

## CHAPTER 5

# **Personal Adaptive Strategies for a Good Thermal Comfort in School Classroom**

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### **5.1 INTRODUCTION**

Indoor environmental quality (IEQ) defines a building's quality and its effects on the health and well-being of its occupants. One element of IEQ is thermal comfort. Thermal comfort refers to one's perception that the thermal environment is not too cold or hot. As thermal comfort is psychological, it may affect the overall morale of the occupants. Environmental thermal comfort conditions influence human productivity; thus, a conducive environment is essential to the classrooms. It is crucial to consider thermal comfort when designing an indoor space. Most concerns about the indoor environment revolve around creating thermal comfort (Barbhuiya & Barbhuiya, 2013). Studies claim that thermal comfort influences students' productivity and well-being. Thermal discomfort might also lead to low productivity, making them not focus on their work. In other words, thermal discomfort could cause unpleasant experiences and hinder learning. Therefore, students' productivity, performance and health are

usually linked to classroom environmental conditions and infrastructure. Such correlation highlights the need to improve classroom infrastructure and environmental factors as they could affect students' productivity, performance, and health.

Many authors stated that thermal comfort could influence students' productivity and well-being. Jiang et al. (2018), stated that classrooms usually have a poor thermal environment that can lead to thermal discomfort, affecting students' learning performance. Having poor IEQ can influence health, absenteeism from school, and decrease performance while at school (Turunen et al., 2014). Providing visual and thermal comfort in educational facilities requires high energy consumption which could negatively impacting students' health and performance (Zomorodian & Tahsildoost, 2016). Thermal comfort and classroom environments are important elements in teaching and learning, influencing students' activities and performance (Puteh et al., 2012). Classroom environment has an impact on students' comfort and health, as well as their ability to learn (Biro et al., 2012).

In the meantime, IEQ is rarely prioritised in most development planning and management processes (Yusoff & Sulaiman, 2014). According to Heracleous and Michael (2019), most people spend 90 percent of their time indoors, including in commercial or industrial buildings, school or college premises, or residences. Based on ASHRAE Standard 55, buildings need to consider indoor thermal environment factors, personal factors and other contributing factors in providing thermal comfort. At the same, the indoor atmosphere in a building must satisfy both functional and desirable standards for the needs of its occupants (Pazhoohesh & Zhang, 2018).

Classrooms and other facilities in educational buildings are classified as special buildings as their primary function is to

create a supportive environment for teaching and learning. Nevertheless, educational buildings frequently lack appropriate maintenance (Singh et al., 2019). According to Heracleous and Michael (2019), schools frequently lack basic maintenance, which causes educational buildings to despair. Building owners often do not invest in immediate maintenance and operation rather than lower the running costs, which leads to not considering improving IEQ (Zuhaib et al., 2018). This is made worse by the high density of students in each classroom. Singh et al. (2018) claimed that, in general, classrooms are more packed than offices or homes since they were built with learning in mind and the intent to fit many students at one time.

In the meantime, most buildings cannot sustain adequate internal thermal conditions due to increased energy needs brought on by higher living standards across the country (Heracleous & Michael, 2019). As most school classrooms in Malaysia use natural ventilation from fans to achieve thermal comfort (Puteh et al., 2012), windows could be one of the elements related to thermal comfort. It is because windows are known to be a part of modern buildings' heating and cooling energy (Kim et al., 2016). As stated by Zomorodian and Tahsildoost (2016), students seated near the windows usually have different thermal comfort levels. Regardless of their energy efficiency, schools cannot be called sustainable if their conditions compromise the effectiveness of teaching and learning (Biro et al., 2012).

Students' behaviour is also one of the main to lead to discomfort or comfort with the environment. According to Kim and Dear (2018), activity levels and clothing insulation affect thermal comfort. Moreover, teachers' preferences or habits influence classroom conditions or environments. Therefore, students tend to be quiet or passive about their comfort. Students