Chapter 10
Developing Engineering Creativity in STEM Programs in Chinese Universities

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ABSTRACT

This chapter aims to formulate a proposal of developing engineering creativity by problem- and project-based pedagogies in STEM programs in university education in China. It will introduce the increasing needs of engineering creativity in China, deepen understanding of the concept of creativity and engineering creativity, and provide a review of diverse models of problem- and project-based pedagogies in STEM programs. This further brings a discussion on how to develop engineering creativity in STEM programs in Chinese universities in order to overcome the barriers caused by traditional education system and culture. A series of strategies will be proposed including supporting student group work, designing interdisciplinary project, facilitating staff development, and developing creative communities, etc. Briefly, this chapter has the significance of developing engineering creativity in China both theoretically and practically, and also implies how to develop problem- and project-based pedagogies in STEM programs in other cultures around the world.

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UNDERSTANDING THE CONTEXT IN CHINA

In contemporary China, both 'innovation' and 'creativity' have been highly emphasized in the S&T policies initiated by the national government that grows the attention to roles of R&D centers in universities in the Chinese national system (Orcutt, & Shen, 2010). As suggested by Li (2011), the shift from 'Made in China' to 'Created in China' is underway, so the strategies for enhancing innovation capabilities have come to occupy an important position in China's development policy. In 2006, China initiated a 15-year 'Medium-to-Long-Term Plan for the Development of Science and Technology'. The Plan calls for China to become an 'innovative oriented society' by the year 2020, and a world leader in science and technology (S&T) by 2050 (Cao, Richard, & Denis, 2006). In the changes towards 'innovative nation', Chinese universities are one of key institutions carrying national engineering research projects. The fruitful research output arising from publicly financed research projects and a growing political pressure to change universities' traditional role of education and research, promote university entrepreneurship (Tang, 2009; Zhou et al., 2017).

However, policies have often failed to achieve their intended outcomes because the process of knowledge transfer is very complex and even sometimes the outcomes of policy are unpredictable (Brown, 2008). This can be indicated by the current debate on China's S&T capability in relation to set goals to become an 'innovative nation', which has reached almost two polar opposite conclusions. On the one hand, there is a pile of data shows China has increased its output in several S&T indicators. For example, China has dramatically increased the number of patents, scientific articles and engineers that it produces. China has also progressed in developing a high-tech manufacturing sector. This progress has led some to believe that China will soon overwhelm the rest of the world in engineering and technology. On the other hand, there is an equally large pile of data that suggests China's current technology capabilities are not that strong, and may remain weak for foreseeable future. Much of China's progress in patents, scientific articles and engineer formation could be described as involving improvements in 'quantity', such as numbers of publications and patents, but not necessarily 'quality' in terms of societal uptake and impact of new knowledge. In addition, China's improvements in high-tech manufacturing remain overly dependent on foreign technology transfer, as China has yet to develop domestic technology generation capabilities that truly rival those of the leading countries. Such debate calls us to rethink that studies on implementation processes must therefore take account of specific local contexts in which the policies are