

## **Interdisciplinarity in Engineering**

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### **Abstract**

Recent trends in engineering are increasingly emphasizing problem-based education and research approaches. By nature these approaches require an intersection of disciplines, not only within the engineering field itself but also between engineering and a broad range of other fields. Community partnerships that explore engineering solutions to problems in the context of real socio-economic environments are also becoming more common. This chapter will use case studies to examine how an emphasis on real problems and community partnerships translate into interdisciplinarity in engineering research and education. In addition, emerging tensions between traditional, narrow focused engineering disciplines and interdisciplinarity will be discussed in the context of both the academy and the engineering profession at large.

The chapter will use civil engineering as the primary discipline via which to explore interdisciplinarity in engineering. Civil engineering was established as a concept around 1750, in order to distinguish between engineering works associated with military operations and those catering to civilians. The chapter will trace the history of civil engineering from a discipline that first produced “master builders”, to a discipline that now has numerous, well established, sub-disciplines including geotechnical engineering, structural engineering, transportation engineering, construction management and even environmental engineering; a focus area now considered to be a discipline unto itself. The chapter will explore how the evolution of civil engineering as a discipline has led to current educational and research structures, which compartmentalize the numerous sub-disciplines within civil engineering to the point where faculty who do not narrowly specialize in one specific sub-discipline are unlikely to succeed, and departments that do not include expertise in at least three civil engineering sub-disciplines cannot offer accredited degrees. Next, the chapter will examine the tensions between current

educational and research structures within civil engineering, and the enormous societal challenges of the 21<sup>st</sup> century. Given that the client for civil engineering products is society, the pressure for civil engineering research and education to emphasize problems such as climate change, water scarcity, the globalization of market places, clean energy needs, etc. is rising. By nature, these problems are interdisciplinary and, hence, require interdisciplinary educational and research approaches if they are to be tackled in a meaningful way. Furthermore, given that the solution to many of these problems will be community based, demand for research and education that emphasizes community partnerships is also rising. Several case studies will be used to illustrate how projects that involve real problems and community partnerships have evoked interdisciplinarity in civil engineering research and education. The case studies will be used to highlight what approaches have worked, and offer promise and prospects for reformation of the civil engineering discipline, and what approaches have not been successful - and why. Finally, the chapter will draw attention to an emerging trend in the civil engineering profession that is again pointing to the concept of the “master-builder” as a leader in 21<sup>st</sup> century civil engineering. Potential reasons for why the profession appears to have gone around full-circle, and back toward the concept of a civil engineer as an integrator of multiple skills will be presented. Suitable references and suggested readings will be provided.