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UNIVERSITI TEKNOLOGI MARA

ISETC2025

2 ND INTERNATIONAL SCIENCE, ENGINEERING AND TECHNOLOGY COLLOQUIUM

THE POWER OF SCIENTIFIC INNOVATION

INTELLIGENT SOLUTIONS FOR A SUSTAINABLE WORLD

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PREFACE

Welcome to the 2nd International Science, Engineering and Technology Colloquium 2025 (ISETC 2025)!

It is with great pleasure that we present this year's colloquium, a distinguished gathering of scholars, researchers, and professionals dedicated to the advancement of applied sciences. Held virtually on 9th July 2025, ISETC 2025 serves as a platform to highlight cutting-edge research, foster meaningful networking, encourage collaborations, and explore innovative solutions to global challenges.

This year's theme, "The Power of Scientific Innovation: Intelligent Solutions for a Sustainable World" highlights our shared goal to solve global challenges through applied science. It celebrates innovation as a key to building a more sustainable and resilient future. We're proud to feature keynote speakers and presenters who bring fresh insights, bold ideas, and breakthroughs shaping tomorrow's world.

We would like to extend our heartfelt appreciation to the Faculty of Applied Sciences, Universiti Teknologi MARA, Perak Branch, Tapah Campus, for their outstanding support and assistance throughout the planning and execution of the event. Their dedication has been instrumental to the success of this colloquium. We would like to sincerely thank all participants and researchers for their valuable contributions. We also appreciate the reviewers for their careful evaluations and helpful feedback. Your hard work and support mean a lot to us.

As editors, we are proud to present this collection of proceedings. It is an honour to bring together the interesting and meaningful work of our speakers and authors. We hope the ideas shared will lead to new discoveries, encourage more research, and help solve global challenges through science and innovation.

Warm regards,

Dr. Emi Norzehan Mohamad Mahbob
Dr. Saiyidah Nafisah Hashim
Ms. Lili Widarti Zainuddin
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ISETC 2025 Proceedings Editors

DESIGNING FOR LEARNING: AN INVESTIGATION INTO SPATIAL AND TECHNOLOGICAL ENHANCEMENT OF ACADEMIC STUDY ROOM

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Abstract: This study looks at potential treatments to improve the study environment and assesses how ambient levels in study rooms affect students' productivity. The data collected will be used to identify the main sources of noise and how they relate to self-reported productivity metrics. Based on the results, suggestions will be made for improving the study environment, including acoustic treatment, layout reconfiguration, and behavioral advice. The goal of this study is to provide valuable contributions to the design of more productive and quiet study areas in schools. The study also takes behavior-based regulation, room zoning, and acoustic insulation into account as ways to reduce noise. The findings are expected to put the importance of noise control in schools into perspective and offer practical ways to support efficient study-room design for better learning.

Keywords: *Decibel, lux, spatial, study room*

INTRODUCTION

The effect of background noise levels in academic study spaces on student productivity is examined in this study. Finding the main sources of noise and assessing how they relate to self-reported productivity metrics are the goals. Environmental measures (noise levels in dB and illumination in lux) and student surveys were used to gather data in a variety of study room configurations. The findings show a negative relationship between perceived productivity and higher noise levels, particularly in open-plan and group settings. To reduce noise and improve the efficiency of study rooms, interventions like behavioural controls, spatial zoning, and acoustic treatment are suggested. The results provide useful recommendations for creating academic settings that are acoustically optimised.

LITERATURE REVIEW

Students' cognitive function and general academic progress are greatly aided by the physical layout of study areas (Ellis & Goodyear, 2019). It has been demonstrated that two important environmental factors—noise levels and lighting—have an impact on learners' ability to focus, be productive, and feel mentally exhausted (Zandvliet & Fraser, 2005). Since excessive noise impairs speech perception and learning comprehension, the World Health Organization states that indoor noise levels in educational environments should not be higher than 35 to 40 dB (World Health Organization [WHO], 1999). But according to a number of studies, noise levels in common academic areas frequently exceed these limits, especially during periods of high usage (Beckers et al., 2016; Evans & Maxwell, 1997). Stress, poor task performance, and working memory impairment have all been associated with prolonged exposure to high noise levels (Shield & Dockrell, 2003).

Simultaneously, it has been widely acknowledged that preserving visual comfort and minimizing eye strain during extended study sessions depends on lighting quality, particularly illuminance levels and glare management (Veitch & Newsham, 2000; Thomas, 2010). Adequate illumination improves mood, reading speed, and alertness. A minimum of 300 to 500 lux is advised by the Illuminating Engineering Society for reading and writing activities (IESNA, 2011; EN 12464-1:2011). However, uneven lighting distribution and glare are still prevalent in many institutional study spaces, which may cause eye strain and short attention spans (Woolner, 2010). There is still a lack of integrated assessments that concurrently analyze illumination and noise levels and their combined impact on students'

productivity, despite increased awareness of environmental ergonomics in educational settings (Finkelstein et al., 2016).

MATERIALS AND METHODS

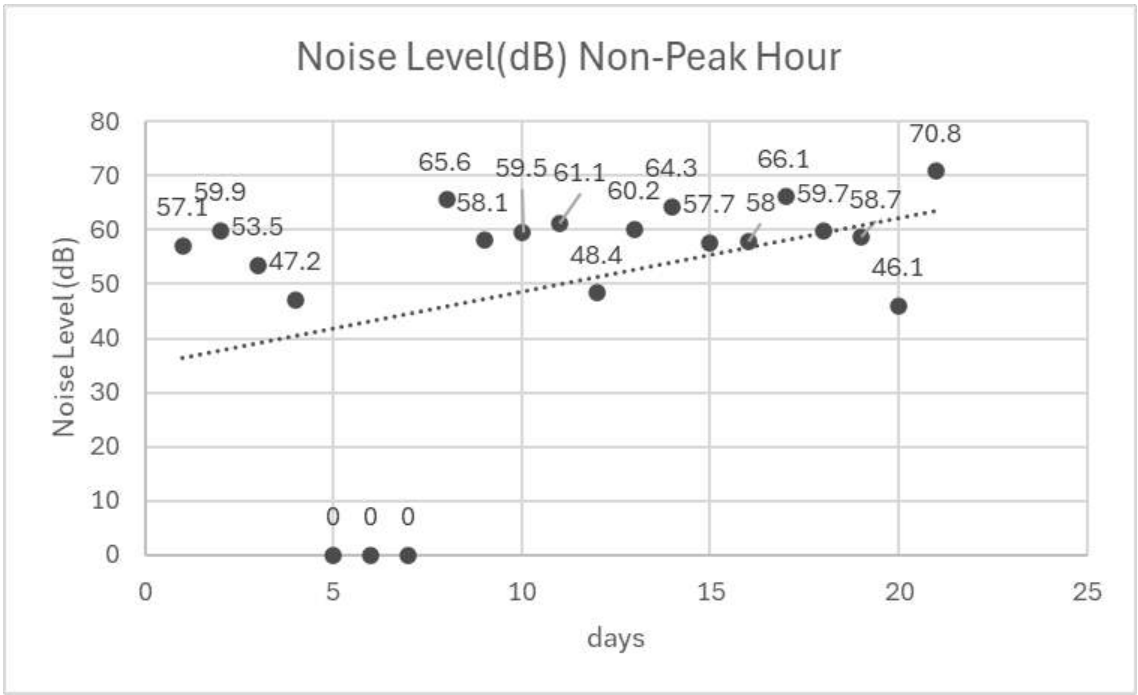
A mixed-methods approach was used in this study, integrating qualitative survey data with quantitative environmental measurements. Over the course of three weeks, the ambient conditions in several academic study rooms were documented. A digital sound level meter and a light meter were used to measure the noise levels (in decibels, dB) and illumination levels (in lux), respectively. For the purpose of capturing environmental variability, measurements were made both during and outside of study hours. Students who used the study rooms during the time of data collection were considered participants. Self-reported productivity levels, perceived noise disturbance, and preferred study situations (individual vs. group) were collected using a standardised questionnaire.

Three criteria were used to classify the data: (1) study mode (individual or group), (2) ambient circumstances and spatial layout, and (3) productivity ratings. The association between noise levels and productivity was investigated using scatter plots and linear regression analysis; trend strength was evaluated using R2 values. The findings influenced the formulation of suggestions for auditory and spatial improvements.

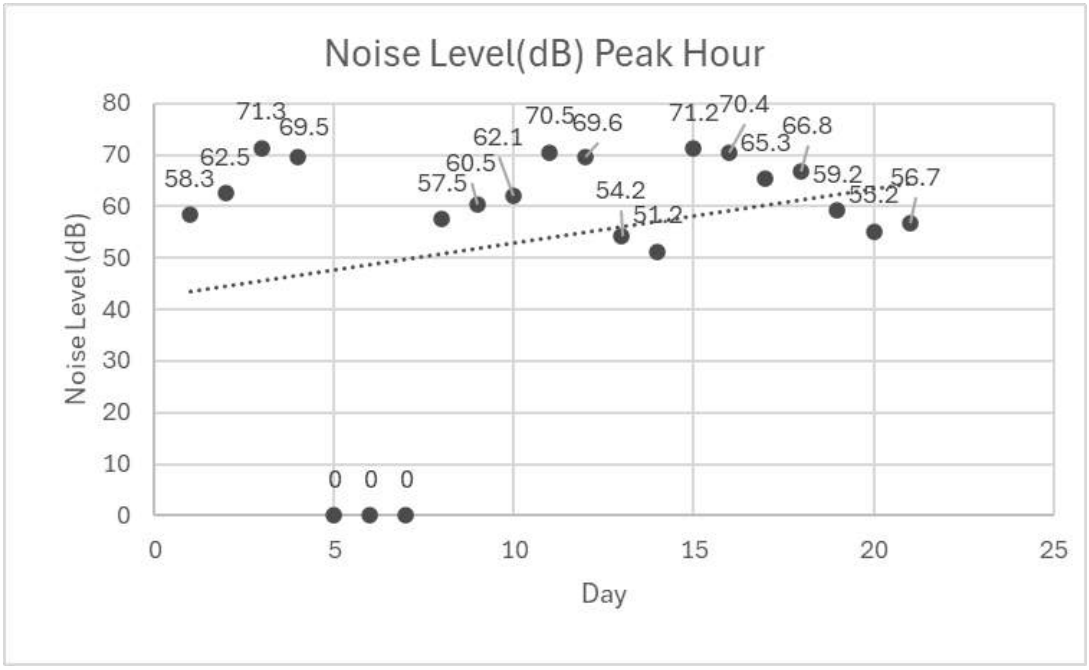
RESULTS

Figure 1 (a) depicts the noise levels (dB) recorded during non-peak hours over a duration of 22 days in a library study area. The data indicates significant swings, with most values spanning from 46 dB to 71 dB, which are extremely elevated for a library setting where silence is anticipated. Several data points, specifically on days 5–7, registered 0 dB, suggesting measurement inaccuracies or equipment failure rather than genuine quiet. Notwithstanding daily fluctuations, the trendline indicates a progressive rise in noise levels over time, with significant peaks observed on day 9 (65.6 dB), day 17 (66.1 dB), and day 21 (70.8 dB). The library environment may be vulnerable to disruptive noise even during off-peak hours, which could damage students' focus and overall study experience. These elevated values above the acceptable noise limits for study areas, which are normally below 40 to 50 dB.

The illustration in Figure 1 (b) portrays the noise level (dB) that is also recorded in the library study area during peak hours over a span of 22 days. The noise levels range from 51.2 dB to 71.3 dB, with multiple occurrences surpassing 70 dB, particularly on days 3, 11, and 15–16, which are significantly elevated for a library environment. Analogous to the non-peak hour data, several anomalies with values of 0 dB are present on days 5–7, presumably attributable to measurement error or sensor malfunction. The dotted trendline signifies a progressive rise in noise levels over time, indicating that peak hour disturbances are both common and escalating. The bulk of values significantly exceed the recommended 40–50 dB for calm study areas, indicating that during peak usage, the library encounters disruptive noise levels that may impede attention and academic production.



(a)



(b)

Figure 1. (a) Graph of Noise Level Non-Peak Hour (b) Noise Level Peak Hour

DISCUSSION/ANALYSIS

The investigation's findings indicate two significant environmental concerns within the research area: (1) elevated ambient noise levels, and (2) irregular and excessive lighting. Both elements have substantial ramifications for students' learning, focus, and long-term health. The mean ambient noise level of 68 dB in the study area, regardless of peak or off-peak times, significantly exceeds the WHO's advised noise level (WHO, 1999). This surpasses the limit at which cognitive abilities start to deteriorate, especially in younger students or those susceptible to auditory disturbances (Shield & Dockrell, 2003). Studies have consistently demonstrated that excessive background noise adversely affects academic performance (Evans & Maxwell, 1997). Persistent exposure not only hinders attention but may also result in mental exhaustion and diminished motivation (Klatte et al., 2010).

Utilize acoustic treatments, including sound-absorbing panels and ceiling tiles, to diminish ambient noise (ANSI S12.60-2010). Implement staggered schedules during peak hours to equitably distribute occupancy. Establish zones for silent, quiet, and collaborative study (Scott-Webber, 2004). Noise-monitoring systems like traffic light indicators can improve awareness (Klatte et al., 2010). In cases where structural changes are impractical, provide noise-canceling headphones or quiet booths.

The examination uncovered problems associated with inconsistent lighting and excessive brightness, especially glare directly affecting users' vision. Discomfort glare causes visual fatigue and headaches, reducing productivity (Veitch & Newsham, 2000). The IES recommends consistent horizontal lighting of 300–500 lux for educational activities (CIBSE, 2015). Excessively bright or uneven lighting can reduce visual acuity and increase eye strain (Oblinger, 2006). Variability in lighting across different angles creates a disjointed experience (Ellis & Goodyear, 2019). Anti-glare diffusers and LEDs with low Unified Glare Ratings (UGR < 19) are optimal (EN 12464-1:2011). Adjustable desk lighting and filtered natural light can enhance comfort and focus during study (Ling et al., 2024).

CONCLUSIONS

The environmental deficiencies identified in these studies specifically the excessive noise and inadequate lighting—constitute significant obstacles to successful learning. In key academic environments like the library and study room, where concentration and comfort are paramount, such situations undermine the quality of learning, productivity, and overall well-being. Resolving these concerns is essential for improving user comfort, guaranteeing equitable educational access, and safeguarding students' emotional and physical well-being. According to the established standards from the World Health Organization (WHO) and the Illuminating Engineering Society (IES), it is clear that without appropriate intervention, the current conditions may lead to long-term adverse effects on students' academic performance, cognitive development, and motivation. The recommendations—encompassing acoustic treatment, illumination enhancements, zoning, and usage policies present pragmatic, evidence-based methods to alleviate these challenges. Although the implementation of these changes in the library and study room may incur substantial initial expenses, especially for architectural alterations, equipment improvements, and continuous upkeep, these investments should be regarded as long-term educational advancements. From a comprehensive viewpoint, the advantages significantly surpass the costs, resulting in enhanced academic performance, increased user happiness, and more conducive learning environments. A meticulously constructed, acoustically optimized, and adequately illuminated library or study area not only fosters student achievement but also signifies a dedication to academic excellence and inclusive education.

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Sekian, terima kasih.

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Setuju.

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SITI BASRIYAH SHAIK BAHARUDIN
Timbalan Ketua Pustakawan

nar