PROFFORMANCE+ International Higher Education Teacher Award 2024/25

Virtual Laboratories in Civil Engineering: Joint Digital Platform & MSc Course Curriculum

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main topic(s)

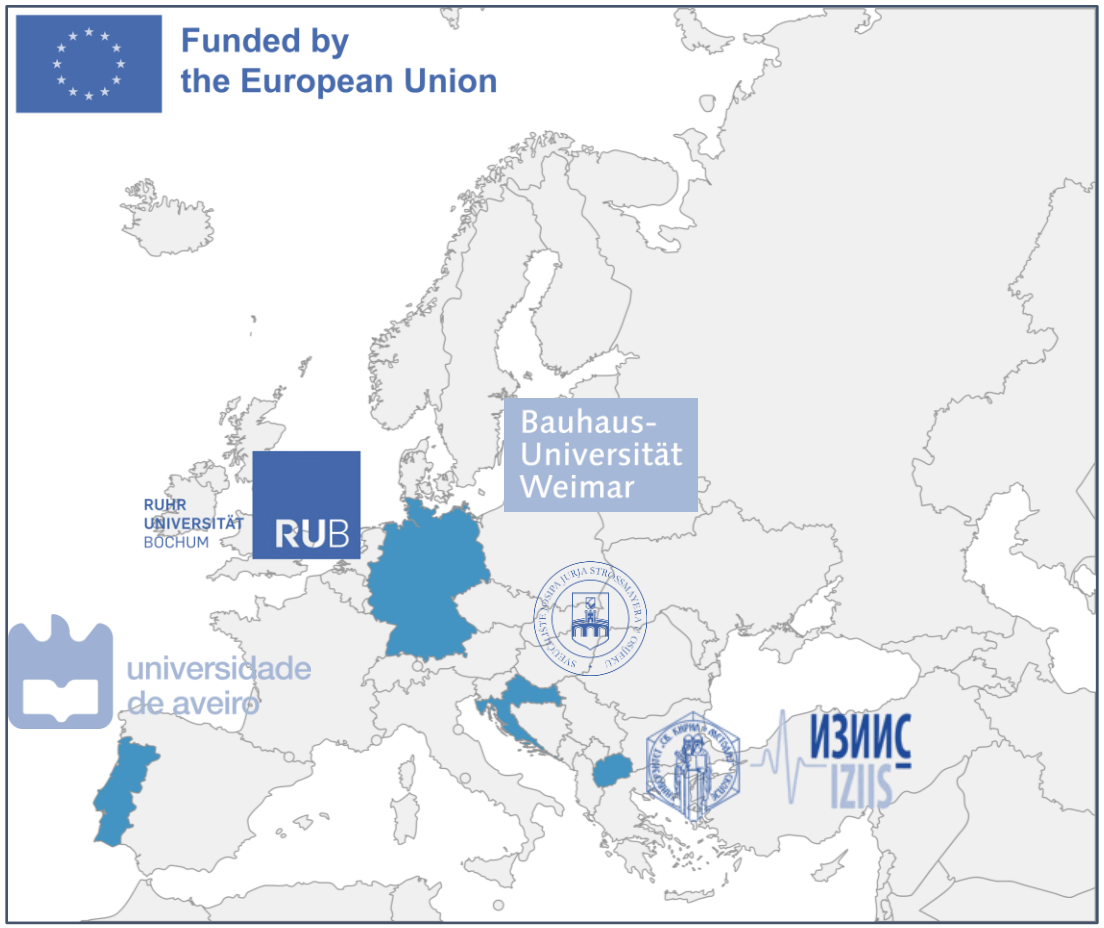
- **development of a joint digital/VR lab platform** for collaborative international learning in civil engineering education
- **implementation of innovative, hybrid and participative teaching methods** in an MSc curriculum
- **inclusive and sustainable access to virtual lab experiments** overcoming physical, social, and geographical barriers
- **digital skills enhancement through immersive technologies** and online international collaboration
- **promotion of internationalization, blended mobility, and interdisciplinary learning** via case-based and problem-based learning (PBL)

challenge/problem: objective

- **challenges / problems:**
- limited access to physical lab experiments during and post-pandemic
- fragmented opportunities for international collaboration in MSc curricula
- lack of engaging, inclusive, and practice-oriented digital teaching formats
- need for scalable, interdisciplinary, and remote-access learning methods

- **objective:**
- to develop an **innovative, open-access VR platform** for remote civil engineering experiments
- to enhance **digital, collaborative, and inclusive learning** through joint international courses
- to integrate **case-based and blended mobility models** into a future-ready MSc curriculum

implementation methodology



- **five European universities** jointly developed a VR-based MSc course in civil engineering under Erasmus+ PARFORCE
- integrated **virtual experiments** in wind, fire, and earthquake testing, accessible remotely across institutions
- delivered through a **blended format** combining online lectures, group tasks, and short-term student mobility
- included training in **data analysis, machine learning**, and collaborative project work (6 ECTS, 180 hrs)
- **successfully piloted in 2022/23** and continued in 2024/25, now open to external students

tools and technologies used

- **3D VR simulations** of complex, high-risk civil engineering experiments (static, dynamic, destructive, non-destructive)
- **high-end video and consumer cameras** with controlled LED lighting for detailed motion capture and full 3D scene acquisition
- **VR headsets** and immersive setups for realistic and interactive student learning experiences
- **Moodle platform** with custom-built modules, tests, and collaborative tools for digital course delivery
- **integration of AR applications** and results from related projects (e.g. AuCity 2) to support enhanced learning

outputs, outcomes, and impact

outputs: instructional guide, frameworks, VR tools

outcomes: enhanced teaching/learning, skill development, accessibility

impact: long-term influence on HE, transferable skills, international exposure

lessons learned: success factors, common pitfalls

- **success factors:**
- dual-layer evaluation using student feedback and ML/statistics to improve teaching and tools
- mixed reality apps enabled interactive model exploration and deeper understanding
- remote monitoring supported cross-institutional teaching and student engagement

- **common pitfalls:**
- complex questionnaires needed refinement to avoid redundancy and improve clarity
- curriculum integration issues due to varying credit systems and institutional rules

adaptability and transferability to other disciplines

- **virtual lab setups** can be reused and adapted by educators and students across institutions and fields
- **open access to VR tools and teaching materials** enables broader impact beyond civil engineering
- **blended learning model** supports inclusion, equal opportunities, and flexible participation
- **aligned with UN Agenda 2030 goals**, especially in sustainable, inclusive digital education
- **enhances global competitiveness** of programs through international, digitalized curricula

key takeaways & final reflection

- as a **pioneering initiative in civil engineering education**, the **IntEIMSc PARFORCE project** combines **virtual experimentation** with **academic outreach** to **overcome institutional limitations** and **enhance learning opportunities**

thank you · hvala · danke · obrigado