Chapter 5
Harnessing Pedagogical Content Knowledge for Cross-Disciplinary Innovation in Engineering

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ABSTRACT

The chapter will present the integration of PCK toward the fostering of cross-disciplinary innovation within engineering. Being itself the composite of content expertise with effective teaching strategies, PCK acts as the main ingredient in developing holistic approaches to education that transcend traditional boundaries. On the basis of PCK, educators will be able to design curricula that enhance not only disciplinary-based understanding but also interdisciplinary collaboration. The chapter shares cases on how PCK-driven approaches to engineering education will let learners solve complex problems creatively and think innovatively about a wide range of contexts. It also provides strategies for embedding PCK in engineering programs through collaborative projects, interdisciplinary workshops, and experiential learning opportunities.

INTRODUCTION

The shifting landscape of challenges in engineering demands innovative solutions that exceed conventional boundaries between the disciplines. The more complex and integrated the engineering problems, the more there is a need for educational approaches that can enhance cross-disciplinary collaboration and creative problem-solving. Pedagogical Content Knowledge provides a correspondingly promising framework to match these challenges by bringing together deep subject matter expertise with effective teaching strategies. The chapter explores how harnessed PCK can drive cross-disciplinary innovation in engineering education, equipping students with the skills and competencies to solve multifaceted problems in dynamic collaborative environments(Bogoslowski et al., 2021).

Pedagogical Content Knowledge was a term first brought about by Lee Shulman in the late 1980s, which means exactly what it says: it reflects the nuanced understanding teachers have about how best to teach specific content. Going beyond the content knowledge, which is an essential ingredient in PCK, pedagogical dimensions zero in on how educators make complex concepts accessible and engaging for learners. This definition clearly takes account of the fact that teaching is not solely about making available information; it lays emphasis on knowing how students learn and knowing how to facilitate such learning in meaningful ways(Cima et al., 2021).

PCK assumes a very particular meaning within the framework of engineering education by representing the answer to the question of how to teach technical content in such a way that it simultaneously becomes understandable and useable. Engineering disciplines, and particularly complex product development, are interdisciplinary by nature. They draw upon insights from mathematical, physical, and