FROM ENGINEERING PHYSICS TO STUDENT INNOVATION: LARGE-SCALE PROJECT-BASED LEARNING AT POLYTECH NANTES

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How can physics remain rigorous, useful and motivating for engineering students? This talk will present a large-scale interdisciplinary project-based learning module developed at Polytech Nantes in the second year of the integrated preparatory cycle. Each year, approximately 144 students work in 12 large teams on projects connecting physics, engineering practice, digital tools and societal or industrial issues. This team size is a deliberate compromise: it creates authentic project-management constraints while keeping supervision manageable.

The module is organized into three phases: training, production and presentation. Initial training sessions help students become progressively autonomous through project management, bibliographic research, scientific writing and digital tools. The production phase is central: students are expected to deliver a concrete outcome, such as a prototype, numerical simulation, IoT system, application or data analysis tool. This tangible objective strongly supports motivation and helps connect physics concepts to engineering practice.

Assessment combines collective deliverables and individual evaluation. Teams submit a preliminary project proposal, intermediate milestones and a final report, and present their work in a final conference. Each student also submits an individual contribution sheet and takes part in a short interview, allowing both personal involvement and understanding of the whole project to be assessed. This limits task fragmentation within large teams and encourages fair engagement.

The talk will highlight the organizational conditions needed for such a format: dedicated support from technical staff, involvement of academic experts and researchers, and participation of industrial and socio-economic partners in the final jury. Concrete student achievements will also be presented. Last year, two projects were communicated at the French national photovoltaic conference: an instrumented high-altitude balloon for qualifying commercial CIGS photovoltaic modules, and a neural-network-assisted extraction of single-diode model parameters from photovoltaic I–V curves.

Finally, the presentation will discuss lessons learned and current challenges, including the role of AI tools, which can support autonomy but also require careful assessment to ensure genuine scientific understanding.