The design of future- and present-oriented teaching modules on the science of complex systems for upper secondary school students

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Many researches and reports highlight that the young generation have difficulties in projecting themselves into the future, and in developing scope as future professionals. Whilst the past generations looked at science and technology as positive possibilities for addressing societal challenges, now the young generation perceive them as sources of fears and unmanageable uncertainty. How can scientific knowledge help the youth to develop skills for enabling them to rationally and emotionally manage their future?

In this talk we address the hypothesis of if and how scientific knowledge, particularly the science of complex systems, can make students develop hard skills and if such skills can be turned into soft-transversal ones. The science of complex systems was chosen because it is intrinsically full of concepts, like feedback and self-organization, which are often used both as common use words in the everyday language and as metaphors of social behaviour.

In order to explore our hypothesis, we designed three sets of specific activities that respectively aim to: i) develop hard-scientific knowledge; ii) turn hard-scientific knowledge into hard skills; iii) turn hard skills into specific soft-transversal skills that we identify as future-scaffolding skills. The first set of activities consists of lessons in which the concepts of feedback, self-organization, emergent properties, as well as the characteristics of the process of modelling and of the different spatiotemporal scales, were interactively taught. The second set consists of the presentation of simulations, as one of the main tools of science for studying the evolution of a system, in the execution of laboratory experiences that pointed out the role of modelling in climate science and led them toward the interpretation of graphs. The last set of activities consists of the guided construction of a logic cause-effect map about a problem related to climate change, in the identification of feedback cycles within a complex problem as a component of the possible evolution of the system. At the end of these activities, we presented an urban problem and asked the participants to discuss about it in term of probable, possible and preferable futures, writing scenarios and designing an action to do in the present in order to realize the desired future. Looking at the way they decided to face the problem and to play with possibilities, we checked the validity of our hypothesis.

All the mentioned activities were carried out within a teaching laboratory-course about the topic of climate change addressed in its many dimensions, targeted to secondary school students (17-18 years old, grade 12-13). In the talk, we will present the activities as well as the pilot study we carried out to test our conjecture.

Keywords: scientific knowledge, hard skills, soft-transversal skills, feedback activities, future activities