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Teaching by doing or a field course in our backyard: the first geosensing of the environment course in this geography institute

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The ubiquitous "field trips in geography" type courses often exclude students on the basis of mobility and flexibility, have a high travel footprint, and rely primarily on passive knowledge. In the summer of 2022, we taught a master level geography course, Geosensing of the Environment for the first time at the Geography Institute at the University of Bern. The course was team taught by the institute field technician, the assistant and master student, and a researcher in hydrology. This course is unlike anything currently or previously taught at our institute. It put the students in charge of their own scientific trajectories, taking them on a full scientific cycle "journey" from idea and question, to device development and measurement, to analysis and communication. The main goal of the course was for all students to use raspberry pi micro controllers or similar devices and a variety of sensors however they wish to build a scientific measuring device, while maintaining this course's relevance and connection to all physical geography subjects.

The pedagogical framework of the course was innovative in a number of ways, namely bringing together a self-learning module teaching the basics of programming microelectronic boards, a hands-on workshop where they got to build their own sensor device based on their own scientific questions, and a follow-up phase where they got to propose a bigger project using their progress in the workshop as a pilot. Students particularly appreciated the open-ended nature of the course that could be adapted to their interests. Although the students' backgrounds were not technical, by the end of the course, we had one group measuring CO_2 over a freeway, one group analyzing temperature variation caused by balcony vegetation, and one group measuring water temperature profiles around Bern. In the end, one device was based on raspberry-pi pico and a second based on the sparkfun thing plus RP2040. In the future, we hope to put more emphasis on energy management and communication of sensor networks. Improvements to this course must balance the goal to empower each student to "start from scratch" or to provide ready-to-go kits, leaving students to mainly choose which sensors they use. Our main lessons learned concern teaching technical subjects in non-technical disciplines, focusing on instrumentation to transcend disciplines, transforming field courses to more accessible and lower-impact formats, and empowering students to build sensing devices starting with a blank sheet of paper (and a raspberry pi).