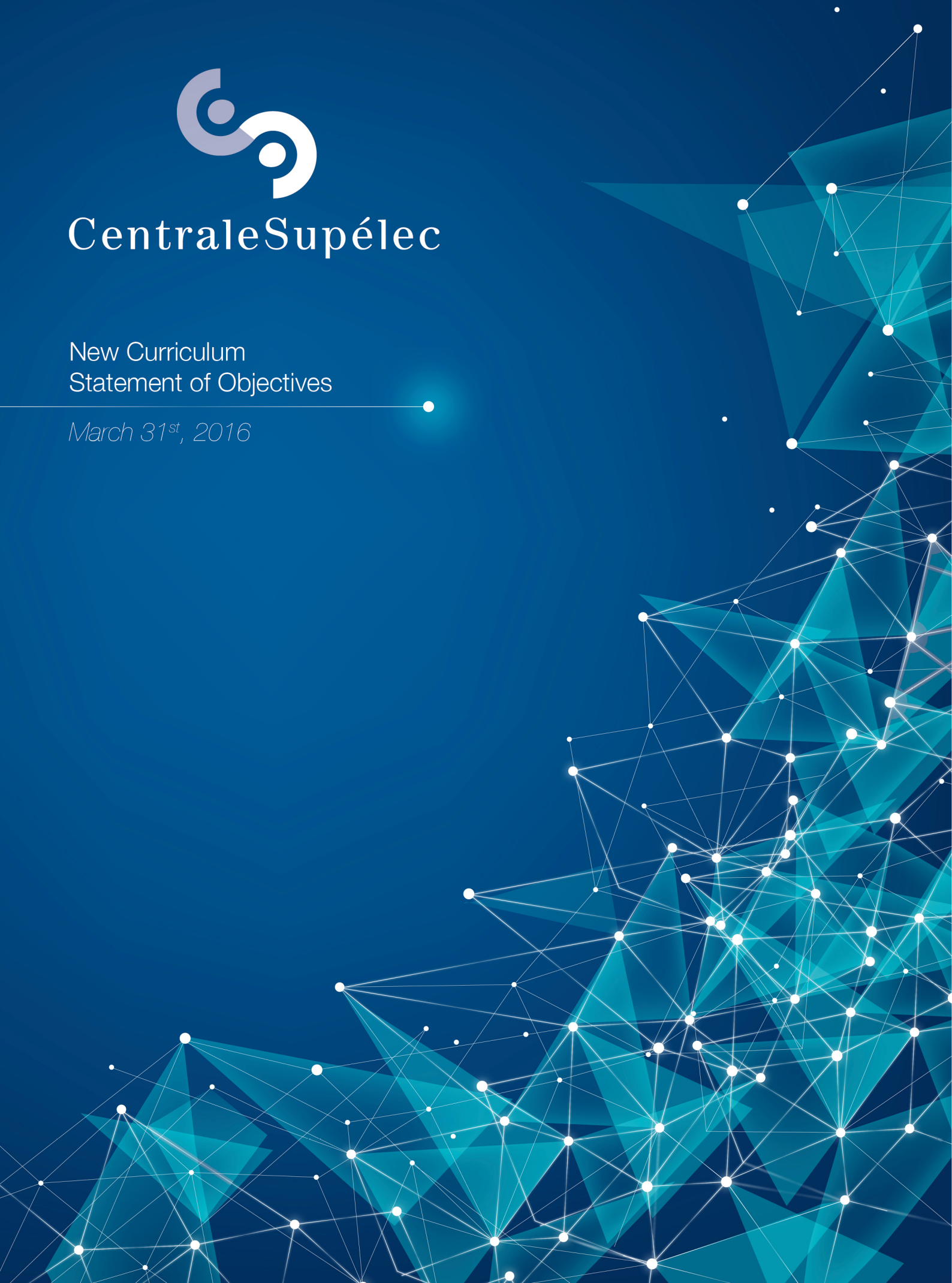
CentraleSupélec

New Curriculum
Statement of Objectives

March 31st, 2016



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CHAPTER I The Importance of the New Curriculum for CentraleSupélec

Within the context of globalization and the competitive environment among the best institutions in the world, CentraleSupélec's ambition is **to become a world-class institution of reference for its four core activities:**

- Training of top-level generalist engineers,
- Specific professional courses (Masters, Advanced Masters and continuing education),
- Training to and via research supported by its Doctoral School,
- Research in Engineering and Systems Sciences.

To achieve this goal, it is essential that we offer a state-of-the-art engineering curriculum of the highest level. It is the flagship and foundation of the Engineering School whose first mission is to open successful career paths for its graduates who are at the service of society.

For CentraleSupélec, this mission is particularly demanding. The nation entrusts the school to train students of the highest level who will utilize their skills to achieve an ambitious, personal project, both for themselves and for the benefit of society. The engineering curriculum is thus at the heart of CentraleSupélec and the entire project is based on it. The school must therefore offer students a challenging curriculum and constantly strive to improve upon the curriculum.

As the globalized context continues to widen and evolve, competition among the best institutions is therefore growing stronger and demands more and more cutting-edge innovations, both in the training offer and the models of the institutions providing it. Therefore, it is essential to succeed in the design of the new curriculum as it is the best guarantee to continue to train top-level students in France and abroad, and to sustain the highest level both in national and international competitiveness.

Moreover, the new curriculum is certainly one of the most important works of CentraleSupélec, if not the biggest. It will be the best illustration of the values held by the new school; it will play a decisive role in building CentraleSupélec's image, motivating the support of staff, students, communities and partners altogether. The project should thus be subject to special attention and commitment of every individual at the school.

Finally, in an ever-changing world, this is a unique opportunity to:

- Reconsider the needs of society, employers and students. These needs have evolved considerably in recent years, and several technological revolutions – as described in CHAPTER III - have a strong impact on us;
- Reconsider our teaching methods and the relationships within the school;
- Rethink the relationship between trainer and trainee; place the student at the center; consider each student not just as a student but as someone we guide along a demanding path;
- Unite the staff of the two merged institutions around one outstanding project.

Success in setting our new curriculum will prove crucial to maintain the motivation of our top-quality students, strengthen the reputation of excellence of the school, and thereby, recruit teacher-researchers at the top of their fields, send and receive the finest students to/in the best institutions, attract the best doctoral students and expand our business partnerships.

In designing and carrying out our new curriculum, we set the foundations of the future we are building.

CHAPTER II **Our ambition. Our objectives**

Centrale as well as Supélec – hence CentraleSupélec – are deeply involved in a Saint-Simonianism humanistic tradition: we maintain the conviction, even the certainty, that science and technology are key factors in the progress of society, and at the service of a project that is for the benefit of mankind. This leads to two important consequences:

- Students are at the heart of the training project,
- The curriculum should offer them essential life skills, which has been preserved through the heritage of our founders, and proven by our graduates' action within society:
    - Work ethic and competence,
    - Ambition for oneself and others, a taste for collective success,
    - Entrepreneurship,
    - Creativity and innovation,
    - Intercultural awareness,
    - Individual and social responsibility,
    - Respect for their fellow man and woman.

The curriculum should, of course, meet employers' expectations - especially companies - and those of society.

CentraleSupélec will continue to prepare its graduates to become business leaders, engineering experts for corporate or public research, entrepreneurs, whether they create, manage or develop companies.

Our ambition is therefore to build the best possible curriculum to meet these expectations. This objective is attainable thanks to the school's strengths, which are already considerable:

- A strong complementarity link between the two schools; we now have a wide range of engineering sciences and a common position on Complex Systems. We also share the same fundamental values;
- The highest level of academic faculty who foster educational innovation;
- Mutually respectful and operational relationships within the corporate world;
- A significantly powerful network of national [1] and international partners, supplemented by the creation of international schools;
- Our active presence within Paris-Saclay University, which will allow us, notably, to develop our scientific excellence.
- The exceptional level of our students upon arrival at the school. Students from preparatory classes, in particular, have internationally recognized skills:
    - A strong foundation in basic sciences,
    - A superior work ethic and level of efficiency,
    - Abstraction skills,
    - Analytical capacities.

We are confident that we have the opportunity to build a state-of-the-art, internationally recognized curriculum that will place us at the top of all French engineering schools and as one of the top ten best schools in the world.

Our collective objective is to put this New Curriculum in place at the start of the 2017 academic year.

[1] Including the *Ecoles Centrales Consortium*.

CHAPTER III **A changing environment. The imperatives for change.**

Since the turn of the new century, mankind has witnessed unprecedented changes; the challenges ahead of us are of a magnitude never reached[2] before and sweeping transformations of our world are currently underway: digitalization, big data, and globalization are entering a new era. These great shifts demand drastic new developments in higher education.

In the case of engineering training courses, these developments result from the expectations of those benefiting from the training: employers, particularly companies, society at large and students.

Companies are facing an increasingly fierce and global competition, therefore they primarily focus on talented people who are ready to get involved, show personal ambition and have the ability to achieve their goals in their new job. Two main profiles are sought:

- "Integrators" who are able to combine varied areas of expertise for the benefit of significant issues;
- "Experts" who are able to develop a specific field which is crucial to the company development, in line with its global challenges.

Both profiles address increasingly complex problems and solve them in referring to systems that are becoming more and more complex.

Beyond knowledge, companies are now seeking skills, abilities, a potential for adaptation and development.

In order to continuously create value for themselves and their customers, companies want to recruit engineers who can:

- Generate new solutions and therefore be open to innovation, be of an excellent scientific level, know how to take advantage of advances in science and technology,
- Implement these solutions and then:
    - Demonstrate leadership, convince, and work in teams,
    - Adapt to an international and multicultural environment,
- Consequently, initiate and promote change with an "intrapreneurship" behavior,
- Operate in an increasingly digital environment taking, of course, full advantage of it,
- Meet societal expectations; demonstrate ethical behavior and business practices and a sense of responsibility.

Diversification of the types of jobs will continue under the effect of:

- Industrial development in new fields (nanotech, biotech, etc.) and new requirements (new energy, health, environment, risks, etc.),
- Development of services in which our engineers already excel (banking, insurance, consulting, purchasing, logistics, etc.).

Work methods will continue to evolve:

- Under the impact of the digital revolution which will further develop cooperative working capacities at all levels, at all times and in all places,
- Depending on the diversification of corporations (startups, SMEs, middle-market companies, international groups, etc.) and working modes (distanced work environments, deferred time, etc.).

Societal expectations will meet those of companies with a strong focus on:

- Ethics, citizen responsibility and commitment including addressing social and environmental concerns,
- Entrepreneurial spirit - entrepreneurship in particular - facing mass unemployment,
- Innovation as a response to the challenges faced by our country and our planet as a whole,

[2] *e.g.* health, the aging population, water, energy, pollution / climate, scarcity of resources.

- Ability to handle social field problems and systems as they become increasingly complex.

Students demonstrate:

- Considerable need for a global mindset and an ability to embrace different cultures, which is mainly reflected by an ever-increasing international orientation,
- Early exposure to working life and its realities,
- Diversification of their success paths and personal projects, many of them in business creation or SMEs development,
- Abilities to build their own training courses in relation to their professional targets, often involving their entire life project,
- Fluent use of digital technologies and affinity with highly digitized environments that are wholly familiar to them.

Mobility will continue to increase, even in developed countries; the brightest students will be increasingly sought and will not hesitate to go abroad for their initial training. The preparatory classes system will thus directly compete with the "bachelor" admission channels of the best foreign institutions.

Students thus seek a highly customized training that offers the best cost/reputation/efficiency and the most suitable institution which can help them build their own project at the level of their professional and personal ambitions.

To meet these expectations, CentraleSupélec will train:

"Engineer-Entrepreneurs of the highest scientific level"

These engineers can master science and technology with extreme conceptualization and abstraction capacities, as well as key skills in the field of complex systems. They are innovators and leaders who undertake initiative and action; they can create economic and social value at an international level. They are comfortable and innovative with major technological and societal changes, especially in the digital world. They are humanists, sensitive to social issues. They have a sense of responsibility and respect for others. These features - uncommon according to our surveys - are likely to allow them remarkable, successful international routes.

The nine major skills[3] corresponding to the CentraleSupélec engineer are described below and detailed in APPENDIX 1. The acquisition of these skills is tiered and fundamental for the curriculum; it is required of all our students. All courses will contribute to it through specific modules.

C1. Analyze, design and implement complex systems with scientific, technological, human and economic components

Graduates will analyze, design and implement complex systems with scientific, technological, human and economic components. A complex system is a set composed of several entities whose piece-by-piece study is not sufficient in order to grasp the understanding of their overall behavior and to act upon it. Complex systems are often composed of a large number of entities which are described by varied disciplines operating at different scales; they comprise feedback loops between these entities, and generate emergences - expected or not - due to the fact that the overall behavior is not the result of the mere sum of the behavior of these entities as described separately, due to the interactions between those same entities.

Complex systems appear in many natural, as well as artificial situations. The electricity network of a country, an A380 Airbus, an artificial heart and the banking system are examples of complex systems.

C2. Acquire and develop in-depth expertise in a scientific or sectorial field and/or job

High competence in the discipline or sector will allow the graduate to master a field extensively, think in depth, and thoroughly understand the difficulties and intricacies of a subject. This "expertise" approach enables one to appropriate complex thought patterns that can then be transferred to other sectors; it gives distance and perspective to effectively address future learnings. In addition, the proximity to research provides objectives of excellence.

Graduates must acquire professional skills along two lines: the discipline or sector of activity, on the one hand, and the job line (cross-sectors, for example: business in design and development, professions linked to operations such as production, supply chain, etc.), on the other.

Graduates are flexible and will adjust their competencies to meet all the requirements in the course of their professional development.

[3] The concept of competencies is defined in Section .VI.1.

C3. Act, initiate, and innovate in the science and technology environment

Entrepreneurship and Intrapreneurship are some of the many strong points of our graduates. They can act and undertake. Entrepreneurs are more than simply drivers of action. They have decided to become masters of their future, to change the system around them, to seize an opportunity and/or fulfill a dream, and they take the risk of starting new activities. They can do so by creating a company or launching an initiative within an existing structure. In all cases, they are personally involved, taking responsibility for the project design, implementation and outcome.

C4. Create value for a company and its customers

Graduates can fully understand and analyze the purposes of the projects they undertake and they can account for their value. They know their customers' needs and address them while suggesting relevant solutions.

C5. Thrive in a multicultural and international environment

Graduates are comfortable working in international, multicultural teams, either in French or English. They can propose solutions suited to their environment in a given country or on a global scale.

C6. Thrive and innovate in the digital world

Digital technologies are still developing at breakneck speed and their use by individuals and companies brings a transformation of society and economy by initiating more sharing, cooperation and empowerment. The movement is accelerating and it can lead companies to transform or disappear. The transformation is technological, but also organizational and cultural. Students are thus at ease in the digital world where they can innovate and interpret. They understand the techniques and sciences that support the digital revolution and know about their developments.

C7. Convince others

Graduates can communicate and convey clear, accurate messages and adapt to a large audience or group of people. They can convince decision-makers and get the support and the resources they need to act.

C8. Be a leader: lead a team, carry out a project

As they work on complex systems that combine many elements and participants, it is necessary for graduates to be a part of multiple teams, to know how to lead them, develop them, and foster the talent within those teams. They are also able to initiate and carry out a project successfully.

C9. Think and act as an accountable, ethical professional

Graduates are the key actors of their professional and personal development. They think and act ethically, respecting their co-workers and business partners, as well as the collective interest and assets.

CHAPTER V **Desirable Developments**

Although there is room for improvement in the current course curriculum it is already meeting many of the expectations that have been expressed above. Before mentioning the general principles of the new curriculum implementation, however, it is advisable to assess the items to be modified or amended in the current courses, as it appeared in the many discussions conducted with teachers and students as well as corporate representatives[4].

The corporations we polled pointed out some inadequacies in the competencies of the engineers they hire, relating to their:

- Ability to persuade and communicate,
- Ability to work in teams and lead groups,
- Ability to take business and human issues into account,
- Concrete sense: pragmatism and action,
- Openness, curiosity and commitment.

Professors consider that the level reached by the graduates upon leaving the school - given their talent and the school's level of ambition - could be higher than it is today, especially for the long-term retention rate (sustainability of knowledge and skills) and contextualization, that is, the use of knowledge and competencies acquired in a domain, transferred to another field or context. This point is also noted by the students who feel they are not sufficiently operational upon leaving the school to fulfill the tasks assigned to them.

Students, as well as faculty, expressed dissatisfaction with the lack of interaction beyond teaching situations. Students do not know whom to address their questions on the curriculum purpose. Teachers find that research, which is a part of their professional lives, is quite often overlooked by their students. Attempts to form relationships have been made (tutoring, etc.), but have led to artificial results that did not meet their expectations.

Current courses are seen by students as built for only one profile and not tailored to the diversity of entrants:

- Teachings predominantly turn to theory with a unique educational format,
- Teachings are, at times, insufficiently relating to real-world problems.

Such classes are considered by some students as all alike, which tends to demotivate them. Some then only seek mere validation rather than actual acquisition of competencies, and they raise the question of the courses' adequacy in the curriculum. Lack of diversity in teaching methods is also pointed out by faculty who consider the current organization of courses as too rigid: they wish greater latitude to design and organize their courses.

These aspects will be addressed in the new curriculum.

[4] More detailed elements are available in [5], [6] and [7].

CHAPTER VI **Implementation Guidelines**

This section on the specifications focusing on the "how" will be more loosely defined than the early chapters, as it is still being designed in working groups by faculty in charge of the implementation. It will nevertheless be based on some key principles in line with the framework mentioned above.

VI.1. A curriculum organized around skills

Definition of a competency

Competency is a set of general and specific knowledge, know-how and life skills used in solving a problem and/ or completing a task[5]. Performing a task should not be understood restrictively but as a means to move from the current situation to a targeted one, using appropriate operations. Three types of operations can be distinguished:

- Representation operations which consist in forming an adequate representation of situations,
- Design and planning of an action plan to transform a situation into another, or start an activity,
- And the implementation of the plan.

Knowledge constitutes the learning foundations to which the school gives utmost importance continually. However, the skills-based approach aims further: students should learn better how to use and apply knowledge in new situations.

Students demonstrate skills when they know how to act effectively and appropriately in a given situation. This skills-based approach focuses on the students' ability to use what they have learnt at the school in new and complex tasks and situations.

Interest of this approach

The skills-based approach is the guiding principle of the curriculum and the main scale for evaluation. It requires:

- A high-level knowledge base, mainly scientific, acquired through teachings and via contact with research activities;
- A number of experiences throughout the educational course.

This approach enables one to:

- Make training more concrete;
- Integrate cross-disciplines according to a transdisciplinary objective;
- Organize teaching based on student learning.

Cross-disciplinary logics is thus in line with focusing learning on complex situations that cannot be addressed separately in order to develop skills that will enable students to be better equipped facing future situations that they could encounter once in the workforce.

The definition of a skills framework enables to accurately formulate what is expected from students at different steps of their curriculum. Particular importance is given to consistency and continuity in competencies among the diverse teachings.

A program approach

Training engineers as described in CHAPTER IV must be part of a "program approach" in which we guarantee progression and consistency in training throughout the curriculum. The program approach enables one to incorporate courses with a cross-disciplinary view of

[5] Definition based on [1]

knowledge, expertise and learning continuity. The learning objectives in the case of each teaching will thus be defined within the curriculum framework.

Some competencies are gradually acquired over time; therefore, they should be part of several courses. Specific teaching may thus aim at acquiring knowledge and competencies in a discipline as well as in cross-disciplinary ones. The key factor is that the educational system ensures that all skills that are described in CHAPTER IV are acquired by the graduate engineer.

Development of the curriculum

Some structural elements and educational changes will be implemented at the start of the new curriculum, but others will be carried out later on[6]. It should be noted that not everything will be perfect the first time. It will take several years before we can find methods that fully meet our ambitions. Therefore, we need an organization that encourages the whole school to collectively proceed toward the target objective.

For this purpose, it is important to have an educational system which provides and supports the ongoing evolution of the engineering curriculum to easily meet future changes in the school environment. A structure should be created, which - through an overall vision of the curriculum and all its components - will enable modifications to the curriculum, both in terms of content and method, relating to changes in the context. This continual evolution in the curriculum will also require the course structure to be flexible enough to evolve with the future needs.

To help teachers find the adequate solutions to the educational issues that may arise, a support unit and training aid should be developed. These structures are described in detail in APPENDIX 2.

VI.2. Student stakeholders of their studies and enterprise

Diversity of students upon entry and graduation

The variety of recruitment channels, on the one hand, and the diversity of personality traits and maturity level of students recruited on the other, lead to an even greater diversity of students on entry, though consistent with the academic prerequisites to attend the courses.

Most students arrive at the school with no specific vocation or project within the curriculum. During their training, they should progressively make reasoned choices on their own to build their professional project successfully. This leads to a wide variety of professional projects upon graduation that we consider as being one of the treasures of the school.

We therefore accept a wide variety of paths and paces to let every one of them progress as to complete their skills acquisition at the end of the courses.

Routes

To meet this diversity, it is necessary to set routes from day one to graduation. Structuring these routes will be as such:

- Give coherence and meaning to educational activities,
- Consider students' maturity relating to the choices required, thus contributing to help them build their project,
- Enable the acquisition of the aforementioned skills.

[6] Because several teaching methods may meet the same need new proposals will be given over time.

Moreover, students can also choose a solid theme to structure their curriculum, for example: apprenticeship, research, entrepreneurship, etc. Other themes are likely to be defined. Therefore, all students will not follow the same routes or acquire the same knowledge. Yet, all will have achieved the same skills upon graduation.

As a result, students will progressively create "their own" curriculum and be accompanied step by step in the process. They are given the right to change their minds and pursue their education in another direction by capitalizing on the skills acquired.

Advising and support

When choosing their educational routes or determining their professional project, students are never left alone; they benefit from individual support. Students are assigned an advisor with whom they meet regularly[7]. To be successful, this advising should be based on closer connections between faculty and students.

Experiences as a basis to build one's enterprise

Students' relevant choices toward their goals are systematically encouraged. Emphasis is placed on personal development and professional project preparation, particularly through numerous contacts with companies, their staff and practices. As a result, students' experiences contribute to the acquisition of competencies, life skills as well as values. They also help forge a mutual serving mindset.

The following experiences that directly link to the realities of professional life are essential:

- Close relationships with the company, not only large groups but also SMEs and startups,
- International experience of at least one semester,
- Work experience in project mode,
- Genuine opportunities for entrepreneurship and innovation,
- Relevant links with research activities to better perceive scientific realities through their methods and prospects,
- Experience in learner autonomy and training.

In addition, skills that result from genuine involvement in community life are part of the training objectives.

VI.3. Active Learning

Students' motivation

Students' motivation is a major factor and is regularly attended to. Beyond extrinsic motivations - graduating or avoiding class repetition - the curriculum should quickly generate a favorable context for producing intrinsic[8] motivation, and to foster active learning and acquisition of the requirements.

Diversity of methods

Our pedagogy is interactive and offers a variety of teaching methods:

- Projects, practical work, case studies, structuring the curriculum;
- Students' involvement through assignments outside the classroom.

[7] Various options were considered for this "advisorship" including individual or small groups, but also through monitoring larger groups supervised by several professors involved in a project, a laboratory or an educational department to name a few.

[8] See [2]

- Students' contribution to the educational project, for example[9]:
    - Producing educational content,
    - Co-construction of evaluation and assessment guidelines,
    - Students supervising students,
    - Peer review.
- Exploration and implementation of motivating factors;
- Use of digital tools, flipped classrooms.

Educational choices are based on:

- Experiments conducted by the school, and/or identified by technological intelligence,
- Cognitive Sciences and Education Sciences.

Evaluation

Evaluation has a huge impact on behaviors. A change in assessment methods could lead to a radical change in the actions of students and teachers. In order to assess not only the students' knowledge, but also their ability to put this knowledge into practice, assessment will be based primarily on the competencies acquired gradually throughout the curriculum. It is one of the strongest ambitions for this new curriculum.

Teaching and assessment methods should promote the sustainability of short and long-term acquired knowledge:

- Continuous assessment during the module with regular feedback to students;
- Ways favoring the sustainability of knowledge and competencies beyond the final evaluation of the module.

Requirements

The ambition of the curriculum is to increase the requirements to the students including:

- More intense learning within the classes;
- The achievements alongside their studies.

Some students may obtain only sufficient results to allow their passage to the next year without wholly investing in their education. This situation is considered inacceptable in view of their abilities. To encourage students' significant involvement in their training, they will have to produce *a major achievement*. The possible features and guidelines of this achievement should be identified in the creation phase of the curriculum model. In addition, for students aiming at excellence, the curriculum will provide opportunities to go further in some set domains[10].

Classroom schedule

In their schedule, students need to devote significant time to develop their competencies acquired during educational phases. The weekly classroom schedule volume will be reduced to allow them personal work time**.** In parallel, it will be necessary to make sure that the targeted requirement is achieved, this through the evaluation system implemented, the tailored resources and compulsory guidance suitable for the purpose.

[9] Several of these methods have already been tested in both existing curricula and will be subject to further investigation before implementation.

[10] For example, students who are passionate about research should be able to pursue thematic research; students passionate about computing could benefit from a "gap year" organized around computing.

VI.4. Autonomous learning

It is unrealistic to expect that graduates learn in their initial training everything they need in their first job or for professional life. Moreover, changes in society are faster than the renewal of generations. Therefore, students will have to evolve regularly during their career, probably even change sector or jobs. Rather than try to teach students "everything", emphasis is given to developing the students' abilities, including to self-train independently and effectively throughout their lives, starting with engineering. Students will then be expected to autonomously acquire the skills and to demonstrate those skills upon graduation.

VI.5. An international school in a suitable environment

An international school

The CentraleSupélec curriculum must be international, that is to say:

- Recruit top-level French and international students[11],
- Develop work skills in an international "context",
- Be recognized by the best French and international companies and institutions.

This requires, in particular:

- Graduates mastery of English, working in English, awareness of its subtleties and intricacies,
- Provide academic paths in English[12],
- Students spend at least one semester abroad and capitalize on our international schools,
- Build a curriculum in a way to manage heterogeneity and capitalize on it,
- Continue to recruit international professors and researchers, and have a clear structure ready for them.

A suitable environment

The curriculum should be consistent with major international formats. It will thus keep the principle of study cycles in semesters and sequences within them, with the opportunity for students to follow a double degree, including a research master in parallel to their final year.

CentraleSupélec curriculum will take place on Gif, Metz and Rennes campuses with multiple interactions with the school's international campuses. Students' mobility between the campuses will be encouraged.

The working environment should offer:

- Modular and scalable open spaces with friendly environments,
- Meeting and exchange locations between students, teachers, technical and administrative staff, companies, startups, etc.
- State-of-the-art technical equipment (for lab work and projects),
- A resource and research center with extended opening hours and numerous resources, available digitally,

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[11] Finally, we should ensure that students from preparatory classes acquire the relevant competencies, if it is not already the case: solid knowledge base, excellent analytical and abstract competencies and great working capacities.

[12] Two phases are planned for the implementation of courses in English. From 2017 onwards, it will be possible to complete the Engineering degree in English. In the short term, all courses will be available in English and French; where the number of students is too small to be split, the courses will be either in French or in English. Switching to English will be on a voluntary basis.

- Interconnected six-campus school equipped for synchronous and asynchronous collaborative work,
- Digital environment with information management and simplified procedures.

Evolution of the teaching profession

The teaching profession is moving towards:

- More interaction with the students,
- More links with research,
- More work in mono or multidisciplinary teams,
- More analysis and reflection on teaching approaches and methods themselves,
- More educational innovation, which requires support systems.

We also expect greater appreciation of education in the development of the faculty's careers.

Our ambition is that the school becomes a place where teaching methods - along with continual improvement - are the subject of ongoing discussions among everyone involved, and that the faculty willingly to become key agents for change and academic innovation.

CHAPTER VII **References**

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APPENDIX 1 Nine key skills of the CentraleSupélec engineer

C1	**Analyze, design and implement complex systems with scientific, technological, human and economic components**
C1.1	Study a problem as a whole and an overall situation.
C1.2	Identify, formulate and analyze a problem in its scientific, economic and human dimensions.
C1.3	Use and develop appropriate models, choose the right modeling scale and the relevant simplifying hypotheses to deal with a problem.
C1.4	Solve a problem through approximation, simulation and experimentation practice.
C1.5	Specify, design, implement and validate all or part of a complex system.
C1.6	Mobilize a broad scientific and technical basis as part of a cross-disciplinary approach.
C2	**Acquire and develop in-depth expertise in a scientific or sectorial field and/or job**
C2.1	Thoroughly master a domain or discipline based on fundamental sciences or engineering sciences.
C2.2	Transpose to other discipline fields; generalize knowledge.
C2.3	Quickly identify and acquire new knowledge and competencies that are required in relevant domains, whether technical, economic or others.
C2.4	Create knowledge via a scientific approach.
C2.5	Master required skills in an engineering core business (junior level).
C3	**Act, initiate, innovate in science and technology environment**
C3.1	Be creative, open-minded, demonstrate curiosity.
C3.2	Leave one's comfort zone, take risks and explore new fields.
C3.3	Adapt quickly to changes including technological and socioeconomic disruptions.
C3.4	Be autonomous and take initiatives, take action.
C3.5	Propose solutions / new tools, either in one-off or continuous projects.
C3.6	Know how to design, build and move to industrialization.
C3.7	Evaluate efficiency, feasibility and strength of solutions proposed.
C3.8	Select solutions and act pragmatically to achieve tangible results.
C3.9	Make decisions in unknown environments; manage risks and the unexpected.

C4	**Create value for a company and its customers**
C4.1	Understand the final objectives.
C4.2	Be customer-oriented. Identify / analyze the needs, challenges and constraints of other stakeholders, including societal and socio-economic issues.
C4.3	Identify opportunities, detect good business opportunities; seize them.
C5	**Thrive in a multicultural and international environment.**
C5.1	Have an excellent command of written and spoken French and English. Speak a third language.
C5.2	Listen, understand and be understood by different audiences (business, culture, etc.), use the appropriate means and registers of communication.
C5.3	Work with cultural leaders, with experienced people and those with varied skills.
C5.4	Propose relevant solutions that can be deployed in another country or on a global scale
C5.5	Be able to evolve naturally in a country other than your native country.
C6	**Thrive and innovative in the digital world**
C6.1	Identify and use the common software necessary for one's work (including collaborative tools); adapt one's "digital behavior" to the context.
C6.2	Use "classic" and "agile" methods of development and decide which to choose depending on the project. Design a solution in a "Design Thinking" process.
C6.3	Use tools of product design and prototyping (CAD, 3D printers, etc.).
C6.4	Specify, design, implement and validate complex software.
C6.5	Master computational thinking skills; grasp the limitations of simulations and what you can expect from them.
C6.6	Operate any type of data, structured or not, including large ones. Understand their transmission.
C6.7	Understand the disruption phenomenon that forces companies to change, and its inevitability.
C6.8	Deploy and use possible connections between objects and people.
C7	**Convince others**
C7.1	Render complex content intelligible. Structure one's ideas and arguments. Synthesize and see the bigger picture.
C7.2	Raise awareness and appropriation.
C7.3	Master scientific and technological communication; be specific, relevant. Gather appropriate and reliable information to support an argument.
C7.4	Master spoken and written communication.

C8	**Be a leader: lead a team, carry out a project**

C8.1 Work in a team / work in collaboration with others.

C8.2 Mobilize and train a group (demonstrate effective leadership).

C8.3 Call on the expertise of others and push back one's own limits. Identify and develop strengths and talents.

C8.4 Work in project mode by implementing project management methods tailored to the situation.

C9	**Think and act as an accountable ethical professional**

C9.1 Reflect upon, understand and analyze the possible consequences of one's actions.

C9.2 Identify the scope of liability of the structure one contributes to, including the company's social responsibility issues.

C9.3 Act with ethics in mind, integrity and respect for others.

C9.4 Exhibit strong self-awareness (self-reflection and evaluation, identify strong and weak points, likes and interests).

C9.5 Formulate and develop one's career plans and make choices accordingly.

C9.6 Demonstrate rigor and critical thinking in approaching problems from all angles, whether scientific, social or economic.

APPENDIX 2

This appendix presents the proposed organization to support the ongoing evolution of the curriculum in a program approach.

Within the Office of the Dean of Studies, a program committee will be set up, that will:

- Have a global vision of the curriculum in all its components,
- Propose changes in the curriculum - both in terms of content and methods - adapted to changes in the context,
- Suggest academic and pedagogical innovations (on links between teachings and teaching methods). After evaluation of the implemented prototypes, it will determine whether to extend it or not, to all or part of that year's Student Class.

Moreover, a teaching resource unit should also be developed, enlarging the current tasks of the Mission of Support in Pedagogy and Innovation. It will be in charge of:

- Monitoring the advances in cognitive sciences and education sciences and their impact on teaching practices,
- Collecting and disseminating good practices among the school's teachers,
- Implementing groups to share practices for teachers who volunteer,
- Organizing training for teachers,
- Assisting and supporting the implementation of new teaching methods, especially the use of digital tools,
- Suggesting benchmarks to assess the curriculum (including motivation, level of mastery of students and their understanding of the purpose).

The French version of this document was approved, unanimously, by the Academic Program Committee "Conseil des Etudes" on March 24th 2016.

The French version of this document was approved, unanimously, by the Board of Trustees of CentraleSupélec "Conseil d'Administration" on March 31st 2016.

School President and Chairman of the Academic Program Committee: Hervé Biausser.
Chairman of the Board of Trustees: Daniel Rigout.

New Curriculum Project Director: John Cagnol.
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This statement of objectives was collaboratively produced based on input from the faculty of CentraleSupélec following the consultation of various stakeholders including companies, staff, both academic and administrative and students of CentraleSupélec.