

# A WORLD OF SMARTPHONE EXPERIMENTS WITH THE APP PHYPHOX

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## SMARTPHONES AS MEASUREMENT DEVICES

The concept of the app phyphox is based on the simple idea that smartphones and tablets come with a plethora of sensors, which can be used for data acquisition in science education. Phyphox was developed at the RWTH Aachen University for this purpose and presents itself as an open source tool with many options to customise data sources, data analysis and data presentation, while not overwhelming students with these options while they use their own devices to discover the world.

### Experimentation with device sensors

There are many situations in which these readily available measurement devices can enhance science education. These range from classical educational experiments that can be reproduced with household items (radial acceleration in a salad spinner), over casually discovering the world around us (determine the speed of an elevator with the pressure sensor) to projects on technical applications (build a Pitot tube based on this pressure sensor).

### DIY-Sensors with Arduino and MicroPython

Beyond these typical experiments, phyphox can be used in modern microcontroller-based projects. Smartphone sensors can easily be combined with cheap external sensors using an Arduino or MicroPython library for phyphox. This allows us to combine the visualisation capabilities of the phone with the wide choice of sensors of DIY electronics and is accessible even to programming beginners.

### Collaborative experiments for large audiences

While these examples are suitable on the scale of typical school classes, the connectivity of smartphones allows us to scale experimental data acquisition to large audiences. Automated data collection and analysis allow for entire lecture halls to participate in live experiments during a lecture and even worldwide experiments to determine Earth's axial tilt have been demonstrated.



**Hundreds of students in a lecture hall experiment with spring oscillators while collective results are automatically submitted and displayed on the main projector.**

## FURTHER READING

Sebastian Staacks, Simon Hütz, Heidrun Heinke, Christoph Stampfer. (2018). Advanced tools for smartphone-based experiments: phyphox. *Physics Education*, 53(4), 045009. <https://doi.org/10.1088/1361-6552/aac05e>

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