO guidelines, and Malaysia's MS 1525, provide frameworks for optimizing indoor conditions, focusing on ventilation, thermal comfort, lighting, and acoustics. ASHRAE emphasizes proper ventilation to reduce indoor pollutants and improve air quality, while WHO highlights the importance of clean air in preventing health issues. Malaysia's MS 1525 offers guidelines suited to the tropical climate, ensuring energy efficiency and user comfort. Adhering to these standards enhances the library environment by regulating air quality, temperature, lighting, and noise levels, creating a space that supports learning and well-being. Compliance with IEQ guidelines not only improves user satisfaction and productivity but also promotes sustainability and efficient building management.

F. Challenges and Opportunities in Malaysian Libraries

Malaysian libraries face several challenges in maintaining optimal Indoor Environmental Quality (IEQ), including poor ventilation, high humidity, and inadequate acoustic control. Many older libraries rely on outdated mechanical ventilation systems, leading to poor air circulation and the accumulation of pollutants like CO₂ and VOCs, which affect both users' health and the preservation of books. The tropical climate further complicates matters, as high humidity contributes to mold growth and discomfort. Noise disturbances also pose a problem due to a lack of soundproofing and ineffective space planning, making it difficult for users to concentrate.

Additionally, budget constraints limit the ability of libraries to upgrade ventilation, cooling, and insulation systems, worsening indoor conditions. Despite these challenges, several opportunities exist to improve IEQ in Malaysian libraries. Implementing natural ventilation can enhance air quality while reducing energy consumption, and energy-efficient building materials can help maintain thermal comfort at a lower cost. Advanced IEQ monitoring systems can also provide real-time data to regulate air quality, temperature, and humidity. Libraries can learn from successful case studies in other tropical countries, such as Singapore and Thailand, which have adopted sustainable building designs and passive cooling strategies. By integrating these solutions, Malaysian libraries can create healthier, more comfortable environments that support learning and research.

III. METHODOLOGY

A mixed-methods approach is utilized, integrating quantitative and qualitative methods for a comprehensive evaluation. Numerical data are complemented by user feedback collected through questionnaires. This integration offers a balanced perspective, capturing both measurable environmental conditions and the experiences of library users.

A. Post Occupancy Evaluation (POE)

The quantitative aspect of the research design is centered around a Post Occupancy Evaluation (POE) using a structured questionnaire. The questionnaire is designed to capture user perceptions of various IEQ factors, including thermal comfort, air quality, ventilation, lighting, and noise levels. The POE helps in understanding the subjective experiences of library users and their satisfaction with the indoor environment.

B. Field Measurements

The qualitative component involves only visual inspection. The symptoms and the condition of the library. Data collection is carried out at various locations within the library, covering different zones and time periods to capture variations in environmental conditions.

In Section A: Demographic Information, the survey results reveal that the majority of library users are students, making up 94.7% of respondents, while only a small percentage consists of staff and visitors. This indicates that the library is primarily utilized by students for academic purposes. The frequency of library visits varies, with 40.4% of respondents stating that they rarely visit, while 36.8% visit once a week, and 19.3% visit two to three times per week. Only a small number of users visit the library daily. These findings suggest that while the library remains an essential resource, a significant portion of students do not frequent it regularly.

Section B: Perception of Indoor Environmental Quality (IEQ), The survey assessed users' perceptions of indoor environmental quality (IEQ) in the library based on factors such as temperature, ventilation, lighting, and cleanliness. In terms of temperature, most respondents rated it as moderate, with 45.7% considering it "good" and 35.1% rating it as "excellent." However, a small percentage found it poor. Ventilation received mixed feedback, with 43.9% rating it as "good" and 28.1% as "excellent," though 14% found it inadequate.

Lighting adequacy for reading was well-rated, with 48.2% marking it as "good" and 14.3% as "excellent," while only a few respondents found it poor. Cleanliness, particularly concerning dust, dirt, and odors, was also evaluated, with 45.9% rating it as "good" and 19.3% as "excellent." However, 14% of respondents felt cleanliness needed improvement. These findings indicate that while the library maintains a relatively satisfactory indoor environment, there are areas where enhancements in ventilation and cleanliness could improve user comfort.

Section C: Health and Comfort Issues. The survey also examined health and comfort concerns experienced by library users. A significant portion of respondents (76.8%) reported experiencing none of the listed symptoms. However, some users did experience discomfort, with 14.3% reporting headaches, 10.7% experiencing eye strain, and 10.7% suffering from allergies such as sneezing and coughing. Other symptoms, including fatigue (8.9%), dry throat (7.1%), breathing difficulties (5.4%), and skin irritation (1.8%), were reported at lower frequencies. When asked whether they believed these symptoms were related to the library's environment, 67.9% of respondents answered "Yes," while 14.3% did not associate their symptoms with the environment, and 17.9% were unsure.

Regarding overall comfort, responses varied. Around 31% of participants found that IEQ factors (lighting, ventilation, temperature, and air quality) moderately impacted their comfort, while 26.3% reported significant effects, and 24.6% felt they were impacted only a little. A small percentage (7%) reported no impact at all. Lastly, when asked whether the library environment helped them stay productive and focused, the majority (68.4%) responded "Always," with 19.3% selecting "Often" and 8.8% indicating that it "Sometimes" helped. This suggests that while most users find the library conducive to productivity, some still experience discomfort that could affect their focus.

Section D: Library Facilities and Improvement. Satisfaction with Indoor Environmental Quality (IEQ). The survey evaluated users' satisfaction with the library's IEQ, which includes lighting, ventilation, temperature, and air quality. Most respondents (52.6%) indicated that they were "Satisfied," while 29.8% were "Neutral." A smaller percentage (8.8%) were "Very Satisfied," whereas 8.8% were "Dissatisfied," and 1.8% were "Very Dissatisfied."

Suggested Improvements for the Library's Indoor Environment, when asked about potential improvements, respondents suggested:

- i) More greenery for better air quality (75.4%)
- ii) Better temperature control (45.6%)
- iii) Improved ventilation (45.6%)
- iv) More comfortable seating (40.4%)
- v) Reduced noise levels (22.8%)
- vi) Enhanced lighting (17.5%)

Specific Recommendations for Enhancing IEQ, Open-ended responses suggested various ways to improve the library's indoor environment. Some common recommendations included:

- i) Controlling air quality
- ii) Installing automated lighting
- iii) Maintaining cleanliness
- iv) Replacing carpets
- v) Adding more digital equipment
- vi) Installing thermal curtains
- vii) Creating more landscape areas
- viii) Implementing smart systems

These responses highlight the importance of improving air quality, thermal comfort, and seating arrangements to enhance user satisfaction and productivity.

CONCLUSION

Indoor Environmental Quality (IEQ) significantly influences the comfort, health, and productivity of library users. Elements such as air quality, thermal comfort, lighting, and acoustics play a vital role in shaping the overall user experience. Poor IEQ can lead to discomfort, fatigue, and reduced concentration, negatively impacting academic performance. In contrast, a well-maintained indoor environment with proper ventilation, balanced temperature and humidity, effective lighting, and minimal noise disturbance enhances focus, learning, and overall well-being. At PTAR, UiTM Seri Iskandar, understanding and addressing specific IEQ challenges is essential to improving library conditions. Given Malaysia's tropical climate, factors like humidity control, ventilation efficiency, and sustainable lighting solutions must be carefully considered. Implementing targeted improvements, such as better

air circulation, enhanced thermal comfort, and noise reduction strategies, will create a healthier and more conducive study space.

By prioritizing IEQ enhancements, PTAR can continue to serve as an effective academic hub that supports student success and well-being. Ensuring a high-quality indoor environment will not only benefit current users but also contribute to the library's long-term sustainability as a comfortable and productive learning space.

ACKNOWLEDGEMENT

I would like to express my heartfelt gratitude to my supervisor, sr. Ts. Dr. Suriani Ngah Abdul Wahab, for their invaluable guidance, encouragement, and support throughout this research. I am also deeply thankful to UiTM Seri Iskandar and the staff of Perpustakaan Tun Abdul Razak for providing access to essential resources and insights on indoor air quality. My sincere appreciation extends to the Building Surveying Department of UiTM Perak Branch for their continuous support, knowledge, and assistance, which have greatly contributed to the success of this study. I am also grateful to my colleagues and friends for their motivation, constructive discussions, and support, which have enriched my research experience. Lastly, I am profoundly grateful to my family for their unwavering love, patience, and encouragement, which have been my greatest source of strength throughout this journey.

REFERENCES

- Allen, J. G., MacNaughton, P., Satish, U., Santanam, S., Vallarino, J., & Spengler, J. D. (2016). Associations of cognitive function scores with carbon dioxide, ventilation, and volatile organic compound exposures in office workers: A controlled exposure study of green and conventional office environments. *Environmental Health Perspectives*, 124(6), 805-812.
- ASHRAE. (2017). ASHRAE Standard 62.1-2017: Ventilation for acceptable indoor air quality. American Society of Heating, Refrigerating and Air-Conditioning Engineers.
- Rahman, N. A., Ismail, M., & Ahmad, S. S. (2023). Assessment of thermal comfort and indoor air quality in Malaysian university buildings. *Journal of Sustainable Construction and Design*, 14(1), 45–52.
- Zulkefli, M. A., Rahim, H. A., & Hassan, N. A. (2022). Indoor environmental quality assessment in academic spaces at UiTM Seri Iskandar. UiTM Institutional Repository.
- Mokhtar, R., Tan, C. S., & Aziz, F. A. (2023). User perception of IEQ in academic libraries: A Malaysian case study. *Creative Sustainable Technology*, 11(2), 33–41.
- Azuma, K., Kagi, N., Yanagi, U., & Osawa, H. (2012). Effects of low-level inhalation exposure to volatile organic compounds on human health: A review. *Environmental Health and Preventive Medicine*, 17(5), 375-387.
- Banbury, S. P., & Berry, D. C. (2005). Office noise and employee concentration: Identifying causes of disruption and potential improvements. *Ergonomics*, 48(1), 25-37.
- Cajochen, C. (2007). Alerting effects of light. *Sleep Medicine Reviews*, 11(6), 453-464.
- Daisey, J. M., Angell, W. J., & Apte, M. G. (2003). Indoor air quality, ventilation and health symptoms in schools: An analysis of existing information. *Indoor Air*, 13(1), 53-64.
- Department of Standards Malaysia. (2007). MS 1525: Code of practice on energy efficiency and use of renewable energy for non-residential buildings.
- Dimitriou, V., & Doukas, H. (2015). Sustainable indoor air quality in university libraries: The role of natural ventilation. *Energy Procedia*, 78, 3032-3037.
- Fisk, W. J. (2000). Health and productivity gains from better indoor environments and their relationship with building energy efficiency. *Annual Review of Energy and the Environment*, 25(1), 537-566.
- Lan, L., Wargocki, P., & Lian, Z. (2011). Quantitative measurement of productivity loss due to thermal discomfort. *Energy and Buildings*, 43(5), 1057-1062.
- Lighting Research Center. (2023). Human-centric lighting and its benefits. *Lighting Research & Technology Journal*.
- PurpleAir. (n.d.). Understanding indoor air quality: The role of smart monitoring. PurpleAir Air Quality Reports.
- Smolders, K. C. H. J., de Kort, Y. A. W., & Cluitmans, P. J. M. (2012). A higher illuminance induces alertness even during office hours: Findings on subjective measures, task performance, and heart rate measures. *Physiology & Behavior*, 107(1), 7-16.
- Sundell, J. (2004). On the history of indoor air quality and health. *Indoor Air*, 14(s7), 51-58.
- Wargocki, P., Wyon, D. P., Matysiak, B., & Irgens, S. (2002). The effects of classroom air temperature and outdoor air supply rate on the performance of schoolwork by children. *HVAC&R Research*, 8(3), 201-216.
- World Health Organization (WHO). (2010). WHO guidelines for indoor air quality: Selected pollutants. WHO Regional Office for Europe.



UNIVERSITI
TEKNOLOGI
MARA

Cawangan Perak

eISBN 978-629-94789-0-4



(online)