THE EMULATE PROJECT COURSE AS AN INSTANCE OF RESEARCH-GUIDED TEACHING

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INTRODUCTION

University education aims at the advancement of the current state of knowledge. Toward this end, research-guided teaching provides a host of effective opportunities. Following this approach, the curricular development for the Master of Building Science programme on the TU Wien integrated a course into its current curriculum that offers a platform for research-inspired teaching. This course is named Project course, and during the Winter semester 2016/2017 students had the opportunity to deepen their knowledge via working on current trends and ideas within two research streams currently followed at the Department of Building Physics and Building Ecology. This contribution reports on the efforts and results of one of the two research streams, called the EMULATE project. The EMULATE project targets the conceptual development of innovative urban energy modelling environment. Currently, the interest in urban-scale energy modeling environments has been steadily increasing. This is in part due to the insight, that certain critical questions regarding the performance of the built environment cannot be sufficiently treated at the level of individual buildings. However, bound to achieve computational efficiency, past urban-scale modeling efforts frequently rely on various domain simplifications. For instance, heat transfer phenomena are captured using reduced order models. This could involve not only the simplification of the geometry and zonal complexity of modelled buildings, but also a significant reduction of the temporal resolution of the modelling results. As a consequence, certain important queries cannot be accommodated with appropriate levels of resolution. Specifically, the temporal dynamics of load patterns and their dependency on transient phenomena (e.g., weather conditions, inhabitants' presence and actions) cannot be realistically represented. To address these circumstances, the envisioned urban energy modelling environment combines various developments in the fields of urban building stock energy performance assessments, microclimate modelling, and occupancy modelling, towards the more realistic assessment of urban and neighborhood level energy assessments. Thereby, the students involved in the project course were given the task to explore the challenges and potentials of the essential features of the above-mentioned integrative environment, specifically, the simulation-supported assessment of urban building stock energy performance, microclimate modelling, occupancy modelling, and alternative urban development and densification schemes.

THE PROJECT COURSE OUTLINE

The project course was split into three different phases (see Fig. 1). The first phase was a research phase, which was used to report on existing research and current developmental activities in the field of urban-scale energy and environmental modeling. Thereby, four dedicated sub-groups were formed, each investigating a different modelling component. Two students investigated the possibilities of a simulation-supported assessment of urban building stock energy performance, two students investigated the methodology to infer local microclimatic boundary conditions from a number of location-dependent variables, two students investigated the representation of occupants'

presence and actions for building performance assessment purposes, and one student investigated the urban densification potentials. The research phase was concluded with a presentation of findings. The subsequent three-month period was dedicated to the investigation of the implementation potential of a number of modeling approaches, as identified in the research phase. This phase was complemented with frequent presentation and discussion sessions. In the final stage of the semester, the participants were asked to present their findings and critically reflect on both strengths and weaknesses of each modeling component. Finally, they were asked to write a comprehensive scientific summary report about the overall process.

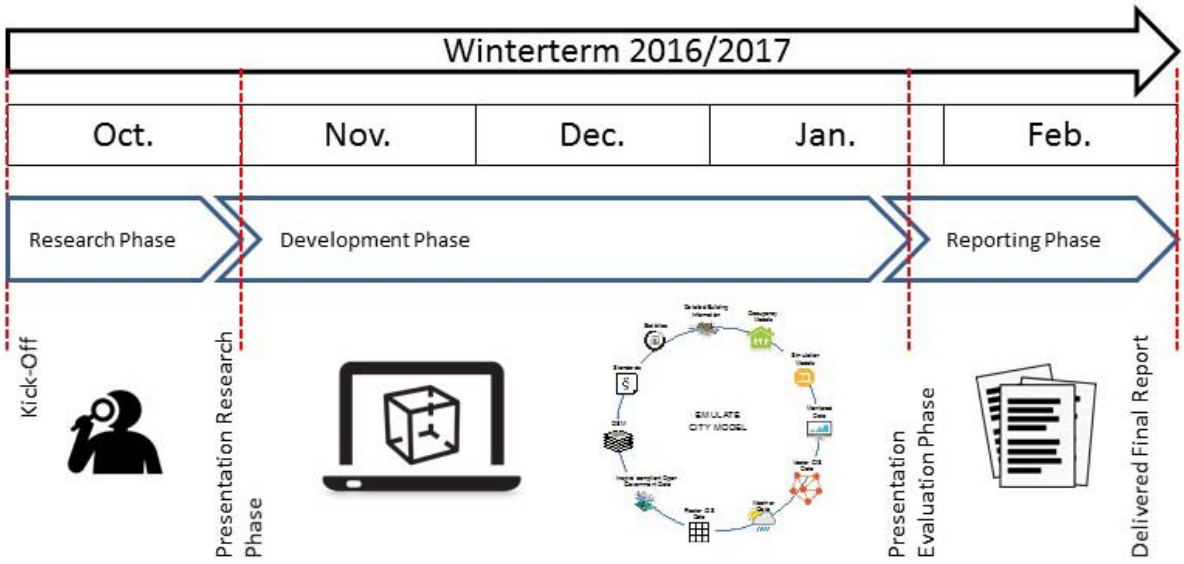

Figure 1: Flow chart illustrating the organizational character of the EMULATE project course

DISCUSSION AND CONCLUSION

The results of the project course encompassed interesting new ideas for integrative urban energy computing approach. Participants reported on the developmental efforts towards generation of a modular simulation-supported integrative urban decision support environment. As a research-guided teaching experience, the project course was perceived by all involved participants (students and instructors) as a satisfying and intellectually enriching experience. Hence, we shall further pursue this promising teaching approach and the corresponding structure in future semesters.