Chapter 4
A Creativity and Innovation Course for Engineers

Giovanni Emanuele Corazza
University of Bologna, Italy & Marconi Institute for Creativity, Italy

Sergio Agnoli
Marconi Institute for Creativity, Italy

Sara Martello
Marconi Institute for Creativity, Italy

ABSTRACT
In this chapter, the teaching methodologies and pedagogical styles adopted within the “Creativity and Innovation” course, offered at the University of Bologna in Italy are described. The main goal of the course is to give students both a theoretical foundation and a hands-on experience about meta-cognitive strategies for the control of the creative thinking process. The students were engaged in the selection of a focus area within the range promoted by a call for new start-ups, creating the playground for team-oriented sessions in which relevant information was collected, divergent modifiers were applied, ideas were generated, business models were sketched and assessed, and finally concluding the course with a team presentation of the generated ideas. The feedback received from the engineering students was very positive. While the ideational part of the class followed a learning-by-doing approach, this was preceded by a specific theoretical part, striking an effective balance between theory and practice.

INTRODUCTION: TEACHING CREATIVITY IN THE INFORMATION SOCIETY

Even though we live in the XXI century, we still have to bear the consequences of the bipartition of schools of thought that occurred as a result of the age of enlightenment, with the sharp separation between rationalism and romanticism. These intellectual movements represented two very different ways of shedding light onto the human mind, as anyone can agree; however, the human characteristics that they praise are not and should not be in contrast. All human beings need both rationality and emotion, and indeed a very careful balance of the two. But this dichotomy is unfortunately still in place, and
works as an implicit theory for both laymen and scholars, such that prejudices divide people into two rather sharply distinct classes. Clearly, engineers are pre-mapped into the rationality container. This is the reason why a discussion of creativity in the domains of science, technology, and particularly in engineering might appear to require qualifying statements. The real paradox is that, if anyone today is asked the simple question: “What do you think represented the major innovation in the course of your lifetime?”, it can be taken as a certainty that nearly all of the answers will regard technology, its systems or its devices, with the Internet and the smartphone contending the first two positions. Clearly, new ideas in the engineering domain enjoy today the highest impact, and therefore this implicit theory is actually far from the reality which is lived everyday by the scientist and the engineer who takes seriously his/her mission to produce advancements in knowledge and inventive innovations to improve the life conditions and sustainability of the human species. Engineers must be creative.

In this Chapter, we describe a course on Creativity and Innovation offered to engineers at the University of Bologna, focusing on the adopted teaching methodologies and pedagogical styles. The course was held by Prof. Giovanni Emanuele Corazza, who is the founder of the Marconi Institute for Creativity (MIC), and who teaches several classes inside the Telecommunications Engineering curriculum. The Marconi Institute for Creativity, a joint initiative of the Fondazione Guglielmo Marconi and of the University of Bologna, was founded in 2011 with the purpose of establishing creative thinking as a science. Some of its inspiring elements came by extracting the principles underlying the work and experimentation approach by Guglielmo Marconi (a Bolognese by birth) and other great inventors, artists, philosophers, designers, etcetera, and then by positioning these principles within a theoretical framework which takes a domain-general view on creative thinking. The three pillars upon which MIC operates are those of scientific research, education activities, and support to the process of creativity and innovation, both in academic and in business contexts. The study of the concepts at the basis of the creative process are considered to be essential to form a new discipline, starting from the belief that creativity itself is no longer an option, but a true necessity for the education of students at any level, and in universities in particular. Within MIC courses, creativity is presented as related to the concept of discovery as well as to the process of invention, both contributing to the development of the Information Society: the world as we know it is permeated by Information and Communication Technologies (ICT), and by the consequent changes that they have imposed on our society (Corazza, Pedone & Vanelli Coralli, 2010), opening up unprecedented opportunities. Every human being who is connected to the Internet can interact with millions of others, and benefit from the largest distributed database ever existed, with access to documents, reports, patents and in general information about any discipline, in real-time. Even though data cannot be confused with knowledge (Reddy, 1979), the fact that information is now a commodity has remarkable consequences on our everyday and professional lives. The expertise related to professional know-how does not have the same value that it had in history, when the spreading of knowledge was limited in time and space. The static possession of knowledge is rapidly becoming insufficient as a distinctive element, if not augmented by the ability to generate new ideas, explore alternatives, and imagine future scenarios: the human being must now bring creativity into play. Only by generating original ideas and efficient solutions can we avoid becoming mere nodes of a massive network. Creativity becomes then fundamental for the dignity of human beings, and it may well be the most difficult ability that can be transferred to artificial forms of intelligence. Even though there are plenty of researchers working on algorithms for the endowment of machines with the ability to generate, we believe it would be dramatic for human beings to give up on this very peculiar characteristic of theirs. Starting from these considerations, we believe that creativity needs to be freed from any romantic myths and be taught as a scientific discipline, which
Related Content

**Placing a New University Model Within the Discourse of Higher Education**  
[www.igi-global.com/chapter/placing-a-new-university-model-within-the-discourse-of-higher-education/223240?camid=4v1a](www.igi-global.com/chapter/placing-a-new-university-model-within-the-discourse-of-higher-education/223240?camid=4v1a)

**Evaluating International Competitiveness: A Study of the Application of External Quality Assurance Performance Indicators in Romania**  
[www.igi-global.com/chapter/evaluating-international-competitiveness/110093?camid=4v1a](www.igi-global.com/chapter/evaluating-international-competitiveness/110093?camid=4v1a)

**Transforming Schools, Communities, and Universities: University-Assisted Community Schools as a Case Study**  
Ira Harkavy, Rita A. Hodges and Joann Weeks (2020). *Emerging Perspectives on Community Schools and the Engaged University* (pp. 114-131).  
[www.igi-global.com/chapter/transforming-schools-communities-and-universities/237498?camid=4v1a](www.igi-global.com/chapter/transforming-schools-communities-and-universities/237498?camid=4v1a)

**Improving Student Engagement in Political Science Courses Through Application of Active Learning and Digital Learning Technologies**  
Victor B. Eno (2019). *Teaching Cases Collection* (pp. 113-134).  