Kawakubo, S., Arata, S., Wakui, K. & Kikumoto, H. (2026). Integrating computational fluid dynamics into introductory architectural education. *Buildings & Cities.*

SUPPLEMENTAL DATA

Table S1. Items assessed in the lectures (full survey forms)

Assessment items	Answer scale
(i) Pre-CFD survey: survey conducted after sessions 1–10	
Level of interest in lecture content	(1) very high (2) somewhat high (3) neither (4) somewhat low (5) not at all
Level of understanding of the lecture content	(1) very well (2) somewhat well (3) neither (4) somewhat poorly (5) not at all
(ii) Post-CFD survey: survey conducted after session 14	
Respondent profiles	
Gender	(1) male (2) female (3) other/prefer not to answer
Interest in the built environment field * at the beginning of the course	(1) high (2) somewhat high (3) neither (4) somewhat low (5) low
Difficulties with science and mathematics subjects	(1) good at (2) slightly good at (3) neither (4) slightly not good at (5) not good at
Experience in considering thermal and airflow (environmental) design * at the beginning of the course	(1) yes (2) no
Awareness of thermal and airflow (environmental) design considerations * at the beginning of the course	(1) high (2) somewhat high (3) neither (4) somewhat low (5) low
Prior knowledge of CFD analysis * at the beginning of the course	(1) heard of CFD before taking this course (2) hadn't heard of CFD until taking this course
Per-lecture changes in interest and understanding	
Degree of increased/decreased interest in each lecture's content * Questions per lecture	(1) increased (2) somewhat increased (3) no change (4) somewhat decreased (5) decreased
Degree of increased/decreased understanding of each lecture's content * Questions per lecture	(1) increased (2) somewhat increased (3) no change (4) somewhat decreased (5) decreased
Challenges during CFD practical training sessions	
Stumbling points/difficulties during practical training in CFD analysis * multiple responses allowed	(1) operation and handling of the analysis software (2) creating the model (3) setting boundary conditions (4) dividing the mesh (5) visualizing the results (6) setting up the analysis contents at the applied analysis (7) nothing comes to mind (8) other (free description)
Perceived benefits and drawbacks of the CFD experience	
Positive aspects of CFD analysis experience * multiple responses allowed	(1) Being able to perform the CFD analysis was a valuable experience in itself (2) Was able to visualize in concrete terms

	what was taught in the lectures (3) Satisfied intellectual curiosity by being able to visualize thermal/airflow, which is normally invisible to the naked eye (4) Was meaningful to analyze a familiar case study (e.g., high-rise building, room with an air-conditioner) (5) Was meaningful to be able to analyze issues set by oneself (6) Want to use CFD analysis for future design issues and architectural design (7) Expanded knowledge of a new aspect of architectural studies (8) Nothing comes to mind (9) Other (free description)
Negative aspects of CFD analysis experience	
* multiple responses allowed	(1) Didn't understand the significance of performing the CFD analysis and considered the practical training itself to be unnecessary (2) Struggled to keep up with the course and didn't enjoy/like CFD analysis (3) There weren't enough examples of analyses in the lectures, and some couldn't be visualized in concrete terms (4) There were many restrictions during the practical training session, and it wasn't possible to perform the desired analysis (5) Couldn't imagine using CFD analysis in the future and thought it would be of little use (6) Nothing comes to mind (7) Other (free description)
Course structure, workload, and support	
Ratio of course lectures and practical CFD analysis to total number of lessons (14)	(1) just right (2) too much lecture/not enough practical training (3) not enough lecture/too much practical training
Volume of analysis content per 100 min of class time	(1) just right (2) too much analytical content for the time (3) not enough analytical content for the time
Number of instructors/teaching assistants compared with number of students	(1) enough (2) not enough
Feedback on analyses conducted by oneself	(1) enough (2) not enough
Changes in interest and awareness (post-course vs. baseline)	
Degree to which the CFD analysis experience has increased/decreased interest in the built environment field (compared with the beginning of this course)	(1) increased (2) somewhat increased (3) no change (4) somewhat decreased (5) decreased
Degree to which the CFD analysis experience has increased/decreased awareness of thermal and airflow (environmental) design considerations (compared with the beginning of this course)	(1) increased (2) somewhat increased (3) no change (4) somewhat decreased (5) decreased
Computing environment and computer issues	
Computer specs for performing the analysis	(1) good enough (2) not good enough
Complaints/failures with the computer during practical training in CFD analysis * multiple responses allowed	(1) the computer was not easy to operate as it differed from the OS normally used (2) the computer screen was small, and visibility was poor (3) behavior became strange during the work (4) too much time was spent on analysis
(iii) Post-course survey: survey conducted after the final examination	
If the highest level of understanding of the content of each lecture was 100, what was the level of understanding (a) immediately after that lecture, (b) after the practical training in CFD analysis, and (c) at present (at the time of the examination).	0–100 (numeric self-rating)
Timing of start of studying for the examination	(1) before the last session of the course (before post-CFD survey), (2) after the last session of the course (after post-CFD survey)

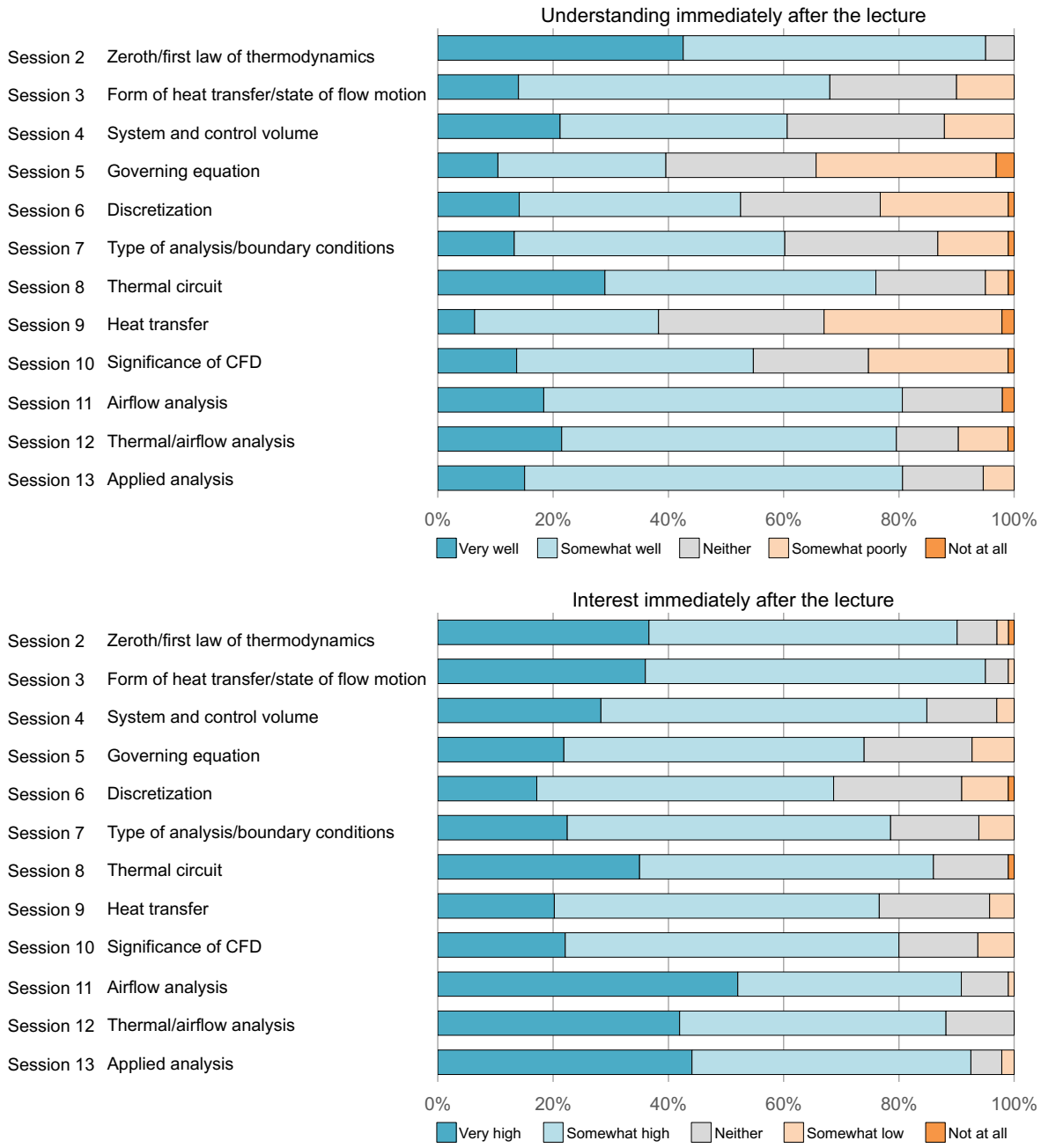


Figure S1. Changes in students' understanding and interest (pre-CFD survey)

Aggregated pre-CFD survey results on per-lecture understanding and interest are shown for reference. In Sessions 11–13, which engaged hands-on with computational fluid dynamics (CFD), both understanding and interest tended to be comparatively high.

■ Overview

In Tokyo, there are high-rise office buildings equipped with wind vents as a countermeasure against building wind. To verify whether the presence of these vents genuinely mitigates the building wind problem, airflow analysis was conducted.

■ Analysis model & result

Analysis area		787 m (X), 787 m (Y), 400 m (Z)
Pressure-correction method		SIMPLE algorithm
Turbulence model		Standard k-ε model (high Reynolds) k=1e-10 m^2/s^2, ε=1e-10 m^2/s^3
Analysis type		Steady state analysis
Discretization scheme for advection term		First-order upwind scheme
Total number of cells		Approx. 1,000,000
Flow boundary condition	Inflow	Ymin power law, velocity: 3.0 m/s (standard height: 10.0 m)
	Outflow	Ymax total pressure: 0 Pa
Heat boundary condition		Not set
Wall boundary condition		Xmin, Xmax, Zmax: free slip Other surfaces: logarithmic law

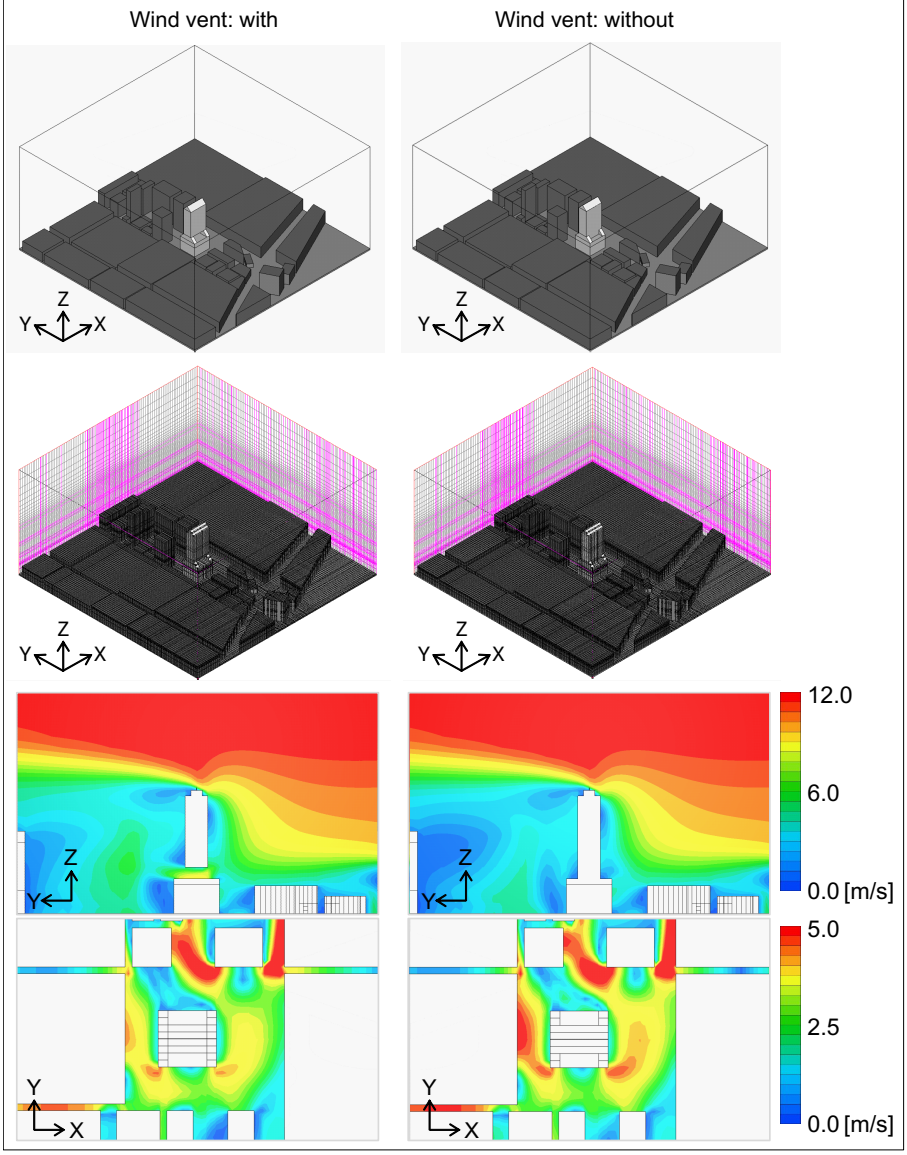


Figure S2. Exemplary student work