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## Tracing the Concentration and the Distance Travelled by the Airborne Droplet Nuclei in an Educational Centre

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### ABSTRACT

Airborne respiratory diseases are caused by the droplet nuclei inhaled through the lungs. The water droplet nuclei are composed of cells, electrolytes and sometimes infectious bacteria and viruses. It comes from the human movement of respiration, sneezing and coughing, and even from perspiration. Droplets with a diameter below 5  $\mu\text{m}$  remain suspended in the air, moving with the air current. Droplets larger than 5  $\mu\text{m}$  tend to fall to the ground due to gravity.

The propagation distance of droplet nuclei with a diameter between 5 and 6  $\mu\text{m}$  is determined using computational fluid dynamics (CFD) software that uses discrete phase modelling. This analysis was conducted in an educational theatre and an infiltrated classroom where the pandemic standard precautions had been lifted.

The first 2 m distance shows that the nuclei concentration is between 0.025 and 0.044  $\text{g}/\text{m}^3$  and is dispersed freely with the airflow in a 30 to 60 second, time-flow simulation. The nuclei then travel up to 9 m and are suspended in the direction of airflow. The concentration drops to 0.014  $\text{g}/\text{m}^3$  when exhaust airflow is directed out of the classroom.

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### BIOGRAPHY

Dr Zulkarnaini Abdullah is currently a Senior Lecturer at the Department of Heating Ventilation and Air Conditioning at Universiti Kuala Lumpur Malaysia France Institute, Malaysia. His specializations are in HVAC design and operating systems, electrical power and computer fluid dynamics (CFD). His work includes studying the airflow patterns of the air distribution using ANSYS Fluent.

