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## Discovery-based environmental engineering education in indoor air pollution: Implementation of a project-based, hands-on, cooperative learning experience through student-led indoor air quality projects

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### **Abstract:**

Air pollution is a pressing environmental issue worldwide, thus this topic has been incorporated into many undergraduate (UG) environmental engineering and science programs. Historically, outdoor air pollution has received a lot of attention in UG environmental engineering and science courses due to their well-known adverse effects on human health and climate. However, the fields of indoor air quality and indoor air pollution have been rapidly growing in importance in recent years. This is because humans are spending an increasingly amount of time living and working indoors. An average person in Hong Kong spends more than 85 % of their time indoors so they are exposed mostly to indoor air pollutants. Exposure to indoor air pollution is a known risk factor for several of Hong Kong's main causes of premature death (e.g., heart disease, chronic obstructive pulmonary disease, and lung cancer). Based on a 2020 survey conducted by the World Green Organization in Hong Kong, common sources. In addition, indoor air pollution is seldom covered as comprehensively as that of outdoor air pollution in the typical UG environmental engineering/science program despite indoor air pollution being listed as one of the top ten threats to global health by the World Health Organization. Hence, students typically have insufficient knowledge of the sources, concentrations, and the physical and chemical processes of air pollutants present in indoor environments, which in turn will impede them from developing innovative solutions to solve current and future indoor air pollution issues. This proposal outlines a strategy to integrate a new project-based learning (PBL) component that focuses on indoor air pollution into the UG environmental engineering curriculum. This PBL



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initiative will be comprised of student-led air quality monitoring projects conducted using portable, low-cost sensors that can measure fine particulate matter in the indoor environment. Students will engage with the scientific literature to discover current areas of interest in indoor air pollution, develop a research question and hypothesis related to an indoor air quality issue that interests them, design and execute their own indoor air sampling study to test their hypothesis and answer their research question, and present their findings to their classmates and the public in the form of an oral presentation and written report. Although the targeted students in this proposal are third year UG students attending a SEE environmental major core course taught by the PI (SEE3203: Air Pollution), the parameters and scope (and hence, the difficulty) of this PBL component can be adjusted so that it can be implemented in other UG courses to introduce other students to air pollutants present in indoor environments. The successful implementation of this hands-on PBL component will allow students to (1) advance their knowledge of indoor air pollution issues through a discovery-based, problem-driven, and cooperative learning approach, (2) enhance their critical thinking, communication, and analytical skills by engaging in the design and execution of their air sampling study, (3) foster teamwork, and (4) create new knowledge on indoor air pollution issues that can be communicated to the public.