



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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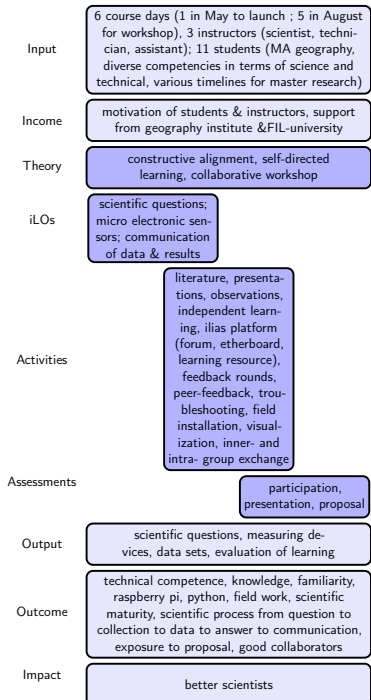
Motivation

- Redefine the traditional "field" course in the summer of 2022 to a learning-by-doing course that does not require travel, thus is in general more accessible and has a smaller carbon footprint.

Learning Objectives

- Ask an original scientific question
- Independently design, build, and program electronic measurement instrument with simple micro electronics
- Answer the scientific question by analyzing data collected with own device and communicating it scientifically

Pedagogical Framework



Self-Directed Learning Period (May – August)

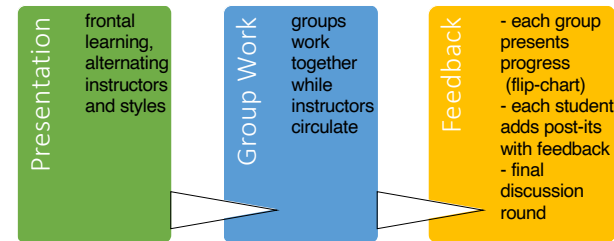
- Goal 1: Gain a foundation with Raspberry Pi Pico
- Goal 2: Generate & Share ideas
- Tool: Ilias (online learning platform) with
 - Book : Halfacree, Gareth, and Ben Everard. *Get Started with MicroPython on Raspberry Pi Pico*, 2021.



- Forum to track progress, ask questions, troubleshoot, exchange, brainstorm
- Library of literature and examples of self-made sensors

Collaborative Workshop: Format

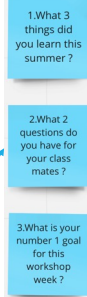
- Course Layout: 6 cycles of 3 "feedback rounds" :



- Spanned a weekend (ideally for data collection: W, Th, F >> M, T)

Six Themes:

- Scientific Questions
- Sensors
- Software, Libraries, Date stamps, formats ..
- Troubleshooting
- Physical hardware, building
- Data Analysis and Scientific Communication

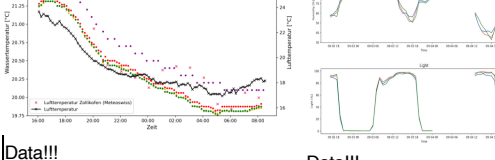
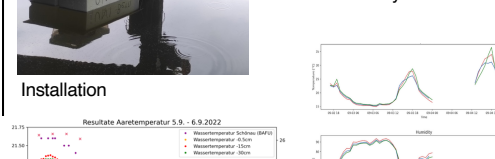
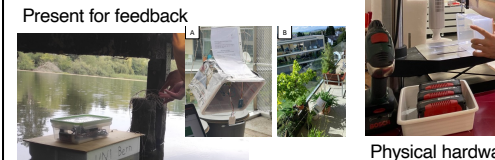
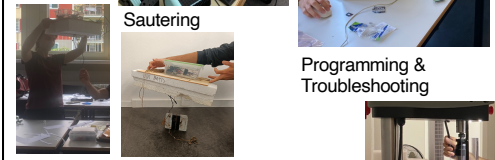
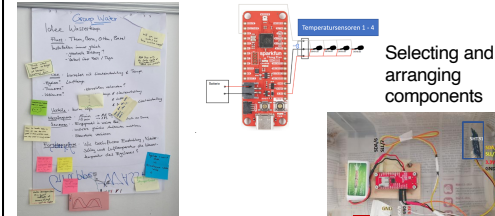


Evaluation / Check- points:

- Transition from self-learning to workshop questions
- Equipment Installed in the field !
- Final Presentation
- Proposal of a more long-term project using class work as a pilot

3 Groups, 3 themes :

- Water temperature in an urban pond
- CO₂ over highway
- Balcony Air Temperature & microclimate



Successes

- Positive reviews from students
- Open-ended nature of the course, adapted to individual interests
- Integration of 2 phases
- Each group had data from a self-made device that they built starting with a blank sheet of paper (and a raspberry pi).
- Focus on instrumentation transcended disciplines (a plus in Geography! Expand) Base for future MA projects.

Observations

- sparkfun thing plus RP2040 sometimes is better adapted than raspberry-pi pico
- Tradeoff: empower each student to "start from scratch" or provide ready-to-go kits?
- Challenge = teaching technical subjects in non-technical discipline. Start from basic; allow time for troubleshooting.
- Feedback rounds were not always popular; restructure so that sharing happens *within* more than *between* groups.

Ideas for Future

- Include python data analysis in the self-directed learning module
- Expand duration but keep hours constant, so more time for troubleshooting
- Include real-time clock, energy source, and communication tool (e.g., LoRa) in "kit" and instruction
- Build two different devices, with different groups so contribute differently skills and not "specialize", also increases learning potential from feedback. E.g, a comparison of available sensors to foundational skills
- Improve assessment so more individual (vs. group) & concrete (vs. participation), e.g., 1:1 interview to explain device.

Acknowledgements

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