A mixed project-based learning framework: preparing and developing student competencies in a French *Grande Ecole*

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Emerging engineers need to rely on a whole body of scientific and technical knowledge, but also on a full set of competencies. For engineering schools, a competency objectives approach requires specific pedagogical methods. Some competencies based on skills and attitudes are difficult to develop through traditional teaching so, in 2003, our institution implemented a project-oriented framework combining pedagogical methods such as project-based learning, active pedagogy, and traditional teaching paradigms. In practice, each semester, students work in groups on a competency-controlled project lasting over 100 hours per student. Although comparisons between various pedagogical methods are difficult and sensitive, numerous internal signals confirm the validity of several aspects of our mixed option.

Keywords: project-based learning; competencies; semester projects; pedagogical methods

About the authors

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Tables and Figures with captions

Transversal competencies	- interpersonal communication (group work, creativity)
	- learning to learn
	- oral communication (presentations, meetings)
	- written communication (technical reports, argumentation techniques)
	- project management
Scientific-technical competencies	- designing (plan, write specifications)
	- modelling (applying theoretical knowledge and methodologies)
	- developing
	- testing, assessing and validating solutions
	- interdisciplinary approach

Table 1. Main competency domains developed.

	S1 Project : "Introduction to complex systems"	**S2 Project: "Start up"**
Situation	Creation of a technical-economical report	Creation of a report for decision makers
Main transversal learning elements	• group work • oral communication	• oral/written communication using argumentation techniques
Transversal abilities	• to collect and to select information in a relevant way • to present the group's work orally, using suitable tools • to learn by using the project as a mainspring of knowledge acquisition • to learn with the help of the group	• to apply brainstorming and creativity techniques • to convince, using well-argued elements • to communicate, to spread and to archive their results • to organize the group in a non-directive way • to identify the tasks and to distribute them among the group of students
Technical abilities	• to explain the benefits and the links between the various disciplines comprising a telecommunication system.	• to identify technological potentialities and their limits in terms of acceptability, feasibility, cost and usefulness • to integrate economic and social constraints
	S3 Project: "Development"	**S4 Project: "Engineering"**
Situation	Technical development in a research discipline of our institution	Technical realization ending with a presentation at the project forum
Main transversal learning elements	• written communication (technical report)	• project management
Transversal abilities	• to reformulate the problem clearly in their own words • to write a quality technical report collaboratively • to supply a product efficiently and in time	• to apply project management methods in order to supply a product with respect to cost, quality and time constraints • to produce several kinds of oral and written deliverables for the project • to conduct a meeting • to trade with a customer
Technical abilities	• to design and to develop a technical solution in the domains of the scientific disciplines studied • to test, to assess and to validate solution elements • to apply a methodology appropriate to the project	• to combine and apply knowledge, methodologies, and practices previously learned • to learn new technology

Table 2: Projects summary.

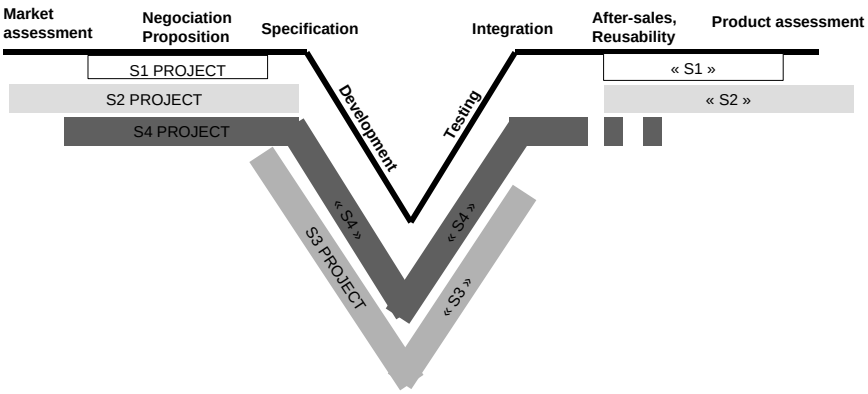

Figure 1. Position of the projects in the "V" life cycle model.