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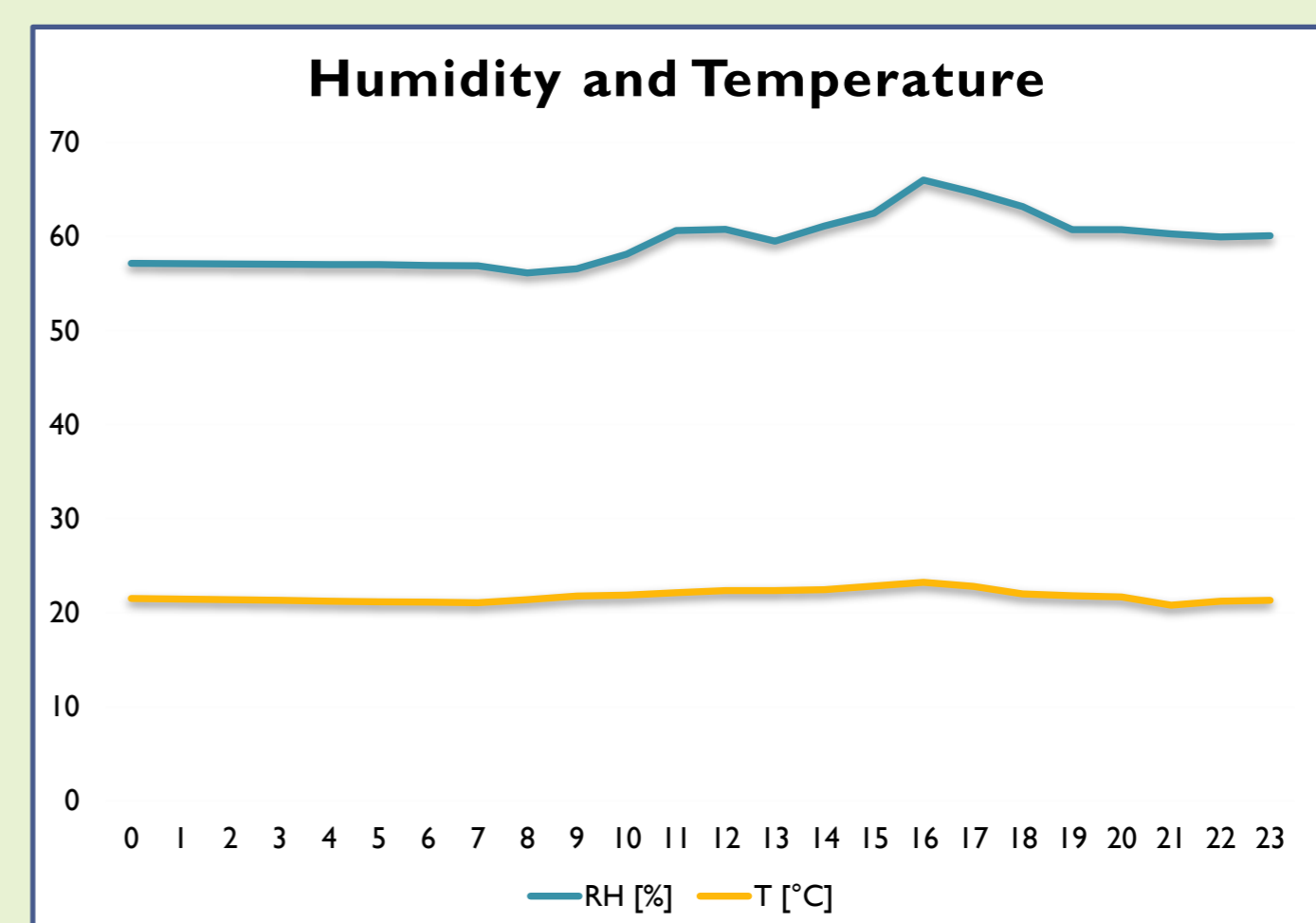
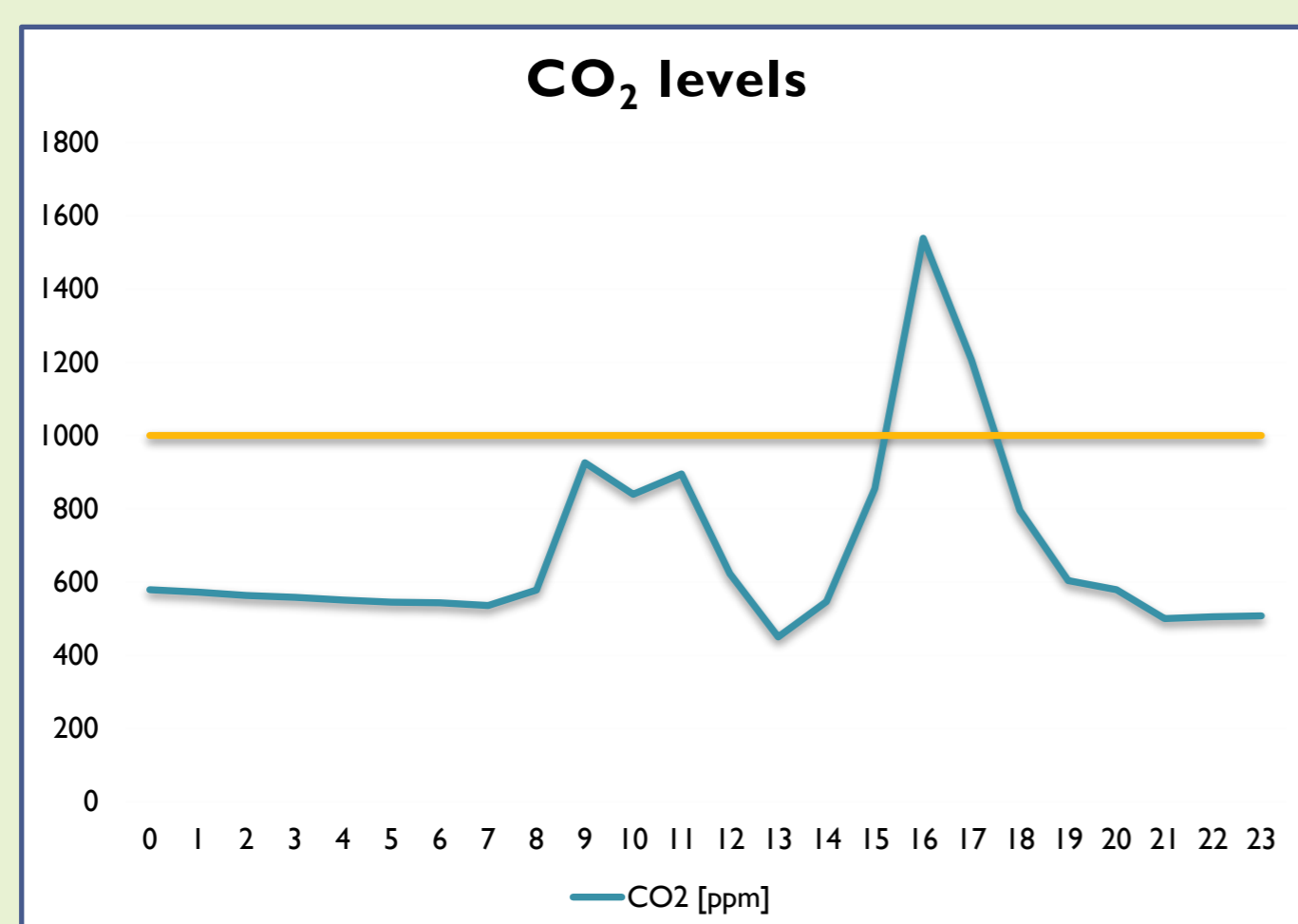
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## INTRODUCTION

The Parma Declaration on Environment and Health from 2010 is based on a fundamental goal – to protect children’s health from health risks arising from inappropriate environmental conditions, such as inadequate air quality that children breathe (WHO, 2010a). The National Development Strategy of the Republic of Croatia until 2030 states that students spend more than one-fifth of their hours in a year in schools (Government of the Republic of Croatia, 2021). The Croatian Institute of Public Health (2015), in its report, states that measurements of CO<sub>2</sub> levels in classrooms across the Republic of Croatia show that it averages 1944 ppm, while the World Health Organization (2010b) recommends a level of up to 1000 ppm. Given this fact, it is important to ensure quality air in classrooms, and this can only be achieved by monitoring the air quality in these spaces. The Croatian Academic and Research Network has launched the AERO project - a smart sensor management system that monitors the most important air quality parameters in classrooms, such as the level of relative humidity, temperature and CO<sub>2</sub> in the room. Thanks to the Croatian Academic and Research Network, the Juraj Dobrila Elementary School in Rovinj has acquired air quality monitoring sensors, installed them in classrooms, and based on the data read, immediate action can be taken to reduce CO<sub>2</sub> levels, thus ensuring air quality.



## MATERIALS AND METHODS

Using a complete set of sensors for monitoring air quality, measurements were taken continuously over 24 hours during the month of November 2025 in the Extended Stay classroom of Juraj Dobrila Primary School in Rovinj (Croatia). The sensor set was installed at a height of 1.70 meters next to the smart board, away from the windows and doors. The data monitored the concentration level of CO<sub>2</sub> measured in ppm (parts per million), the air temperature measured in degrees Celsius, and the humidity expressed as a percentage.

The measured data was collected automatically and regularly uploaded via the Internet to the Smart Sensor Management System for smart monitoring of the basic indicators of air quality in schools: air temperature and humidity, as well as CO<sub>2</sub> levels (CARNET, 2026). 12<sup>th</sup> November 2025 was randomly selected from the database and data from the system was retrieved in raw format for analysis purposes. For the graphs, MS Excel was used.

## REFERENCES

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4. WHO (2010a). Parma Declaration on Environment and Health. URL: <https://www.who.int/europe/publications/i/item/EUR-55934-5-1-Rev-2>
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## RESULTS

The CO<sub>2</sub> data reveals several distinct phases throughout the day. In the early morning hours (0–8h), levels remain relatively low at around 550–600 ppm, consistent with an empty or sparsely occupied room that had been ventilated overnight. As the school day begins (8–12h), concentrations rise sharply to approximately 930 ppm around 9h when children arrive and activities start, with a brief dip below 900 ppm around 11–12h. During the lunch and rest period (12–14h), CO<sub>2</sub> drops notably to around 450 ppm, corresponding to empty or well-ventilated classroom. The most concerning phase is the afternoon (14–17h), when levels surge to nearly 1550 ppm around 16h — well above the 1000 ppm threshold marked on the chart — corresponding to the after-school care session, when the room is most densely occupied and ventilation appears to be insufficient. By evening (17–23h), levels quickly return to 500–600 ppm once the children have left and the space has aired out.

Relative humidity (blue line) hovers between 56% and 66%. Morning values (57%) are normal. The increase in the afternoon to 66% directly correlates with the increased number of people — each person breathes and releases water vapor. This is a healthy range — the WHO recommends 40–70% relative humidity indoors, so there is no reason to worry.

The temperature (orange line) is remarkably stable — it hovers between 20°C and 23°C all day long. The only slight increase is seen in the afternoon (2–5 pm) when the room is most crowded, which is to be expected.

## CONCLUSION

CO<sub>2</sub> concentrations above 1000 ppm are known to cause drowsiness, reduced concentration, and impaired cognitive performance in children, making the recorded peak of 1550 ppm a concern for a learning environment. Considering that ventilation is used in the classroom as a natural method of regulating CO<sub>2</sub> concentration, we can conclude that it is necessary to continue monitoring with sensors, while during the disputed time interval, it is essential to enhance ventilation.