

The French higher education system's response to the call for a preparation for social responsibility

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“The French higher education system’s response to the call for a preparation for social responsibility”

Christelle Didier, Antoine Derouet

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Introduction

For the past twenty years, some French institutions have appealed to the engineers’ sense of social responsibility: the Conseil national des ingénieurs et scientifiques de France (CNISF), which represents the engineering profession, through its code of ethics (CNISF 1996, 2001), the Commission des titres d’ingénieurs (CTI), the regulatory body of engineering education[a] in its guidelines (CTI 1995); the trade union Confédération Française Démocratique du Travail (CFDT), which have sought to define how the teaching goal of engineering education could take into account social responsibility. Nevertheless, this call is scarcely heard: the CNISF has no means to enforce its code of ethics, and the vast majority of French engineers do not know about the existence of its code; the CTI’s guidelines do not include the possibility to specifically alter the program, but only to give recommendations; and the CFDT document was conceived as food for thought, but did not lead to anything definite in education (Didier 1999, 2000).

Most engineering schools seem to ignore these recommendations because they assume the courses that are intended to broaden the students’ mind already exist in the curriculum. Courses in literature, philosophy, law and economics have indeed been introduced since the XIXth century in some schools, but only in the most prestigious ones. In most places, such courses remain relatively rare and have appeared more recently. Thus, on the one hand, there has been a lot of talking over the topic of the engineers’ social responsibility, and on the other hand, there has been some teaching practice that contributes to a greater social understanding by students. However, as we found in our investigations, the relationship between this talking and the teaching practice remains thin[b]. This does not mean that there are no influences at all, but that are no objective links between the ideological discourses that promote specific content such as ethics, social responsibility or humanities and the actual creation of courses.

We hypothesize that the emergence of social responsibility in engineering education is neither a spontaneous phenomenon nor the mechanical answer to external requests. Instead, it is the result of a long process linked the history of the engineering profession. This process is not new, although institutions like CNISF or CTI have stressed it only fairly recently and goes back to the inter-war period when the

profession structured. Furthermore, we aim at showing that the answers given by French engineering education to the call for social responsibility which are influenced by local dynamics, opportunities and constraints (which we will not study in paper), also depend on less obvious important macro-social factors. Our goal is neither to study the formal, prescribed curriculum, nor the real curriculum, i.e. the implemented one (Perrenoud 1984). Instead we aim at studying the evolution of the engineering curriculum through the twofold lens of the sociological and historical perspective.

In the first part of this paper, we provide an overview of the scarce attention given to non-technical education in the human and social sciences literature in France and show the limits inherent to the existing literature. In the second part, though a study of the terms used in the ideological debates over the last century on what should be the definition of the engineer (and of his social role), we intend to highlight the conceptual framework which contribute to design the definition and objectives for what we call "the other formation" [c] adopted in French engineering education. In the third part, we focus on the stating of a specific corpus of non-technical education for engineers, different from the tradition academic approach of knowledge transmission. In the two last sections, the particularity of the Grandes Ecoles system in the French educational landscape, as compared to the university system[d] on their peculiar way to transmit knowledge, will be given the closest attention.

1. Scarce literature on engineering education in France.

The study of the teaching of social responsibility to engineering students requires studying the history of the emergence of this theme in the curriculum. A mere survey of what is proposed today to the engineering students would give an overview of the current situation. However, this approach undertaken alone would not be sufficient to understand why the field of non-technical education took the shape it did. Actually, there has been a long process of development of non-technical topics in engineering education for decades, and in some cases, for centuries. Within this vast field, the issues related to social responsibility have appeared recently, under this heading or another. Their emergence can hardly be understood without studying the process that allowed them to be taken into account.

In the field of social and human sciences, there is limited literature in France concerning the teaching of social responsibility or related fields such as ethics. The same shall apply to the literature on French engineering education in general. Up to now, there have been mainly school monographs such as Polytechnique (Shin 1982), the Ecoles d'Arts et Métiers (Day, 1991), the Ecole nationale des Ponts et Chaussées (Picon 1992) to mention only a few of them. Gary Lee Downey and Juan Lucena also highlighted the prominence of schools monograph in their pioneering article about what is called today "engineering studies" within the field of Science and Technology studies (STS) (Downey et al. 1995).

Concerning the teaching contents of non-technical subjects - or humanities, or Human and Social Sciences, HSS - in France, only a handful of researchers have contributed to the debate (Dufour 1998, Giré et al. 2000, Minguet 2001, Lemaître 2003). But their works mainly consisted of the description and defense of a few teaching experiences, all considered as being novel, which were set up in a teaching environment that would consist exclusively of education of technical topics. The common bias of those authors is linked to the relationships they keep up with their subject. All of them are not only researchers. As teaching staff, they are also participants who study and write about a social world they belong to[e]. Still, one cannot dismiss these contributions as simply being opportunities to underline the worth of the teaching model that these authors designed for their students[f]. Although lacking necessary distance and focusing sometimes only on a few significant experiences, these studies have contributed to gather some original information on what is going on practically in engineering education these days in France.

In order to understand what enabled the emergence of teachings related to social responsibility in engineering education, we think it is necessary to analyze the genesis of non-technical teaching in France and see their common goal, in spite of their diversity, to answer the same hackneyed question: how to educate the future engineer to become more than just a technologist?

2. Towards a definition of "the other formation" of engineers.

2.1 An ideological debate within the professional world.

Our investigations on the curriculum of the first French engineering schools show that the wish to educate the complete or the "whole engineer" (SEFI 1995) has been present for a long time. This intention seems to be as old as the formalization of engineering education itself. Philosophy had been taught long ago at the prestigious Ecole Polytechnique, law at the Ecole Centrale, social economics at the Ecole des Mines de Paris. At the turn of the XXth century, at least in the few top schools, non-technical education had undoubtedly its place in the curriculum. It was part of the programs but there were no debates about it. There was no generic term to describe those "no technical" contents offered to the students. These courses were not considered "different": Their presence was obvious in the early French engineering education. Later, when the issues of providing social education to engineers were discussed, some foundations had already been laid.

Between the two world wars, graduate engineers took advantage of a favorable time for their profession to gather in powerful organizations. Through these organizations, they made their social position evolve, broadened their professional prerogatives and consequently changed their collective identity. Engineers extended their traditional scope of action and expertise to the management of areas lying beyond science and technology. They also obtained after twelve years of discussion, in 1934, that the French government voted a law to protect the title of graduate

engineer (Grelon 1986). The Committee for the title of Engineer (CTI) was created with this law. It is still in charge of accrediting the engineering schools today.

The Social union of catholic engineers (USIC in French), a powerful organization that promoted the social teaching of the Catholic Church among engineers, aimed at the enlargement of the scope of the engineering profession. In the 1940s, the Vichy administration with its reformist-conservative political climate enabled the USIC to frame its project of including social skills into engineering education. This social training consisted of specific knowledge and know-how and a broad general knowledge. It was considered by the Social Union as a means for the engineer to be more aware of the role they played towards the working class and towards society in general, and to prevent the class war therewith

The claim for a new definition of the profession did not continue after WWII. However, the discussion about engineering education made a new start in the mid 50s within trade unions, which were not engineers-only organizations any longer. The few engineers-only unions created after WWI merged with new or existing labor unions or changed their character and became professional associations. Acknowledging the increasing distance between themselves and their employers, the graduate engineers were afraid to become assimilated into the larger group of workers. They contributed to the creation of a new social category of high-level employees called: the cadres. Their wish to be considered as cadres rather than engineers was, at that time, a way to establish their position within the companies as mediators between the leading and the working classes. It was also a means to emancipate themselves from their technical role and ask for wider responsibilities (Boltanski 1982).

A large debate went on among professional organizations and unions on the training of engineers to their social function, social role and/or social responsibility. For the members of the French national union of employers (Confédération Nationale du Patronat Français, CNPF), engineers needed to be more educated in economics, in order to improve productivity. For the members of the major labor trade union, the Confédération Générale du Travail (CGT) the aim of social training was to enable engineers to improve the workers' social conditions. The high-level employees union, the Confédération Générale des Cadres (CGC) defended a position in between. For their members, two domains were to be developed in the programs: a better understanding of the human factor, and a wider general liberal education. Some catholic movements close to the ex-USIC argued in favor of the inclusion of traineeships in factories for students to become acquainted with the working class so as to provide a way to reduce the mutual ignorance that leads to class conflicts (Derouet et al. 2010).

Through the commitment of many organizations (professional societies and unions) the question of the "other formation" of the engineers, first marginal, has been given greater legitimacy. In the mid XXth century, the prevailing approach is the one defended by the French national confederation of employers, which is characterized by a clear cut between the Grandes Ecoles model and the university one and by a

vision of an engineer as a man with a general culture, mainly comprised of business knowledge.

2.2 The academic world takes over

In the 1970s, the unions and other professional organizations left the discussion to the engineering schools, which at that time federated into various associations of Grandes Ecoles. The main participants in this new phase of the debate were the Centre d'Etude sur les Formations d'Ingénieurs (Center for the study of engineering education, CEFI) created by the French Government to set up surveys on the profession and to spread information about engineering schools, the Conference des Grandes ecoles (CGE, which brings together the major engineering and business schools), the Fédération des Ecoles Supérieures d'Ingénieurs et Cadres (FESIC, which consists of private catholic engineering and business schools) and the Conference des Directeurs des Ecoles et des Formations d'Ingénieurs (CDEFI, which gathers the heads of engineering schools). These groups started to make statements not so much to justify the existence of non-technical education in the engineering curriculum as to define its role more precisely. Publications, congresses, meetings were organized about the presence and role of non-technical education (CGE 1988, 1996; Humanités pour les ingénieurs, 1994).

At the turn of the XXIth century, a few researchers also published articles and books in the fields of social sciences or educational sciences about Human and Social Sciences and humanities in engineering education. During this period, all those networks supported the emergence of a new type of expertise that intended to define the contents and goals of the human and social skills to be transmitted in engineering education. The development of those researches can be seen as a consequence of the importance given to non-technical education. It also indicates that it has become meaningful for engineering school academics in charge of non technical education to study and write about their practices (Derouet & Paye 2010). A major reason is that non-technical education (and social responsibility within this larger field) has become a means for engineering schools to differentiate themselves from one another at a time when they simultaneously find it harder to attract students, because of –among other reasons - the growing competition with schools of management[8].

Two factors contributed to legitimate to the other formation of engineers in the educational debates: because of the dual structure of higher education in France and the importance of the initial degree to achieve high level of responsibility, non technical education became an important issue in the higher education competition. Moreover, the discussion about the need to introduce human and social contents became performative because inside the educational field, some agents developped their own interest in being active supports of these change.

3. Who is in charge of the “other formation”? What are the legitimate contents?

3.1 Defining a corpus of knowledge and a “way of knowing”

The above study of the debates about the introduction of social and humanistic teaching into the engineering curriculum enables us to understand who the way the main protagonists tackled the issues at stake. However, it is important to realize that the development of new courses evolved largely in its own way, independently from the debates, because of local reasons in each engineering school. As previously said, there have always been courses devoted to the education "beyond the technical skills" (USIC 1941) in the most prestigious Grandes Ecoles. Their aim was to educate a civilized and universal man by studying philosophy, to teach him how to master useful tools and methods by studying social economy and to allow him to compete with other professionals targeting at the highest social ranks by reading law.

If the headings of those courses sound familiar, their contents have always been peculiar in engineering education. Everyone believes he has an idea of what philosophy, social economy and law are because those subjects exist at the university. But these topics have always been taught in a different way in engineering education. This is a consequence of the gap existing between the Grandes Ecoles and the French University, which contributed to a long lasting and specific construction of the engineering curricula.

From the outset, the engineering schools designed a particular corpus of non-technical knowledge taught by specific teachers. At the Ecole Centrale, law was taught mainly by lawyers - not by academics - whose goal was to transmit the latest rules and regulations of the industrial world and not the history or theories of law. The teachers of Social economy at the Ecole des Mines were followers of the ideological movement launched by Frédéric Le Play[h]. They aimed at spreading his social theory, in a time when it was not well accepted at University (Kalaora et al. 1989). As a consequence, and still today, many courses offered in engineering education have headings similar to an established academic subject, while being epistemologically very different from those, as Antoine Derouet and Delphine Thivet have shown in their case study of the Ecole Centrale of Paris (Derouet & Thivet 2010).

Although contingent local reasons might explain the presence of a specific course in a given school, it is interesting to observe the large institutional movements that have influenced the development of non-technical courses in the French engineering education. The first movement is simultaneous to the creation of the USIC. As a catholic organization, it aimed in the first place at spreading the catholic social teaching of the church to its members, even though the union had also an interest in the development of its members' social awareness and sensitivity (Thépot 1985). This confessional movement, inspired by Le Play's monographic methods, became a real institution of social training, thanks to its magazine and conferences. Up to 10 000 members made up for their supposedly insufficient education by discussing social, technical, economical and even political issues. Concerned by this lack of education and bolstered by its members' experience, the USIC formulated the very first terms of a social training to be included in the engineering curriculum in 1942 (Boltanski 1982).

After WWII, the trade unions took over the question of non technical education and developed courses in the fields of social education and economy. In the 50s and 60s, several institutes, meant to provide a continuous education to "cadres", blossomed. Some of them depended directly on organizations of engineers and cadres or employers' unions, like the Research center on business leaders of the employers' union CNPF or the Institute for scientific management of the French scientific management committee CNOF (Derouet 2010). Others were linked to the main labor unions (the communist CGT and the catholic CFTC) or the cadres' union CGC. Those centers were training institutes for continuing education, but they also constituted a means for the organization they depended on to spread their ideologies and express their views on how French engineers should be trained.

The ideas developed in the trade unions and professional associations were nourished by the lectures of intellectuals such as André Siegfried, Jean Fourastié, Roger Millot and Gaston Berger, who were all members of the Academie des sciences morales et sociales. Michel Crozier appeared on this scene from 1960 onwards. These intellectuals, who were sometimes also researchers and faculty members, were requested to defend and develop original ideas beyond their academic position. This explains again the differences between the content of disciplinary teachings at the university and the specific corpus designed in engineering Grandes Ecoles.

While the need for non-technical education for engineers gained recognition, the definition of the legitimate corpus of knowledge took shape. Since most actors did not belong to the academic world, or did not intervene as academics but as intellectuals or experts, this definition was founded in a way of knowing that had little in common with the scholarly scientific one.

3.2 Towards more academic teaching & back to a Grandes Ecoles approach

Gradually, the social and human teaching switched from the trade unions' institutes of continuing education to the engineering schools that had not been involved until then. The unions maintained their training organizations, which progressively became think tanks and invented a new type of centers for continuing education. In a first stage, the engineering schools invited their graduates to complete their education with post-graduate programs, which they offered, mostly in economics and business administration. The underlying idea was that it was better to expose the students to the social and human training after a significant period of professional experience (Derouet & Paye 2010). Moreover, those skills were regarded necessary only for the business leaders, i.e. the engineers who had graduated from the most prestigious schools.

In a second stage, elements of social and human training were incorporated into the entire curriculum in many schools, first as electives and increasingly as compulsory courses. The more time was devoted to those disciplines, the more non-technical teachers were hired as permanent school members. Some schools even encouraged the creation of research teams dedicated to non-technical topics, mainly in the most famous ones. At the Centre de Sociologie de l'Innovation (CSI) in the Ecole

des Mines, philosopher Bruno Latour and engineer and sociologist Michel Callon developed the Actor-network theory in the 1980s. At Polytechnique, polytechnician and philosopher Jean Pierre Dupuy who helped introducing Ivan Illich's work in France, created the Centre de Recherche en Epistémologie Appliquée (CREA) in 1982.

The creation of such departments empowered the new permanent staff to define the contents of non-technical education for engineering students, and also to have their own discipline taken into consideration. Their power was strengthened by the absence of common standards or external requirements assigned from outside, i.e. an accreditation commission or a regulatory body. They could shape the "non technical" programs and were often in charge of hiring the nonpermanent teachers. This led to the blossoming of a great variety of headings and contents[i]. The higher the required level to apply for a permanent position was, the more posts as professors in the field of non technical topics were occupied by PhD graduates. The borderline between the academic world and the world of engineering education became narrower and narrower, because more and more permanent staff in charge of the other education belonged to both worlds: they behave as academics when doing research and as Grande Ecole staff when teaching, designing courses, or hiring non permanent teachers and nonacademic contributors. Yet, the way to address the question of non-technical subject matter remain specific because of the lasting gap between the Grandes Ecoles and the university system, also because many schools' heads tended to perpetuate what was done before.

While the institutional context of non-technical education evolved, the French Higher education system also changed and broadened the opportunities to develop new courses. Like elsewhere in Europe, employees' unions demanded in the 1960s that the higher education open their doors to the industrial world. The answer came quicker from the Grandes Ecoles (engineering schools and also the very few recent business schools) than from the university. Recruitment policies in engineering schools changed and more and more people experienced in industry were hired particularly to teach non-technical topics. The human training was then meant to convey experience rather than knowledge. From the 1950s to the 1980s, the hierarchy within the Grandes Ecoles also changed. Many engineering schools lost their dominant position while business education became more and more attractive. In order to compete with the newcomers and offer good jobs to their graduates, engineering schools increased the time devoted to non-technical topics, but more in the field of management and economics than in the classic humanities.

With the development of research center in engineering schools, the distinctive conception of the other formation reduces, even if most school do not house its own HSS laboratory. However, the research centers reproduce the French engineering education approach characterized by its distance from university, and from the academic standard of knowledge production. The research undertaken there is conducted by hybrid teams composed of academic and non academic members, and produces mostly knowledge for, and sometime, by engineers.

Conclusion

One can try to define what the proper goals, contents and methods, for a non-technical education aiming at enhancing the engineers' social responsibility should be. There has been a lot of discussion about this topic for a long time, by many people, in many countries. Our study of the French case enables us to better understand that the answer given to "the call for social responsibility" is not a mechanical reaction to external pressures or calls from the outside world: it also follows a process grounded on institutional and structural features. In France, the particular – and lasting - relationships between the Grandes Ecoles and the University had a major influence on the shaping of non-technical teaching in engineering education. Some important changes such as the academic status of the HSS teachers might have reduced the specificity of non-technical topics in engineering education, but this was not the case. The competition between engineering schools and with the business schools had more influence on the development of non-technical education than the requirement of external official stake-holders and the presence in engineering schools of HSS full-time permanent staff holding a PhD and involved in research.

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Notes

[a] Since 1934, the CTI and the law protecting the title of graduate engineer in France has been delivering accreditation to the French engineering schools and since 1996 the CTI is conducting regular audits in the more than 250 schools of the country. In France, there is no national engineering degree but accredited schools' diplomas.

[b] This paper is based on an original research conducted by Antoine Derouet from 2008 to 2010 which consisted in an exhaustive analysis of the content of 30 engineering journals published in France from 1919 to 2009, and of many reports and scholarly articles published these last 30 years. Four case studies were also made on engineering schools, two in France and two in Belgium. The present paper is based on the French corpus and case studies. Concerning ethics education, which is narrower than our focus, Colby and Sullivan (2008) have pointed the weak impact of the accreditation committee ABET on the teaching practices in the US.

[c] Talking about the "other education" is a means for us not to define too precisely what has not been defined precisely neither in the discourses about engineering education in France nor in the teaching practice. Human and Social science, as well as Humanities sound too academic for the unclear object we study. One reason for choosing this concept is that in France the various component of engineering education are thought in opposition from one another and often negatively in comparison to the core scientific and technical subjects. Using the expression "the other formation" is a means to define positively what is often defined as what it is not: the "non technical education".

[d] The French "Grandes Ecoles" is a whole higher education system built outside of the university system. This model which was conceived at the time of the very first engineering schools in the XVIIIth century has long been considered to be more prestigious than any other program of higher education. This is still true for those with the best reputation.

[e] Christelle Didier was one of them when she wrote in the European Journal of Engineering Education about her own experience of teaching ethics at the mining school in Douai (Didier 2000).

[f] A. Dufour, lecturer in sociology in an agriculture engineering school who studied the underlying dynamic behind the introduction or relegation of sociology in her school writes that "sociology has a federative role in the curriculum". D. Minguet also lecturer in sociology at the Ecole des Mines de Nantes considers that his role is to enable social science to be considered legitimate by the students, through creating a specific discipline: "social sciences for engineers".

[g] Gilles Lazuech (1999) showed that the same logic prevailed with the issue of "internationalizing" engineering education. The adaptation of the schools to depended less on the answer to an external call than tan issue in term of competition between schools

[h] Polytechnician, industrial engineer, Professor of metallurgy at the Ecole des Mines, then member of the Conseil d'Etat - an organ of government with legislative and advisory functions-, Frederic Le Play is considered as one of the founder of modern empirical social science. He established the basis of a social science, committed to an empirical and action oriented approach, which goal was to ensure social peace and preserve the moral foundation of society.

[i] After a lot of reflection in the mid 80s, the French accreditation body for engineering education, CTI, had expressed its wish that humanistic training be better informed in the programs (CTI, 1995); but it had not set out any formal requirement. Only recently, the Committee created a commission in charge of clarifying the teaching goals of HSS[i]. In order to do so, its members requested the help of a group of teachers which has started in 2006 a national network of HSS researchers involved in engineering education, called Ingenium.