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UNIVERSITI
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PROCEEDINGS OF JOHOR INTERNATIONAL INNOVATION INVENTION COMPETITION AND SYMPOSIUM 2024 (JIIICaS 2024)



*“Flourish and Nurturing Sustainable
Innovation for a Prosperous Nation”*

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Preface

In the name of Allah, the Almighty who gives us the enlightenment, the truth, the knowledge and with regards to Prophet Muhammad (peace be upon him) for guiding us to the straight path. We thank to Allah for giving us guidance and strength to write this e-book.

This e-book compiles the extended abstracts that submitted to Johor International Innovation Invention Competition and Symposium 2024 (JIIICaS2024), where JIIICaS2024 is a virtual platform for all creative minds to share and present their invention and innovation. Each abstract gives a brief background on the innovation or project.

We hope that this e-book will help the readers to get to know the innovation done by the students and get some ideas to develop future innovation products.

Foreword Rector



Assalamualaikum warahmatullahi Wabarakatuh,
Salam Sejahtera, Salam Malaysia MADANI and
Salam UiTM Dihatiku.

In the name of Allah, the Most Gracious, the Most
Merciful.

It is a great honor to welcome you to the Johor
International Innovation, Invention, Competition, and
Symposium 2024 (JIIICaS 2024). This event

connects various disciplines, focusing on education and engaging educators,
students, researchers, and innovators from all walks of life.

Innovation is not just about ideas; it demands perseverance, creativity, and
determination to turn those ideas into reality. The remarkable projects
showcased today highlight the dedication and spirit of all participants.
Initiatives like this not only explore new technologies but also cultivate skills
and leadership among our youth. At Universiti Teknologi MARA (UiTM) Johor
Branch, we are fully committed to fostering a dynamic culture of innovation,
promoting the commercialization of new products, and encouraging
meaningful collaborations with industry and society.

As we celebrate this event, I would like to extend my heartfelt gratitude to all
sponsors, judges, the College of Computing, Informatics and Mathematics,
UiTM Pasir Gudang Campus as the event organizer, as well as to the
researchers and participants for their hard work in making this event a
success. Let us continue striving for innovation and excellence. May the
ideas presented today inspire us and lay the groundwork for future
achievements.

Thank you.

Associate Professor Dr. Saunah Zainon
Rector
Universiti Teknologi MARA (UiTM)
Johor Branch

(A-ST133) BREATHING KINDERGARTEN FRAMEWORK

Intan Bayani Zakaria^{1*}, Norhayati Mahyuddin¹, Mohd Firrdaus Mohd Sahabuddin²

¹Department of Building Surveying, Faculty of Built Environment, Universiti Malaya, 50603 Kuala Lumpur, Malaysia

²Department of Architecture, Faculty of Built Environment, Universiti Malaya, 50603 Kuala Lumpur, Malaysia

*s2004713@siswa.um.edu.my**

ABSTRACT

Indoor air pollution (IAP) presents a substantial risk to the health and well-being of occupants in various building types. This issue is particularly acute in kindergarten buildings, where young children, who are highly sensitive to air pollutants, are present. The internal layout and spatial organization of early childhood education environments are crucial in fostering active learning, as emphasized by educational philosophies. However, a notable challenge exists in the context of kindergarten design in Malaysia, where many private kindergartens operate in buildings originally intended for non-educational purposes. This discrepancy between the spatial requirements dictated by educational philosophies and the existing layouts often results in poor indoor air quality (IAQ). Therefore, developing a comprehensive framework to mitigate IAP is essential for creating healthy indoor environments in kindergartens. The primary objective of this innovation is to provide guidance on spatial arrangements for kindergartens located in repurposed buildings. The framework, termed the "Breathing Kindergarten Framework," is designed based on IAQ measurements of parameters such as carbon dioxide (CO₂), carbon monoxide (CO), total volatile organic compounds (TVOC), particulate matter (PM_{2.5} and PM₁₀), and microbial contaminants (bacteria and fungi) collected from six kindergartens in Selangor between 9:00 a.m. and 5:00 p.m. The data obtained from these measurements were analyzed using descriptive and multiple regression analysis. The development of this framework involves the integration of fieldwork data, relevant guidelines, and expert validation. Key components of the framework include orientation, floor area, window openings, ventilation, ventilation systems, location, and compartmentation. The implementation of this framework is anticipated to significantly enhance IAQ in kindergartens operating in repurposed shop office buildings, thereby fostering healthier environments for young children.

Keyword: indoor air quality; pollution; kindergarten; spatial arrangement

1.0 INTRODUCTION

Clean air is crucial for children's optimal health and brain development and among key factors that significantly affect students' feelings of the indoor environments (Sadrizadeh et al., 2022). Thus, the quality of air plays a significant role in shaping the cognitive and academic performance of children in educational settings. However, the growing scientific evidence during the last decade indicates that the air inside buildings can be more polluted than the outdoor air (Anake & Nnamani, 2023). Children attend kindergartens for approximately 40 hours per week and almost one-third of their time is spent in indoor area such as in the classrooms (Baharfar & Mohammadyan, 2021). Indoor areas enable potential contaminants to build up more concentrated than open spaces (Kankaria et al., 2014) especially when pollutants are generated from indoor sources. Furthermore, many studies have reported that kindergartens' environment contains various types of organic and inorganic contaminants with potential toxicity and allergenicity (Baharfar & Mohammadyan, 2021; Oluchi, 2017), to the extent that kindergartens are considered hazardous for children. Investigation of indoor air quality in different kindergarten typologies by Sarijuddin et al. (2018) recorded higher CO₂ in kindergarten at shop office building. The lack of fresh air intake for the air-conditioned space and the higher occupant density possibly contributes to this situation. Pollution accumulates indoors when there is insufficient air flow (López-Chao et al., 2020). In the context of kindergarten spaces, the challenges presented by shop office buildings directly affect the spatial arrangement, potentially impinging on the ability to provide a conducive environment for learning and play. When observed from both design and environment perspective, it becomes clear that the physical setting of kindergartens in change of use building is still immature and undeveloped, making it significant to understand and contribute to its development. Local authorities undoubtedly offer guidelines for the design of kindergartens spaces, but are limited to general aspects and less explanations especially regarding air-conditioned spaces (Uniform Building By-Laws 1984 (Amendment 2021), 2022; Private Education Division of the Ministry of Education Malaysia, 2021; Town and Regional Planning Department, 2017). Current guidelines may not sufficiently address the nuanced challenges presented by these structures as highlighted by Zakaria et al. (2023). Therefore, there is an urgent need

for comprehensive breathing kindergarten framework tailored to kindergartens situated in change of use buildings.

2.0 OBJECTIVE

The primary objective of this innovation is to provide guidance on spatial arrangements for kindergartens located in repurposed buildings.

3.0 METHODOLOGY

The proposed framework was developed based on the findings of the following completed activities: a) Reviewed extensive literature and guidelines governing kindergarten establishment [Guidelines on the Establishment of Kindergarten and Child Care Centre (2017), Guidelines for the Establishment, Registration and Operation of Private Kindergartens of the Ministry of Education Malaysia (2021), Uniform Building By-Laws 1984 (Amendment 2021) and Street, Drainage and Building Act 1974 (Act 133)]; b) 2784 minutes / 232 hours (9:00 a.m. to 5:00 p.m.) of monitoring indoor air quality in each of kindergarten spaces such as classrooms, common areas and kitchens located in six (6) shop office buildings using calibrated IAQ apparatus; c) The compliance of indoor air quality levels according to Malaysian Industry Code of Practice on Indoor Air Quality (ICOP), 2010 and World Health Organization, 2021; d) Expert review. Overall research conducted as below:

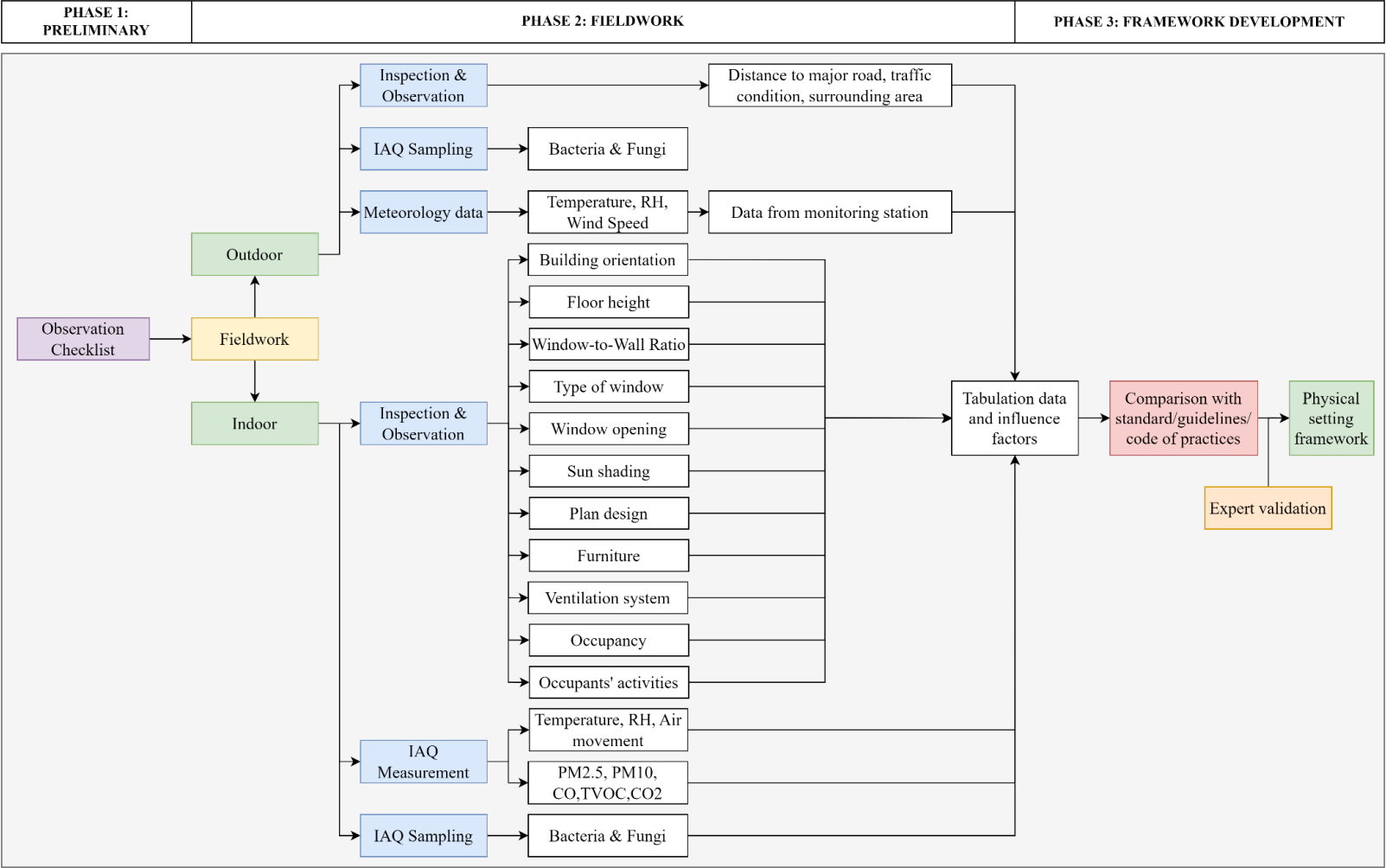


Figure 1.1 Research flow

4.0 RESULTS

The proposed framework comprises three key components: adherence to kindergarten guidelines and building regulations, identification of factors contributing to IAP, and recommendations for appropriate physical settings for kindergartens in shop office buildings. The overall breathing kindergarten framework as shown in figure 1.2.

Fresh Air Kinder Hub			
Orientation	Classroom	Common Area	Kitchen
	Classroom should face to south	No specific orientation	Kitchen should face to north
Floor Area	36 square meters	50 square meters	4.5 square meters
Window opening	For optimal ventilation, it is recommended to open window in the morning and during break times	Common area can be located as a center point of kindergarten with cross ventilation from classroom and kitchen area	Kitchen area is required to have an external facing window to reduce humidity
Ventilation	Classroom with air conditioning unit shall have an external facing window		
Ventilation system	Accompanying air conditioning with a ceiling fan can help improve indoor air circulation	Accompanying air conditioning with a ceiling fan can help improve indoor air circulation	Install exhaust fan or hood above cooking appliances to capture and expel airborne particles and gases
Location	At any position with window opening	Recommended to be situated centrally serve multiple functions, including use as an assembly hall, play area, dining area, nap area and mini classroom area	Avoid situating the kitchen area adjacent to the entrance of the toilet
Compartmentation	No specific requirement	No specific requirement	Compartmentation for kitchen can help reduce the spread of heat and smoke during cooking activities

Figure 1.2: Proposed breathing kindergarten framework

5.0 CONCLUSION

This framework is structured into three main components: compliance with kindergarten guidelines and building regulations, identification of factors contributing to IAP, and recommendations for suitable physical settings for kindergartens in shop office buildings. Among highlighted criteria were orientation, floor area, window opening, ventilation, ventilation system, location and compartmentation. The successful accomplishment of this objective not only enables the transformation of findings into practical recommendations but also presents an opportunity to contribute

to new knowledge and understanding. The framework is a valuable resource, offering insights into enhancing the physical setting by establishing guidelines for key areas that easily susceptible to the development of IAP in kindergarten.

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