New device monitors schoolroom air for carbon dioxide levels that may make kids drowsy

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With nearly 55 million students, teachers and school staff about to return to elementary and secondary school classrooms, scientists today described a new hand-held sensor — practical enough for wide use — that could keep classroom air fresher and kids more alert for learning.

They reported on the device at the 244th National Meeting & Exposition of the American Chemical Society, the world's largest scientific society, being held here this week. The sensor detects the amount of carbon dioxide (CO_2) in classroom air. The average person in the course of normal breathing exhales about 2 pounds of that colorless, odorless gas each day.

"Poor air quality in school classrooms is a growing concern," said Jack N. Driscoll, Ph.D., who led the team that developed the sensor at his firm, PID Analyzers, LLC, Sandwich, Mass. "Many school districts are in the midst of budget crunches that have delayed construction of new facilities. As a result, school classrooms are getting more crowded, with occupancy levels as high as one person for every 40 square feet. The average office worker has about 140 square feet of space."

Energy conservation is another factor, Driscoll said, noting that newer school buildings are more tightly sealed against drafts. Unless heating and air-conditioning systems are ventilating the building properly, stale air can get trapped in classrooms. For example, in the past, air in the

typical school classroom was refreshed 4-6 times an hour. In energy-efficient classrooms, there may be only 1-2 exchanges per hour.

The new so-called "dual-beam" sensor is simpler and less expensive than past CO_2 monitors and more stable than those so-called "single-beam sensors." It requires calibration to ensure accuracy only once or twice a year, compared to weekly calibrations for existing devices. Driscoll added that the new sensor is simple enough for anyone to operate, and can collect data for up to 450 hours. The remedy for poor classroom air quality often is simple and inexpensive, he added. It may involve replacing dirty air filters or adjusting the speed of blowers in the heating or air conditioning system.

More information:

Abstract

Poor air quality in school classrooms is a serious problem now since school classrooms can have occupancy levels as high as 40 sq. ft. per persons compared to average office occupancy of 140 sq. ft. per person. Other considerations include the number of portable classrooms being used on a semi-permanent basis. Many of the urban schools are old, situated near industrial sites and have poor HVAC equipment. With classrooms that have individually controlled HVAC, improving the air quality could be accomplished by simply monitoring CO2 and using that to control the HVAC system. Of course, most schools do not have that capability. We have developed an indoor environmental quality (IEQ) sensor package that has the capability to monitor CO2 in the crowded class rooms (high levels of CO2 cause drowsiness), temperature, VOC's from a variety of sources, and a fourth sensor that can be selected. The CO2 sensor is a low power IR sensor with a range of 0-2,500 ppm and the VOC's will be measured with an electrochemical sensor with ppb capability. The third sensor is air temperature. The fourth sensor can be

chosen from a variety (30 different) of electrochemical sensors. The Bluetooth wireless datalogger module has four analog inputs that are supplied from the sensor amplifier. The sensor package power is only a few milliwatts so a battery operated system with the capability to run for 450 hours provides nearly three weeks of data which would be sufficient to evaluate a classroom and make decisions about the corrective actions to be taken. The datalogger in the system has Bluetooth wireless capability that can send a signal 200-300 ft. so a PC with a wireless receiver (in the area) can be used to collect the data on a weekly basis without disturbing the classroom. A variety of classrooms will be evaluated with the sensor package including labs, portable classrooms and lecture halls to evaluate the IEQ. The IEQ package is compact and is easily moved to different locations since no external power is required. This study could lead to improved air quality in classrooms. If achieved, a positive benefit would be that this can lead to higher test scores as shown in a number of studies.

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