OPTIMIZING AIR FLOW DISTRIBUTION OF THREE NON-AIR-CONDITIONED PRE-SCHOOL AT MELAKA

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BACHELOR OF MECHANICAL ENGINEERING TECHNOLOGY (MAINTENANCE TECHNOLOGY) WITH HONOURS

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**A thesis submitted
in fulfillment of the requirements for the degree of
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DECLARATION

I declare that this Choose an item. entitled "OPTIMIZING AIR FLOW DISTRIBUTION OF THREE NON-AIR-CONDITIONED PRE-SCHOOL AT MELAKA is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Date : 19 January 2023

APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours.

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Date : 19 January 2023

DEDICATION

To my beloved parents.Thank you for helping me to shape my life with positivity and passion. Without you, I'd never been the person I am today. Thank you for always supporting me in all the good and bad times. When the world closed its doors on me, you both opened your arms for me. When people shut their ears for me, you both opened your hearts for me. Thanks for always being there for me and making me believe that i can do everything and anything in life. In addition, I would like to express my heartfelt gratitude to my supervisor, Ts. Dr. Amir Abdullah Bin Muhamad Damanhuri, and my friends for being a part of this journey, and I wish everyone the best of luck in their future endeavours

ABSTRACT

Air flow distribution refers to the air circulation in the classroom. Students unable to concentrate and feel distracted from the class activity due to their need comfortable surroundings. Lack of environmental parameter such as air velocity and air temperature cause of air distirbution in the classroom will result in environmental stress and negative trends toward occupants during teaching and learning session. This study is focused on the monitor and simulate the air flow distribution at three different preschools in Malacca which are Tadika Kemas Rumah Pangsa Kampung Padang, Tadika Kemas Kampung Padang A and Tadika Kemas Kampung Padang B. The goal of this research is to discover the appropriate flow of air circulation that should be present throughout the learning process. It has been found that the value of environmental parameter of these preschools out of acceptable range value based on standard recommended by ASHRAE 55 - 2010 as well as Industry Code of Practice Indoor Air Quality, DOSH Malaysia (2010). Several data collection of environmental parameter more conducted air velocity and air temperature by using TSI VelociCalc instrument to improve air flow distribution in the classroom at three preschools. By using CFD simulation analysis tool method, an appropriate layout to improve air circulation are conduct. It will carry out four probability layouts of classroom for each three different preschools. From the simulation of all probability layouts, it carries of detailed map-out of air flow distribusion consist of air velocity and air temperature on the classroom of each three preschools. As a result of probability layouts, it can optimize which is the best layout of classroom that consists of great enviromental parameter to be used as classroom layout for each preschool. The suitable layout to be use for preschool Tadika Kemas Rumah Pangsa Kampung Padang is the layout (b), preschool Tadika Kemas Kampung Padang A is layout (a), and preschool Tadika Kemas Kampung Padang B is layout (c). The best selected layout that suitable to be used to classroom at preschool is because consist the combination quality of air velocity and air temperature. By conclusion, the best selected layout of classroom for each three different preschool can solved the discomfortness of occupants in the classroom especially during teaching and learning session.

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ABSTRAK

Pengagihan aliran udara merujuk kepada peredaran udara di dalam bilik darjah. Pelajar tidak dapat menumpukan perhatian dan berasa terganggu daripada aktiviti kelas kerana mereka memerlukan persekitaran yang selesa. Kekurangan parameter persekitaran seperti halaju udara dan suhu udara menyebabkan pengagihan udara di dalam bilik darjah akan mengakibatkan tekanan persekitaran dan trend negatif terhadap penghuni semasa sesi pengajaran dan pembelajaran. Kajian ini tertumpu kepada memantau dan mensimulasikan pengagihan aliran udara di tiga buah prasekolah yang berbeza di Melaka iaitu Tadika Kemas Rumah Pangsa Kampung Padang, Tadika Kemas Kampung Padang A dan Tadika Kemas Kampung Padang B. Matlamat penyelidikan ini adalah untuk mencari kesesuaian aliran peredaran udara yang perlu ada sepanjang proses pembelajaran. Telah didapati bahawa nilai parameter persekitaran prasekolah ini di luar nilai julat yang boleh diterima berdasarkan piawaian yang disyorkan oleh ASHRAE 55 - 2010 serta Kod Amalan Industri Kualiti Udara Dalaman, JKKP Malaysia (2010). Beberapa pengumpulan data parameter persekitaran lebih banyak menjalankan halaju udara dan suhu udara dengan menggunakan instrumen TSI VelociCalc untuk meningkatkan pengagihan aliran udara di dalam bilik darjah di tiga buah prasekolah. Dengan menggunakan kaedah alat analisis simulasi CFD, susun atur yang sesuai untuk meningkatkan peredaran udara dijalankan. Ia akan menjalankan empat susun atur kebarangkalian bilik darjah untuk setiap tiga prasekolah yang berbeza. Daripada simulasi semua susun atur kebarangkalian, ia membawa peta keluar terperinci pengagihan aliran udara yang terdiri daripada halaju udara dan suhu udara di bilik darjah setiap tiga prasekolah. Hasil daripada susun atur kebarangkalian, ia boleh mengoptimumkan susun atur bilik darjah yang terbaik yang terdiri daripada parameter persekitaran yang terbaik untuk digunakan sebagai susun atur bilik darjah bagi setiap prasekolah. Susun atur yang sesuai digunakan untuk prasekolah Tadika Kemas Rumah Pangsa Kampung Padang ialah susun atur (b), Tadika Kemas Kampung Padang A prasekolah ialah susun atur (a), dan Tadika Kemas Prasekolah Kampung Padang B ialah susun atur (c). Susun atur pilihan terbaik yang sesuai digunakan untuk bilik darjah di prasekolah adalah kerana terdiri daripada gabungan kualiti halaju udara dan suhu udara. Kesimpulannya, susun atur bilik darjah pilihan terbaik bagi setiap tiga prasekolah yang berbeza dapat menyelesaikan ketidakselesaan penghuni di dalam bilik darjah terutamanya semasa sesi pengajaran dan pembelajaran.

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LIST OF SYMBOLS AND ABBREVIATIONS

D,d	-	Diameter
Ta	-	Air temperature (℃)
V	-	Air velocity (m/s)
MOE	-	Ministry od Education
DOSH	-	Department of Occupational Safety and Health
ASHRAE	-	American Society of Heating, Refrigeration and Air-Conditioning
IAQ	-	Indoor Air Quality
CFD	-	Computatitional Fluid Dynamic
CV	-	Constant Volume
VAV	-	Variable Air Volume
VSD	-	Variable Speed Drive

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CHAPTER 1

INTRODUCTION

1.1 Background

Education is very important in our lives. It is because learning is the process of gaining information, skills, or habits. Kindergarten, primary school, high school, college, and university are the stages of formal education in Malaysia. There are several educational institutions from which students can enrol, whether private or public.

School is an educational building where students may receive information, a hub for social events to gains the interaction between students towards the surroundings and a location where students can engage with their environment. It is critical that children have a pleasant atmosphere in which to learn. According to research, students aged 2 to 26 spend most of their waking hours in a classroom (from kindergarten to university) (de Dear et al., 2015). Students must attend school for a minimum of seven hours. It runs from 7:30 a.m. to 2:30 p.m. and is usually followed by compulsory co-curricular activities or extra classes. Each school has its own system of regulations that students must adhere to.

Malacca is located in Malaysia's southern region. Malaysia's tropical climate is hot humid all year. The climate has changed for unknown reasons, with the consequences of rising temperatures, severe weather events, and declining public health in Malaysia (Tang, 2019) This problem arises because of behaviours that contribute to global warming and greenhouse gas emissions, such as burning fossil fuels, chopping down trees, and raising animals. Furthermore, a curriculum is developed depending on local climate conditions, (Perkins et al., 2018). The surrounding environment influences students' performance in a classroom, such as attention, concentration, and learning. It makes no difference whether you are in elementary, secondary, or university.

In Malaysia, educational institutions must provide the basic criteria of satisfaction and comfort, such as a good environment, in order to improve student performance (Mazlan et al., 2020). The level of comfort between performance and environmental circumstances can be improved. A strategic place to develop a school building is also an important factor where children may study comfortably and focus while the teaching and learning process is carried out. This is because the surrounding environment could influence students' actions and desire to act. Students will be more focused and motivated to learn if they feel at ease. Furthermore, a pleasant, clean, and appealing school environment may encourage students to study well. Therefore, the preschool needs to prepare a good layout plan to get good air flow in the classroom. Window openers during teaching and learning session are very important to get good air flow to supply fresh air into the classroom.

1.2 Problem Statement

Classrooms are created for students to spend the most of their time in during the teaching and learning process at school. Teachers will typically apply all ideas and applications between students in the classroom. Students require pleasant environments throughout their studies to optimise their learning and performance at school. Thermal comfort of the surroundings is important because a lack of comfort might result in environmental stress and a negative trend (Nico et al., 2015).

Quality of the interior environment in elementary schools is frequently poor. According to (Wargocki et al., 2020), the temperature in the classroom has a significant influence on learning. Furthermore, the air quality in the classroom may influence cognitive skills since students are unable to concentrate and are distracted from the activity that they were intended to complete. Students' performance may feel the consequences of teachers' inability to teach effectively due to their need for comfortable surroundings. Thermal comfort is difficult to accomplish due to fluctuations in environment and weather. Because Malaysia's tropical climate is hot and humid, the temperature that has already been considered for human comfort is between 27.1°C and 29.3°C. To avoid this problem, we need to provide good air circulation to school buildings, especially classrooms.

1.3 Research Objective

In this study, there are a few targets to be given fully attention to achieve these objectives.

a) To monitor air temperature and air velocity of non air-conditioned for three different pre-school at Melaka.

b) To simulate air flow distribution based on environmental monitoring of three non-air-conditioned based on four probability layouts of pre-schools.

1.4 Scope of Research

The aim of the research is to analyze whether or not the distribution of air flow in classrooms non air conditioning at a number of different preschools located in Malacca. In this research, three preschools will be chosen: Tadika Kemas Rumah Pangsa Kampung Padang, Tadika Kemas Kampung Padang A, and Tadika Kemas Kampung Padang B. The classroom will be occupied by students as well as other people at some point throughout the process of learning or having a discussion. In addition, the total number of pupils who will participate in this research will range from 15 to 20 in each preschool, and the mechanism that will be used will be a fan.

The air temperature (Ta), the air velocity (V) are going to be the parameters that are employed in this research that are dependent on the air distribution. A "thermometer enviroment indicator tool" will be used to measure the air temperature, a "air velocity meter tool" will be used to measure the air velocity, and a "Hygrometer tool" will be used to measure the relative humidity data (DOSH,2010). In addition, the data from the measurements will be taken using a "Hygrometer tool." Using design software, a visual layout of the classroom should be created after the necessary data has been collected. CATIA V5 2020 is going to be utilised for the structural analysis programme that will be used. After the structure has been created, the simulation can be simulated using the data that has been collected to run the simulation. This may be done depending on the data that has been taken. The software that will be used for the simulation is the most recent edition of Ansys Fluent, which is version 2022.

CHAPTER 2

LITRERATURE REVIEW

2.1 Introduction

In the context of comfortability, air distribution and indoor air quality IAQ are two key concerns that crop up on a regular basis (Merabtine et al., 2018) Comfort is of the utmost importance for both the environment and the individuals. People need to feel comfortable while they are engaging in an activity, regardless of whether it is taking place indoors or outside. For instance, students who are in class and workers who are working at their place of employment or even outdoors. In order for them to provide their best performance in the classroom, they need a sufficient supply of clean air. It is essential to make the space in which people live aesthetically pleasing, since this is where they will spend the majority of their time. It is necessary, for instance, that the temperature in the construction area be set appropriately in order for them to feel at ease there. In this chapter, a summary of the past study will be presented, as well as information on the distribution of air flow and the methods of simulation analysis.

2.2 Preschools In Malacca

The Malaysian Ministry of Education claims that there are a total of 6,214 preschools throughout the country, including 170 in the city of Malacca alone. These preschools may be found in both urban and rural areas. Before starting elementary school, it is the goal of the preschool to provide youngsters with opportunity to develop core skills such as learning and exploration so that they are better prepared for those experiences. The minimum age that a student must be in order to be accepted into a preschool programme in accordance with the regulations established by the Ministry of Education varies from four to six years old. The majority of institutions of this kind are either privately owned or run by the government. Figure 2.1 shows the proportion of children in Malaysia who are under the age of 18 years old divided by state.

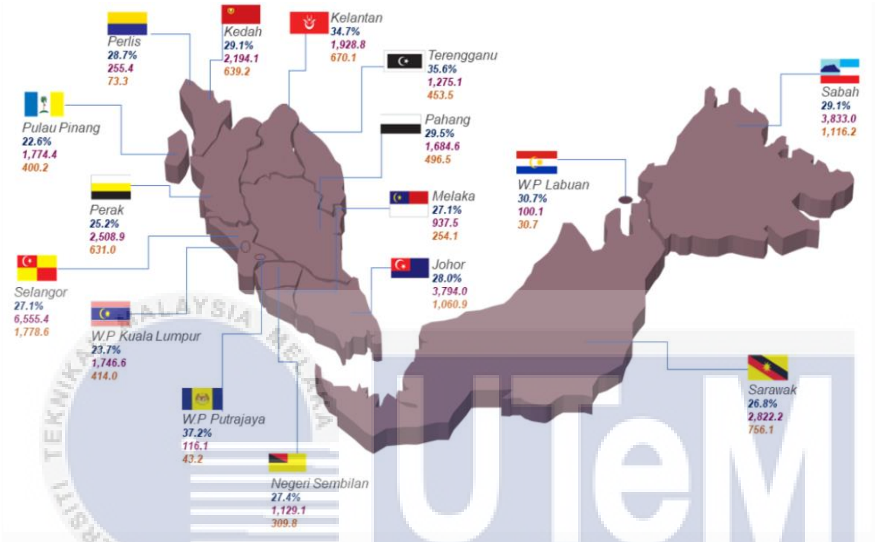

Figure 2.1 Percentage of children (under age 18 years), by state, Malaysia, 2021.

Preschools are often located by the side of the road, in residential neighbourhoods, or even on the grounds of nearby elementary schools. In most cases, parents will bring their children to preschool on their way to work, and they will pick them up again on their way home from work in the evening. The majority of parents choose to enrol their children in private schools as opposed to state institutions for education. They do this because they care about their students and want them to have a pleasurable interaction while they are learning. For instance, students at a private school would have access to an air conditioning system in the classroom, whereas at government schools, students would only make use of wind fans.

This would allow students at private schools to participate in a wider variety of activities without feeling uncomfortable.

When it comes to the teaching and learning process in an academic setting, the environment of a classroom is just as important as how pleasant the seats are. In an essence, the children's ability to concentrate will be affected if the kindergarten is located in an area with a high level of pollution (Tong et al., 2017). The number of childcare centres that have been officially registered in Malaysia is shown in Figure 2.2 below for both 2018 and 2019.

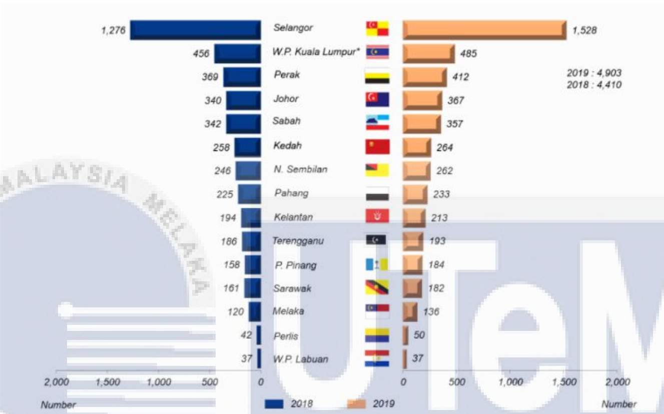

Figure 2.2 Number of registered childcare centre by state, Malaysia, 2018 and 2019.

2.3 Description of Air Flow Distribution

Air distribution systems consist of air handlers, ductwork, and other components for heating, ventilating, and air-conditioning buildings. They provide fresh air to maintain indoor air quality and conditioned air to counteract heating and cooling demands. Their many components must act in concert in order to adequately sustain the appropriate conditions. Applying intelligent operating methods and appropriate maintenance procedures may greatly minimise their energy use. Constant-volume (CV) and variable-air-volume (VAV) air-