

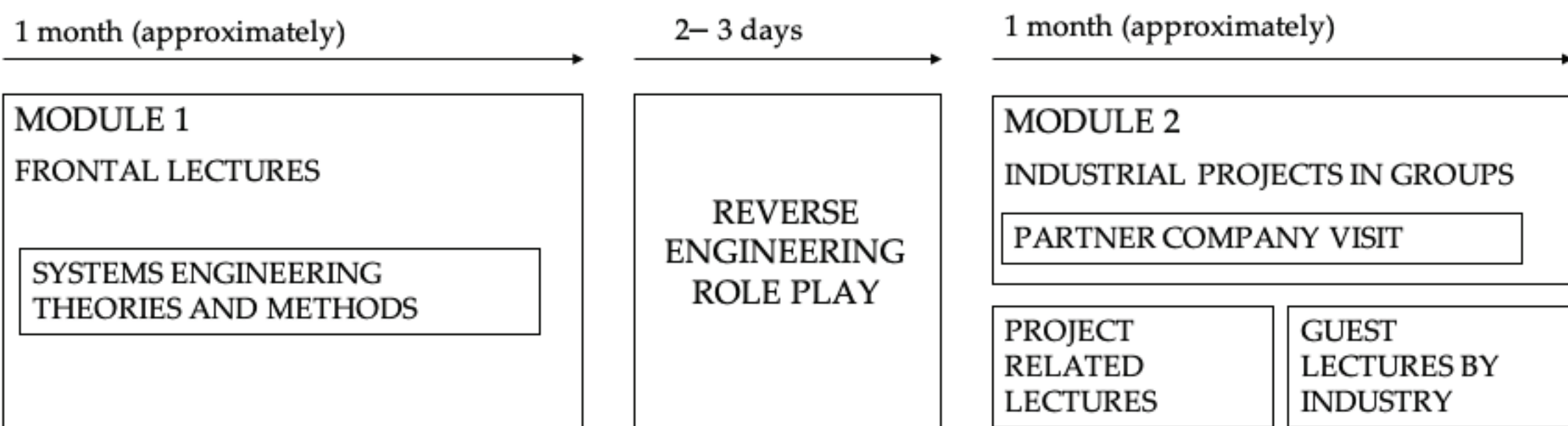
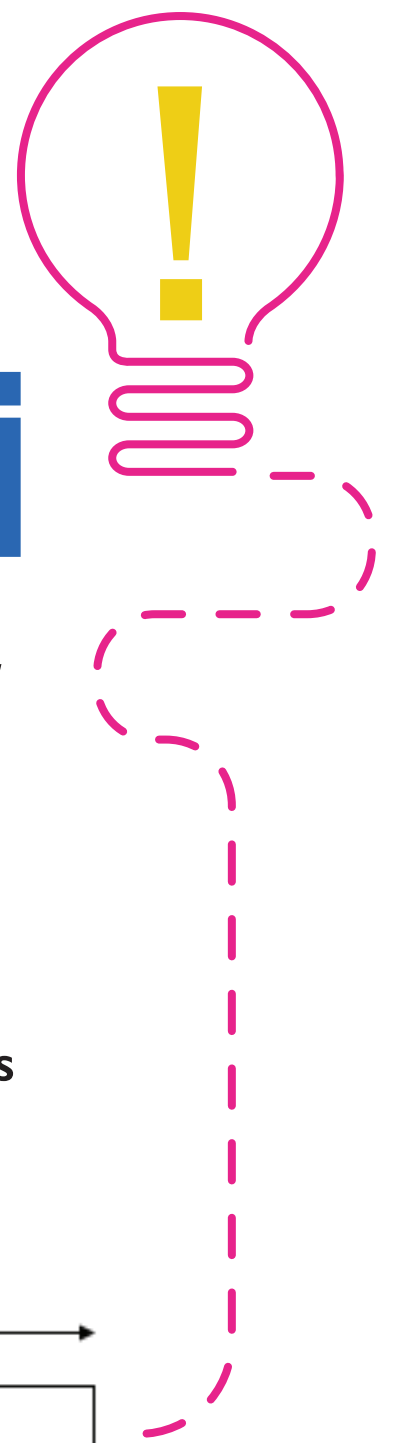
# BEST PRACTICE 2019



## Alessandro Bertoni

### Reverse Engineering Role Play to teach Systems Engineering

Engage the students in a three-stage reverse engineering role-play to increase their awareness of the importance of correctly using systems engineering methods, by experiencing them “in real life”.



Systems engineering projects require multidisciplinary skills and cross-functional design teams, including a wide set of disciplines, such as design, manufacturing, system analysis, knowledge management, and sustainability analysis. Different methods to structure, formalize, and validate knowledge have been developed by both researchers and industrial practitioners since the 1980s

However, students engaged in systems engineering education typically lack experience and understanding of the multidisciplinary complexity of systems engineering projects. They struggle to understand the value, rationale, and usefulness of established systems engineering methods, often perceiving them as banal or trivial.

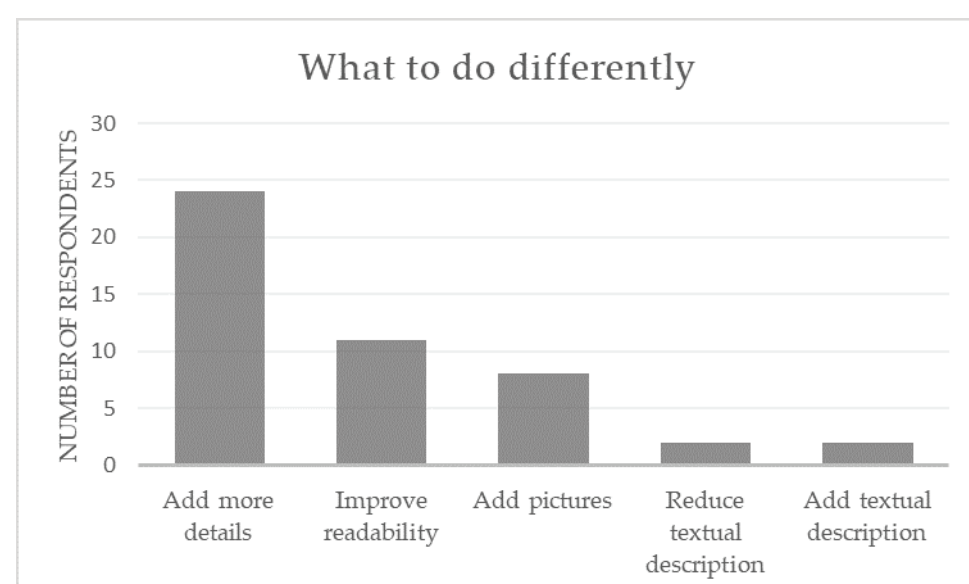
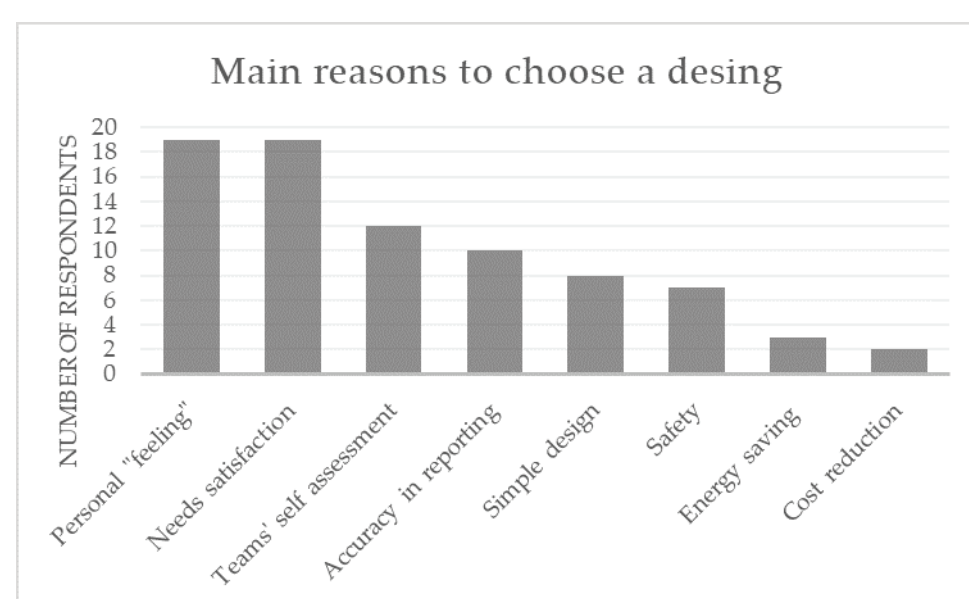
The reverse engineering role-play is designed to address two intended learning outcomes of the course:

- Be able to develop a systems engineering concept design as the basis for further detailed design;
- Apply systems engineering tools (e.g., requirements development and management, robust design, design structure matrix) to realistic problems;

The activity focuses on providing a realistic project in which students can apply systems engineering methods and reflect on their benefits, drawbacks, and challenges. The role-play is organized as a two-day activity in which the students act initially as members of an engineering team dealing with the reverse engineering of a product (stage 1), assuming later (stage 2) the role of members of a product innovation team in charge of the redesign of the available product. The two stages are followed by an individual activity, in which each student takes the role of a manager to select the most relevant design to be further developed. This is done to replicate a cross-functional development scenario in which designers and decision makers are two different groups of stakeholders.

At the end of the role play the students are asked to self-reflect on what they would do differently the next time they will face such a problem. In the last years the majority of the students stated that they would make

a bigger effort in adding details to the models and make them more readable. Thanks to the role play the students developed a critical perspective toward their own work, and the data from the last years show a shared understanding about the necessity to use well-formalized, detailed, and effectively communicated methods during SE, suggesting that the learning activity is effective in avoiding the risk of the systems engineering methods being considered as a triviality.



For more information see: Bertoni, A. (2019). A Reverse Engineering Role-Play to Teach Systems Engineering Methods. *Education Sciences*, 9(1), 30, part of the Special Issue "Toward Excellence in Engineering Education".

