Chapter 1
Fostering Creative Problem Solvers in Higher Education: A Response to Complexity of Societies

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ABSTRACT
Recent studies have emphasized issues of social emergence based on thinking of societies as complex systems. The complexity of professional practice has been recognized as the root of challenges for higher education. To foster creative problem solvers is a key response of higher education in order to meet such challenges. This chapter aims to illustrate how to understand: 1) complexity as the nature of professional practice; 2) creative problem solving as the core skill in professional practice; 3) creativity as interplay between persons and their environment; 4) higher education as the context of fostering creative problem solvers; and 5) some innovative strategies such as Problem-Based Learning (PBL) and building a learning environment by Information Communication Technology (ICT) as potential strategies of creativity development. Accordingly, this chapter contributes to bridge the complexity of societies, creative problem solving skills, and higher education development in one theoretical framework.

COMPLEXITY AS NATURE OF PROFESSIONAL PRACTICE
The complexity of the world is increasing and it has become a popular term in current discussion. Schollemr and Tomaszek (2010) argue that the emerging complexity brings massive changes in economics and markets that require companies to change swiftly too. In the book Social Emergence: Societies as Complex Systems, Sawyer (2005) argues that societies are complex dynamic systems and that it is necessary to develop the concept of emergence, focusing on multiple levels of analysis—individuals, interactions, and groups—of how social group phenomena emerge from communication processes among individual members. There are also studies in fields such as management (Lissack, 1999) and education (Haggis, 2004). Undoubtedly, emergence is a valuable topic to be explored and theories of complexity are fundamentally interdisciplinary and are of contemporary interest in many areas (Tosey, 2006).

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However, how to understand complexity theory and what does the emergence mean? According to Tosey (2006), complexity theory refers to a cluster of ways of thinking that have developed over the past decades from branches of ‘new science’ concerned with the behavior of nature systems, such as chaos theory, dissipative structure theory, and quantum physics. It offers a way of thinking about human systems. Basically, a complex system means a system whose perceived complicated behaviors can be attributed to one or more of the following characteristics: a large number of elements; a large number of relationships among elements; non-linear and discontinuous relationships; and uncertain characteristics of elements (Zhou, 2012). This demonstrates a shift in thinking from seeing parts to seeing systems of parts, recognizing that the interaction of those parts is not static and constant, but a dynamic process (Calvano & John, 2004). Complexity refers to the condition of the universe that is integrated and yet too rich and varied for human beings to understand in simple common mechanistic or linear ways. Although many parts of the universe can be understood in these ways, the larger and more intricately related phenomena can only be understood by principles and patterns—not in detail. So complexity treats human systems as directly analogous to nature, which is rarely predicable and linear. This means human systems appear to display many of the characteristics of complex adaptive systems. In particular, coherent patterns of behavior can arise from the apparently idiosyncratic interactions of random individuals (Tosey, 2006).

The property of complex systems, a phenomenon known as emergence, is highly significant. Theories of emergence have influenced psychological theory since the beginning of the field in the late nineteenth century. Emergentism in psychology has its roots in nineteenth century organicism: the theory that the organism is different from the sum of its parts and that it depends on the structural arrangement of those parts. Social organicism—the notion that society forms an integrated unity similar in some sense to that of living organisms—can be traced to classical social philosophy, but the publication of Darwin's account of evolution gave new energy to social organismic theories (Giddens, 1970). In the nineteenth century, organicism was prominent in German social philosophy; influential advocates included Schäffle and Lilienfeld (Sawyer, 2003). These theories influenced German psychologists, including Wundt and the early Gestaltists. So, evolutionary and organicist thinking were strong influences on psychology’s founders. This further influenced later researchers who are working as neurologists, evolutionary biologists, and materialists (Sawyer, 2003). However, the emergentists rejected mechanistic theories that held that the behavior the whole could, in theory at least, be deduced from a sufficient knowledge of how the components behave in isolation or in other wholes of a simpler kind (Broad, 1925). Based on the work of Kim (1992) and Teller (1992), Sawyer (2003) summarized the following claims:

- There are basic, non-emergent entities and properties, and these are material entities and their properties.
- Emergence is a process that occurs over time.
- When aggregates of basic entities attain a certain level of structural complexity, properties of the aggregate emerge. New stuff does not emerge; rather, it is properties of the higher level entities that emerge.
- What emerges is a new level of reality corresponding to evolutionary or historical stages.
- Because these properties are properties of complex organizations of matter, they emerge only when the appropriate lower level material conditions are present.
- What emerges is novel; it did not exist before the process of emergence.
- What emerges is unpredictable, and could not have been known analytically before it emerged.