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INDOOR THERMAL ENVIRONMENT IN KINDERGARTEN AT SERI ISKANDAR, PERAK

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ABSTRACT

Indoor thermal comfort is crucial for well-being and productivity, especially in educational settings like kindergartens. This study examines thermal conditions and occupant satisfaction in such environments. The American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) defines thermal comfort as occupants' contentment with their surroundings, yet achieving universal comfort is complex due to individual differences. Adaptive models, especially in naturally conditioned spaces, highlight the interplay between individuals and their environment. Focused on kindergartens, where classroom quality directly affects comfort, this research aims to grasp user perceptions, assess occupant satisfaction, and explore thermal conditions. The indoor thermal environment's intricacy arises from temperature, humidity, air circulation, and sunlight. While global benchmarks provide thermal guidance, personal preferences, and adaptability are crucial. Findings from two kindergarten case studies showcase diverse comfort levels among staff, underscoring the need to address individual preferences. Recommendations include enhanced air circulation, precise temperature regulation, insulation, sunlight management, personalized settings, weather-adaptive strategies, and ongoing assessment. This study underscores thermal comfort's importance in educational settings, promoting well-being and enriched learning experiences through the suggested measures.

Keywords: *Indoor Thermal Environment, kindergarten environment, teaching and learning environment.*

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INTRODUCTION

Thermal comfort is defined as "a state of mind expressing satisfaction with one's thermal environment." Because of the wide physiological and psychological differences between people, it is difficult to satisfy everyone in space. Furthermore, the thermal comfort requirements for naturally conditioned spaces differ from those for other air-conditioned spaces (ASHRAE, 2017). As a result, the adaptive model was established for naturally conditioned buildings, which rely on the active link between people and their environment, i.e., people react to restore their thermal comfort whenever discomfort circumstances emerge (Al-Absi & Abas, 2018). In Malaysia, most kindergarten buildings not originally built as a function of kindergarten and need to renovate to fit the purpose of learning space for children (Kamaruzzaman S N, 2011). Therefore, the buildings are facing several problems such as sick building syndrome, poor air quality and inefficient physical design due to the renovating activity (Mohidin H H B, 2015). This may result uncomfortable environment, limited space for children to move around, to receive stack air within building and have potential to expose to poor air quality that led to bad health (R.A., 2011). The objective of this research is to attain occupant comfort while also guaranteeing occupant health. So, research and efforts must be performed to achieve the objective.

LITERATURE REVIEW

The indoor thermal conditions within kindergarten buildings are often influenced by external factors like climate, urban layout, and building design, including materials and structure. Effective management of thermal interactions through the building envelope is essential to ensure a comfortable indoor environment for kindergarten occupants. This necessitates the careful selection of appropriate strategies and building materials to uphold thermal comfort. Numerous comfort parameters play a pivotal role in creating an optimal space where children in kindergartens can experience comfort during their stay. These parameters encompass aspects like air quality, spatial arrangement, lighting, and aesthetic appeal, particularly within the indoor settings of the building (Ortiz, 2017).

For instance, focusing on air and thermal comfort, and maintaining good indoor air quality is critical for children's health and overall development. Implementing efficient natural ventilation systems becomes imperative to provide children with fresh and healthy air. This not only influences their physical well-being but also impacts their growth (A, 2011). Ensuring air quality involves regulating humidity levels, eliminating odors, reducing dust, and maintaining a comfortable indoor temperature (Stankovic, 2015).

The choice of interior finishing materials is equally important, as inappropriate selections can have adverse effects on children's health and performance. Opting for a range of safe and eco-friendly materials such as wood, brick, concrete, steel, and child-safe plastics like polycarbonate boards is advisable (Kotnik, 2014). These materials should possess pleasant textures that contribute to a comfortable indoor temperature, minimizing the need for mechanical cooling.

Furthermore, integrating natural elements like deciduous trees and indoor plants can significantly enhance the environmental quality of kindergarten spaces. These natural features serve as filters against direct sunlight, help regulate room temperature, and contribute to the overall sustainability and well-being of the building, thereby fostering a conducive learning environment for kindergarten occupants.

Thermal Comfort Conditions and Its Parameters

In accordance with the purposes of usage, certain comfort condition features, which are indicators of user satisfaction in an environment, should be met on account of health and efficiency in a living space. Although a relative notion, some general conditions are expected to be maintained in the environment in accordance with the characteristics of users. The comfort conditions in an enclosed environment are affected by thermal comfort, indoor air quality, and visual and auditory comfort parameters. Thermal comfort conditions consist of factors, such as relative humidity, air flow rate, and air temperature.

In general, parameters that are effective in thermal comfort could be categorized as personal and environmental parameters. While, ambient temperature, ambient relative humidity, ambient air speed, and average radiant temperature are named as environmental parameters; personal parameters consist of the person's metabolic activity level and clothing (Aydođan, 2010).

METHODOLOGY

This research adopted a quantitative approach, using Google Forms as the main platform and distributing questionnaires to users. This study will use a quantitative method, using Google Forms as the main platform and distributing questionnaires to users. Therefore, data will be analyzed using Microsoft Excel. The quantitative method will be used in this study, as it is more effective and efficient due to the convenience of mobile questionnaire completion. The focus of this study is to determine the satisfaction level of the building's occupants in terms of indoor environment. The selected case studies are Tadika Mutiara Islamic Montessori and Taska Qaseh Bashira. All selected case study is located in the state of Perak.

FINDING AND ANALYSIS

The questionnaires by Google Forms were administered to the staff members of both kindergartens, with a total of 20 respondents participating in the survey. The data from each questionnaire were collected automatically and analyzed. The questionnaire consisted of three sections: Section A, Section B, and Section C. The results of the analysis are presented in this section, where the data has been tabulated for further examination.

The level of satisfaction of the kindergarten’s occupants towards the current indoor thermal environment in the kindergarten.

Table 1: Respondent’s Result

How do you feel about the temperature in the classroom at this moment?	Frequency	Percentage (%)
Cold	1	5
Slightly cool	2	10
Neutral	8	40
Slightly warm	8	40
Hot	1	5
How do feel at this moment in terms of humidity?	Frequency	Percentage (%)
Much too dry	1	5
Slightly dry	5	25
Fine	13	65
Slightly humid	1	5
Do you feel comfortable now?	Frequency	Percentage (%)
Very comfortable	7	35

A little comfortable	12	60
Uncomfortable	1	5
How do you rate the overall acceptability of the thermal environment at this moment?	Frequency	Percentage (%)
Acceptable	19	95
Not Acceptable	1	5
What is the acceptable state that you expect?	Frequency	Percentage (%)
Cooler	14	70
No change	4	20
Warmer	2	10

The study aims to interpret the level of satisfaction of the kindergarten's occupants towards the indoor thermal environment. The analysis of the responses reveals that most participants perceive the temperature in the classroom as either neutral or slightly warm, indicating a satisfactory overall comfort level regarding the temperature. However, a small number of individuals perceive it as slightly cool. Similarly, regarding humidity, most participants find it acceptable or satisfactory, while a few perceive it as slightly dry or humid. Overall, most participants feel at least a little comfortable in the kindergarten at the moment, with some individuals expressing feeling very comfortable and a few indicating discomfort.

The feedback from the participants suggests that they are generally content with the thermal environment in the kindergarten, expressing satisfaction with the temperature and overall comfort level. However, it is important to recognize that individual preferences may differ, and providing an acceptable thermal environment is crucial for creating a pleasant and supportive learning environment for the kindergarten staff, enhancing their well-being and productivity. Participants' expectations reveal that the majority desire a cooler thermal state to feel more comfortable, but some express satisfaction with the current conditions, indicating a need to find a balance that aligns with their preferences. The preferred methods of environmental control include room air-conditioning units, ceiling fans, windows and window blinds or shades, and portable fans, indicating a preference for a combination of cooling and airflow mechanisms to achieve a comfortable classroom environment.

Overall, the study provides valuable insights into the subjective experiences and preferences of individuals regarding the indoor thermal environment in the kindergarten. By understanding these perceptions and expectations, improvements can be made to maintain optimal conditions in the classroom, ensuring the occupants' satisfaction, well-being, and productivity are enhanced. The findings also shed light on the preferred methods of environmental control, which can inform future enhancements in classroom infrastructure and equipment to better cater to the occupants' needs and create a conducive learning environment.

CONCLUSION

The study underscores the pivotal role of external variables, notably weather conditions such as outdoor temperature and sunlight, in shaping the indoor thermal ecosystem. A comprehensive comprehension of these influences enables the implementation of targeted measures to uphold optimal thermal harmony within classroom spaces. In summation, while a significant majority of participants expressed contentment with the thermal conditions within kindergartens, a scope for refinement exists—one that caters to individual preferences and augments overall comfort. The proposed recommendations, encompassing elements like enhancing air circulation, precision in temperature control, bolstering insulation, and adept management of incoming sunlight, offer a pathway for kindergartens to cultivate an environment that fosters heightened comfort and a conducive learning ambiance for their educators. Such endeavors hold the potential to amplify well-being, enhance productivity, and ultimately elevate the educational quality bestowed within kindergartens.

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