Humanistic Training in Engineering

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Abstract

This article rescues the need to professionally train engineers from the humanistic point of view, as a complement to the scientific-technological training that is usually offered in Argentinian Universities. Considering the philosophy of education, as a supporting element of any educational project, the analysis is focused on the relationship between science and technology and the role that engineers play in the development of people's quality of life.

Keywords: professional training, computer science, philosophy of education

Introduction

The aim of this work is to analyze whether the engineer who is being trained at the Argentinian Universities has the humanistic training that every professional should have, according to the philosophy of education.
Starting from the assumption that the philosophy of education provides the anthropological essence in an educational project, and therefore, it cannot and should not be ignored at the time of formulating it, the professional profile of the engineer is analyzed, taking as an example the career degree of Computer Engineering from the Catholic University of Salta. It is understood that the conclusions of this study are not intended to be generalized.

Methodology

Let's start at the keystone of this whole question: Education.

At the beginning of one of his works, Cirigliano [1] raises a very interesting discussion about how ***we experience*** education with respect to what really ***it is***. With great clarity he says that we rationally understand education as "*... a development of human nature ...*" and that we know (because this is how reason shows us) that *"... the education orders various qualities, perfects person, ends it or fulfills it ...*". And anyone who raises the issue will come to the same conclusion: the education is in the essence of person, it is centered on it.

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But there is a big difference between what ***we think*** of education as and ***how we apply*** or implement it. At the time of reaching person through education, we get lost in a labyrinth of methods, ideas, techniques and we end up forgetting the ultimate goal: the person himself. In practice, this means that we are more concerned with "finishing the dictation of the program" than considering our students as "*... perfectible persons... where the education is only the perfecting process of the person...*" [1]. In other words, we start the task of educating with very good intentions, but halfway through we lose our anthropological vision and end up simply dumping knowledge but not training (or educating ...).

The **first assumption** about education is then raised: we know that it is the way by which person achieves itself, but we also know that we forget this concept in practice.

On the other hand, it is convenient to introduce here the eternal discussion between science and philosophy, not to develop it or fix positions, but to analyze how this paradigm affects the formation of an eminently technical professional, such as the engineer. The rupture produced during the rationalism between science and philosophy has left its mark on education in general, and in particular, in the area of the so-called "hard" sciences (it is taken what was said by Mauricio Shoihet when say that "with hard sciences we refer to highly formalized sciences that operate with mathematical instruments"[2]). The whole process of "experimenting to recognize it as valid" favored science in its growth, but in many cases it did not feed on a philosophical support.

That has changed. So that the popular conception of considering philosophy as the "mother of all sciences" because it guides about the last causes, has been modified by that of an "applied philosophy" as the foundation of the rest of the sciences. For this reason, Cirigliano speaks of the modern conception of philosophy that now allows us to work on the "philosophy of the company", "philosophy of democracy", among others.

It is clear that there is no dissociation between science and philosophy, but on the contrary, philosophy sustains and promotes science through the constant search for truth, and in opinion of the author, without losing the humanistic vision in that search.

Having said this, let us take as a **second assumption** that: philosophy itself is in the essence of any other knowledge, and therefore, presumably this approach ***should be noted*** as natural and indispensable.

Digging a little deeper into the elements of engineering training, we can find another factor of discussion and rupture: the encounter (or disagreement?) between science and technology.

At first, the hierarchical relationship between science and technology was perfectly understood, where the later was the tool for the development of the former; that is, there was science first, and then technique was used to incorporate it into immediate reality.

Today, the symbiosis between both elements is undeniable: "*…this is how Husserl considers it, when speaking of the technification of science, as well as the scientification of technology according to Habermas, and even Bunge's notion of a scientific-technical system…*" [3]. In any case, there is a proven interdependence

between science and technology. Our time is deeply marked by the rise of technologies and their application in all areas of life (the author challenges to the reader to find some science, discipline, art or trade that has not incorporated the so-called information technologies), and sometimes it is questioned which comes first: science or technology.

With this the **third assumption** is established: science and technology are closely related and it is not possible to understand one without the other.

Consequently, based on these 3 assumptions:

- Education is the way by which man achieves himself,
- Philosophy is in the essence of any other knowledge,
- Science and Technology are closely related and it is not possible to understand one without the other.

It could be thought that in a natural, coherent and consistent way there should be a philosophical root in the engineering training. However, reality shows us otherwise. Somewhere that humanistic approach has been lost.

Just to approach philosophy from a more technician-friendly perspective, let's not take it from its essence, but from the anthropological foundation that it contributes to education; consequently, let us study the humanistic training of the engineer from that human vision (or even social if you will) and not from a perspective of integration of knowledge with a philosophical basis.

It should now be clarified that we are not talking about humanism in a Renaissance sense (Humanism as a philosophical current founded by Francesco Petrarca), but about humanism in "*... everything that contributes to humanize the person, everything that makes the person be more human, more person ...*" [4].

What it is meant by this? That we should not only think about the humanistic training of the engineer but also in gives it a humanistic vision of his profession. Let's analyze both approaches: the training and the humanistic vision of the engineer.

First, let's define what we mean by ENGINEER, and simply to work on a formally constituted basis, it is borrowed the definition of engineering and engineering practice proposed by Sobrevila [5]:

Engineering *is the profession in which knowledge of the mathematical and natural sciences acquired through study, experience and practice is used wisely in order to develop ways in which materials and forces of nature can be used optimally for the benefit of humanity, in the context of ethical, physical, economic, environmental, human, political, legal and cultural restrictions.*

The ***Engineering Practice*** *includes the study of technical-economic feasibility, research, development and innovation, design, project, modeling, construction, testing, optimization, evaluation, management, direction and operation of all types of components, equipment, machines, facilities, buildings, civil works, systems and processes. Issues related to safety and the preservation of the environment are a fundamental aspects that engineering practice must observe.*

The study carried out by Sobrevila is not wasted, and exhaustively addresses this issue, expressing the concern with which the name of engineering is beginning *to*

be bastardized (even the correct use of the term bastardized is clarified: “degenerate of its nature and origin, deny its nobility”), trying with this a contribution to the current problem, especially in these moments in which the Law of Higher Education has fallen with all its rigor on the engineering faculties of our country.

Returning to Cirigliano, do we find in the definition proposed by Sobrevila a “pinch” of humanism in the engineer? Yes, when he talks about it being a profession that works *"...for the benefit of humanity, in the context of ethical, physical, economic, environmental, human, political, legal and cultural restrictions*." From which we deduce that an attempt is made to center the professional development of the engineer on the “person”.

But, what about "engineering practice"? Here we already forget about good intentions and strongly emphasize the guidelines of structuring, technicality and practicality that characterize the mentality of the engineer. Timidly it is mentioned at the end that "*...issues of safety and the preservation of the environment, constitute fundamental aspects that the practice of engineering must observe.*", but in my opinion, it is not enough to highlight the ***purely social function*** that engineers have.

This may seem like an exaggeration ... but the problem for engineers is not "***knowing how to do it***" but rather "***knowing whom it is done for***". It says a saying: "*If it is about doing ... consult an engineer*", and the author would add *"... as long as you know it does it for you!".*

It is thus outlining the central position of this work. We engineers know how to do things, and for that they prepared us, but we do not know who we do them for, and for that ... they also prepared us.

it is given as an example something from my own computer competence: when we define the "***user***" we are talking about who uses the system? Or is it used by the system? The author usually raises this discussion among my students as a way of making them understand that engineers are not only technicians, and that the story does not end with "software development".

Where then is the problem? Precisely in what the engineering training has long ignored: to take as its ultimate goal the social contribution of the engineering profession, to give a solid foundation to professional training. We have forgotten the concept of education initially raised: *"... the education orders various qualities, perfects person, ends it or fulfills it ...*”.

Logically, this is not the only problem, if we continue analyzing this question we find various causes, all of them of more or equal importance as the previous one:

- Engineering curricula are obviously formulated by "engineers", usually eager to provide students with the "knowledge" indispensable for their time, but usually neglected in human training. Most of the time, everything ends with the identification of a "professional ethic" or, with the ecological contribution of environmental management (which the author does not criticize, but it does not seem enough).
- The very definition of ***the professional*** understood as the accumulation of knowledge, experiences, common sense, creativity, innovation, drive, dynamism and many other “soft” characteristics that postmodernism demands.
- The obsolescence of any educational project compared to the results it produces. Nowadays the study programs cannot be "tested" or "adjusted" trying to find the

most successful path for the intended graduate, simply because it is not known what ***type of graduate*** is needed. And here the much-talked about globalization of the economy bears most of the blame.

- Other defects that the curricular projects have in themselves, such as the horizontal and vertical articulation of the subjects (to give an example) and which is reflected in the lack of a ***systemic view*** of each of us who participate in the training of this professional, because we think that our subject is the most important, the only one, and without whose knowledge the students will not be able to survive in their work.
- The lack of pedagogical training for professors, who, of course, are mostly engineers. And this is related not only to the "way" of transmitting knowledge, but essentially to the organization and development of the class as an educational project, rather than a mere transmission of knowledge by an expert in the field.
- The lack of awareness of the professor, who still does not assume that it not only teaches with his word, but also with the example, the projection and it trajectory, and not only professional, but above all human.

The questions cited here have the same basis: the humanistic vision.

It seems then, that if we incorporate "humanistic subjects" in the curriculum, we could save the issue. But it is not only about this, and here It presents the experience of the Computer Engineering degree at the Catholic University of Salta that in its curriculum (Plan 2002) proposes as objectives:

- To train an engineering professional who respects freedom and the values with which we sustain our existence and who adheres to the ethical principles of Christian morality.
- To prepare a graduate capable of projecting, directing and operating information technology systems with a strong human training that seeks the development of the country and the region.

These general objectives are in full agreement with the institutional ideals that propose the "*... comprehensive training (humanistic, democratic and christian), technical, scientific and professional of its students ...*" [6].

The study programs of this career assigns its place to subjects such as Philosophy, Theology, Social Doctrine of the Church and Ethics, but they are not enough to give its IT professionals a humanistic training and a humanistic vision of their profession.

Without being sufficient by itself, this knowledge, turned into a curriculum that responds to the structure as identified in previous paragraphs, cannot leave traits fixed in the students. Especially in a discipline such as Computer Science, where the temptation to deify the technique is very great, so that everything is subject to the computer, ignoring the role of the person and, what is worse, taking for granted that the systems "they are made for people of course".

So just a humanistic body of knowledge is not enough, much more is required.

There is another very interesting perspective on the subject of this discussion: is it necessary for engineers to have a humanistic training? Isn't it enough with the methods, techniques and projects if what is intended is that ***they do***? Here it adds a contribution from various authors that it is consider is appropriate to include.

The philosopher and social researcher César Rodríguez Gamboa, who for more than three decades trained Peruvian engineers, says *"... against technicists tendencies I uphold the principle that humanistic education is an inseparable part of the integral training of the engineer ... open the eye of the conscience to the meaning of cultural objects and actions, that is, to their relationship with values, is the most transcendental effort that fits those who educate. And it is only in this way that cultures are preserved and can be expanded and modified with new creations* "[7].

For his part, Professor Álvaro A. Hamburger Fernández from the University of San Buenaventura in Colombia, responds to those who criticize the incorporation of engineering careers as a "falsification of the humanistic spirit and disposition" of that institution, with these concepts: *"... today, in the year 2000, almost seven centuries later, like Petrarca, we ask ourselves: what are the causes of corruption and evil in today's world and how can we put a stop to them? And, like Petrarca, we will have to lead, inevitably, to a humanism ... that turns on the knowledge and development of the inner world of man, of his essence.*" [4]. But now we speak of humanism as a container (and disseminator) element of human's actions to improve his own quality of life: with itself, with it fellow person and with the world that surrounds it.

In another context, an expert from the Royal Academy of Sciences of Spain, discusses the incorporation of mathematics in current educational projects, and there he says: *"... what Pythagoras and the Pythagoreans began to perceive in their mathematical contemplation, were the deepest harmonies present in the very structure of this universe in which we live, And on such contemplation they based their very ethical and religious life. This broad vision ... should transform rival mathematics education (in perpetual competition with humanistic education, as it seems to be perceived by many), into the valuable educational ally that it has been in the thought and practice of leading thinkers. of our civilization.* " [8]. If mathematics is the essence of techniques and is a substantive foundation in the training of the engineer, why are they so alien to a social approach?.

For his part, Pedro Pascual says *"... There is still discussion and turning an endless wheel about whether culture is the exclusive patrimony of humanists (artists, philosophers, writers) and not of technicians and technologists, in a absurd dichotomy of creating culture. Everything is science and everything is and must be epistemology, the same matter is the learning and the foundation of knowledge of literary theory what that of physics ... what happens is that the expression of the arts called humanistic or liberal, in their teaching and normal formulations, follow different paths from the ones of engineering... "*[9].

The author cannot help but consider Serres who in his New Humanist Manifesto summons all educational actors in a *"... universal humanism that would contribute to creating a peaceful globalization ... at the moment when globalization reaches communications and, Through them to the economy, we, researchers and teachers, can fight on equal terms with it and against it, complete it or* ***make it human*** *since, precisely, the first globalization is done through science, study and the research*"[10]. He also speaks that the current division between hard sciences and social sciences does not contribute to seeing the world as a unit, proposing a "common program" (based on both types of sciences) for all students of all disciplines in order to enable a humanism arising from the human gender and adapted to its needs.

Can be cited as a corollary, that the great scientists of humanity were also

great philosophers, and most of the time, it were totally attuned to person and society.

At what point did technique separate from humanism that we did not realize?

Conclusion

Much remains to be said. The discussion has simply been raised knowing that it is by no means over. But it corresponds to fix a position and outline a proposal:

- When speaking of ***the humanistic training of the engineer***, It does not mean simply to train a professional with a social sense. It is much more than that, it aims to mark the need to incorporate humanistic training in various orders:
    - In the interior training of the engineer, so that he is recognized as a unique, indivisible man, who must not separate his intimate being from his professionalism. Some people understand that "it is an engineer from Monday to Friday and from 9 to 17 ... the rest of the time it is just a person."
    - In the professional training of the engineer, so that he maintains an ethical, supportive and service attitude towards his client, for the improvement of the quality of life of all, those his and of his community.
- It is supposed that the lack of humanism in the engineering profession should not be an exception. At this stage of economic and social globalization, my concern must be shared by professionals from other disciplines, since this experience is the consequence of a generalized crisis situation and of our time, so that it will not be easy to solve the problem either, but simply as an outline it is proposed:
    - Disseminate among professors of the engineering career the need to provide a social approach to each of the contents of the curriculum. It is understand that it is not easy to look for a social perspective in the Windows Operating System or in the differential equations, but at least we could make efforts to think about it.
    - Make the professors participate in the career project, explaining them about the role that each one fulfills in it, not only from their subject, but as a “focus” that the student follows with great attention. It is know this is easier said than done, especially with the “taxi” professors (those who work in 2 or more educational institutions) and who usually work as university professors. And here we could add a whole list already developed by education specialists about why educational projects fail.
    - With the same emphasis that we try to develop a curriculum to “accommodate the contents to the times”, let's discuss about incorporating a humanistic vision in the profession.

So, how does the story end? As always...looking for the balance point that allows to incorporate humanism in engineering, without losing its own essence as a technical profession. In short, it is proposed to start training engineers who "think about the other" rather than the technique or the most appropriate method to solve a problem.

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