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Undergraduate Teaching of Ideal and Real Fluid Flows: The Value of Real-World Experimental Projects

This study describes the pedagogical impact of real-world experimental projects undertaken as part of an advanced undergraduate Fluid Mechanics subject at an Australian university. The projects have been organised to complement traditional lectures and introduce students to the challenges of professional design, physical modelling, data collection and analysis. The physical model studies combine experimental, analytical and numerical work in order to develop students' abilities to tackle real-world problems. A first study illustrates the differences between ideal and real fluid flow force predictions based upon model tests of buildings in a large size wind tunnel used for research and professional testing. A second study introduces the complexity arising from unsteady non-uniform wave loading on a sheltered pile. The teaching initiative is supported by feedback from undergraduate students. The pedagogy of the course and projects is discussed with reference to experiential, project-based and collaborative learning. The practical work complements traditional lectures and tutorials, and provides opportunities which cannot be learnt in the classroom, real or virtual. Student feedback demonstrates a strong interest for the project phases of the course. This was associated with greater motivation for the course, leading in turn to lower failure rates. In terms of learning outcomes, the primary aim is to enable students to deliver a professional report as the final product, where physical model data are compared to ideal-fluid flow calculations and real-fluid flow analyses. Thus the students are exposed to a professional design approach involving a high level of expertise in fluid mechanics, with sufficient academic guidance to achieve carefully defined learning goals, while retaining sufficient flexibility for students to construct their own learning goals. The overall pedagogy is a blend of problem-based and project-based learning, which reflects academic research and professional practice. The assessment is a mix of peer-assessed oral presentations and written reports that aims to maximise student reflection and development. Student feedback indicated a strong motivation for courses that include a well-designed project component. Author 1: Hubert Chanson h.chanson@uq.edu.au

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