

Proceedings of the 4th International Barcelona Conference on Higher Education**Vol. 1. Ethics and relevance of scientific knowledge: what knowledge for what society?**GUNI - Global University Network for Innovation – www.guni-rmies.net**Valores y actitudes del ingeniero en las escuelas de ingeniería****Jaume Fabregat Fillet**

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Abstract

The schools and faculties of engineering have to open the mind to the values in the engineering in the managerial spheres, in the departments, in the educational meetings, in the academic commissions, and in the work of the teaching staff.

University has to believe in the importance and in the category of the values and attitudes (constancy, creativity, strenght, perseverance, ...). Teaching staff has to be sustained in values, has to protect, has to defend and has to transmit values, has to educate with values and in values to the new generations of professionals (sometimes, leaders). The unit UPC-Fecsa/Endesa-Endesa/Escuela de Energía "Victoriano Muñoz Oms" animates this spirit.

There are many reasons in order to work in the achievement for the future engineers of a visible maturity, of an exercise of performances balanced on rights and duties, and of a vigilant attention to an ethical behaviour in the professional activities. Devoted to the engineers of the future, there are numerous arguments to promote a will of cementing, constructing, collaborating and sharing .

The communication describes different representations of the word "values" and sets forth some annotations that guarantee the importance of thinking about the consideration of the values as pillars in the formation of the engineers. The

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contribution puts emphasis in the signification and the consequences of a preparation in suitable attitudes.

Some results of a monographic study in the field of the values and attitudes carried out with teachers are narrated. The establishment of priorities regarding attitudes which it is necessary to take into account firmly, for hierarchical or operating reasons, is something that derives from the study.

The ultimate goal of the cited global study is to favor that the values are considered in the classrooms, in the laboratories and in more spaces of the university, not only implicitly but also explicitly.

1. Values in engineering

Principles and appropriate attitudes have to be present in the existing science and technology. For this cause, we feel that it is understandable that a lot of voices around the world are calling for education in values and attitudes as a significant portion of the training of new technicians in the contemporary civilization.

Inside technical universities or inside non-specialized universities, the colleges of engineering have to open the eyes to the values in the technological sector. The word “values” combines different senses: values could be understood as ideals of reference (the truth, the freedom, the justice, the beauty...), as pillars where the ethics is sustained, as attitudes of an advance towards the perfection in “to be” or “to do”. Besides opening the eyes to the values, the colleges of engineering have to internalize such values in order to involve with them the daily action of its directive teams, of its departments, of the boards, of the academic commissions and, in general, of the personal and collective organs of government and management and of the different structures of the organisation. Furthermore values have to be present in the work of craftsmanship of the teacher, when he marks the goals of the subjects, when he designs the methodology of teaching - learning, when he plans the evaluation processes, and afterwards when he converts such plans in actions.

The systems of higher education have to see and consider the relevance of the values, the attitudes and the ethics in the educational processes. The truth has to be sustained, the freedom has to be protected, the justice has to be defended, the beauty has to be transmitted; the engineer has to be educated with values and in values.

The professor of an institution of higher education has to instruct in conceptual knowledge, but not exclusively, has to endow of tools, but not merely. The university professor also has to promote in his/her students some adequate attitudes for the professional, often a potential leader. The achievement of a perceptible use of the reason, of a lively and encouraging spirit, of a balanced exercise of duties and rights, of a position of responsible commitment in the face of the duties from the work, of an

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energy for lifting, of a desire to build, of an attachment to help, of an arrangement to share they are fruits for conquering in a engineer. And to attain an affectionate and nice person is significant.

It is customary that the engineer can face technically a challenge in a few ways. The engineer has to choose the best formula or the best technical solution. What means “the best”? The answer depends on the values: is much appropriated to consider its, since the criteria of decision that the engineer will apply often rest in the values. In the new European stage of the higher education the university formation is framed about the necessary competences in the professional who prepares the university. These competences can get along, with skills and intellectual knowledge, like an intersection of attitudes and values (autonomy, coordination, initiative, responsibility...)

More than the past few decades, young people seem to have worried about fundamental troubles which have an effect on the majority of human beings: the problems that could be partly described using the words ‘unsustainable development’. Also it is significant to indicate wide-ranging human values necessary for students and engineers are linked in a straight line to the social implications of engineering and their relationship with progress.

All through recent years a number of adaptations have been put in place to firmly establish teaching concerned with a constant course of actions which stimulates the consideration of the economical, political, intellectual and social surrounding interrelations, the searching around for lively ways to improve human development, and the backing up of the values and attitudes associated by means of shared aims and social justice.

2. The VMO Unit

The “Càtedra Victoriano Muñoz Oms (VMO) – Human Values in Engineering” is the specialized component of the Technical University of Catalonia (UPC) devoted to values, personal attitudes and ethics in engineering. This Unit is sponsored by the Company ENDESA, the leading Spanish electric firm. This VMO Unit has been devoted, since its founding, within the structure of the university itself and also externally, to the study and the dissemination of the existence and the work of the famous engineer who gives his name to the VMO Unit. At the same time it puts forward a group of activities related to the endorsement and the learning of the human values, personal attitudes and ethics in engineering; so a lot of examples were given by this engineer.

One topic dealt with by the VMO Unit, throughout last years, is concerning a methodology in the direction of elaborate studies about education in values in engineering. What about the forecast and the hopes of the engineering degree course

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students regarding values on the moment they start higher education? What about their point of view when they are concluding their degree? What about the analysis of the teaching staff? What do young graduate professionals believe relating to this topic? What is the standpoint of senior engineers?

The “Càtedra VMO” voted for to do a large study in values education, divided in several sections, which made an attempt to cover a lot of features and get many answers to various questions related to the cited topic within Spain. Several of the results which stood out from the study emphasized the aspects related to ideals and ethics in the professional performance of engineers. The conclusions were one of the preliminary points intended for introducing changes in the study programme dedicated to future engineers.

3. The Federation WFEO

The World Federation of Engineering Organisations (WFEO) is the world's largest engineering organisation. This planetary federation is involved in many worthwhile projects that benefit together the line of engineering works and the society, cooperating with national and other international professional institutions into developing and applying engineering. Founded in 1968 with a group of regional engineering organisations, under the sponsorship of the United Nations Educational, Scientific and Cultural Organisations (UNESCO) in Paris, the World Federation of Engineering Organisations (WFEO) is a non governmental international organisation that brings together nationwide engineering organisations over 90 nations and represents some 15 millions engineers from around the earth.

This Federation provides information and leadership to the engineering professions concerning issues about peace and sustainable development, about global basis of well engineering teaching and tuition, about exchanges and sharing of technology and about principles related to the profession. The VMO Unit is an associate of the WFEO.

4. The Conference ICEHVE

The recent 1st International Conference on Ethics and Human Values in Engineering (ICEHVE) , organised by WFEO and VMO Unit, provided an exchange of information and points of view, and to gave a debate, between engineers, institution of higher education professors, researchers, employers, entrepreneurial agents in addition to other involved people to facilitate the thought on personal values, ethics, and social impact in engineering.

The ICEHVE distinguished and motivated some tasks in different areas, connected to the human sustainability, the values in science and engineering, the attention for the social impact of the technology and the consideration of the principles

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of the engineering inside the society. The Conference supported the development of systems to achieve that the student of engineering observes humans faces of the technology, and obtain an additional global view of engineering.

One thematic area was “Appropriate attitudes for the engineer as a leader” (logical and critical thinking about thoughts and facts, mature and autonomous production of the decision processes, coherence and personal commitment in face of the conflicts, attention to the diversity of the involved people, road-mindedness as well as affective implications ...)

Another thematic part was “Education in values in engineering” (specific subjects on values and attitudes, engineering history and other CTS issues, curriculum impregnated by values, humanistic grounding in engineering degrees, and contribution of students as social volunteers...)

A third thematic element was “Current interactions between engineering and society”

(technological skills in basic education for ordinary people, engineering in the international collaboration, engineering and human sustainability, engineers and engineering in the media, patents right and technological transfer...)

The last thematic constituent was ‘Ethics and professional deontology in engineering’ (relationships between engineer (or engineers) and employers, between engineer(s) and persons directly involved in their tasks, between engineer(s) and the communities, between engineer(s) and natural world, between engineer(s) and artefacts, ethics of the engineer(s) and the social responsibility of the corporations...)

The International Conference recognised and stimulated the elaboration of papers made by teachers participating in the Conference, devoted to educate in engineering degrees about human values, emphasizing their implementation in the edge of the social repercussions in the general spot of the companies of the technological sector. The Conference on Human Values and Ethics offered incentives to the participants in the gathering in order to do research works concerning human values in engineering and/or global visions of the professional action in the technological areas.

5. A number of consultations on attitudes

At the same time of the last phase of the organisation of ICEHVE, during the most recent semester, the VMO Unit has designed a model of interview to entities of the Technical University of Catalonia (UPC). The goal of this interview has been to analyze the performances of diverse entities of the UPC (organizations, services, associations, NGOs...) developing some actions on the subject of training in attitudes. The information obtained through this instrument will be useful for elaborating a material, as a guide, that will provide to the teaching staff a real range of performances and directed

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educational resources for the training in attitudes. The incorporation of a description of some of these entities will facilitate the contact and a joint work of these with the teaching staff of the UPC on the subject of formation in the attitudes.

The information obtained through the administration of this interview has been analyzed by a group of study. The information sources will be recognized in the final report that later will be published. Always of agreement to the purposes and characteristics of the study, some experiences will be incorporated as a part of the study in the book that we will distribute at the end of the process.

How this interview was? The interview that we carried out to some entities ascribed to the UPC consisted of three sections: in the first section there was a small introduction where we provided an information about whom we are, the goals that scrolled us to carry it out and what we will make with the data that we obtain from this instrument; at the second section data of the interviewed entity were picked up and in the third the questions that shape the interview were included.

The body of the interview were formed by three blocks, configured from the subject matters that they themselves pick up: the first block incorporates general questions about the attitudes which it is considered that they should be part of the engineer as a professional, about the role that the university has to play in the formation and about the role that in this sense assumes the entity interviewed; in the second block an approach to the training carried out in attitudes is aimed for by the entity, from where two more appraised or interesting will be extracted for being shared with the academic community and the third and last block tried to pick up information about the actions developed related to the mentioned attitudes.

The clear-cut questions in the last block orient themselves to our last goal: the creation of a guide about how the teaching staff of the UPC can introduce the formation in attitudes into their planning and educational performance. All blocks have configured a semi structured interview, with 14 questions preferably open, an approach to the way that they consider themselves more suitable for the goals of the study in those aspects.

What do we understand for attitudes? We understand the attitude like a “learned predisposition, non innate, and stall even though it can change, to react in a favourable or unfavourable way in front of an object (individuals, groups, ideas, ...)”. Seeing to several authors, the attitudes are shaped by three components, these are the cognitive one (that it reaches the area of the knowledge and thoughts), the affective one (with a feeling favourable or contrary to the object that provokes the attitude) and the conative one (which hits directly upon the performances and actions that the person carries out in front of the object). As more important characteristics, it is worth to say that the attitudes are acquired along the life, changing and dynamic according to the formation and experience of the person who develops them and adaptative to the situations that happens.

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Some examples of attitudes can be: the responsibility, the orientation towards the innovation, the propensity towards the critical reflection, the pragmatism, the assumption of the leadership of a team, the restlessness for the learning, the respect towards the natural environment, the commitment with the sustainable development, the understanding of the social frame, the empathy with determinate situations and social problems, the will of an active participation in the community, the social commitment, the orientation towards the increase of the quality of life of the persons...

The questions of the interview are:

1. Which attitudes would he/she remark that has or will have to have a good engineer?
2. Which paper do you believe that the university has to play in the formation in these attitudes?
3. How does his/her project/service contribute in the training in attitudes of the student?
4. Which attitudes are worked within the framework of his/her project/service?
5. Of the mentioned ones in the former question, which are the two attitudes more considered and appraised by his/her service/institution/organisation/NGO/project? Why?
6. How much time do these attitudes bring work within the framework of his/her project/service/? Is the formation in these attitudes addressed to teachers, engineering students ...?. How would you describe the collective that really participates in your project/service?
7. Could you make us a description of the performances that they develop for the training in these attitudes? Which goals do you consider? What about concrete activities carried out for the attainment of its goals?
8. Which property do they start off for the work about these attitudes? How do they determine or do they appraise the acquisition of these attitudes among the participants?
9. Which have been the results obtained through the formation in these attitudes? (about the satisfaction of the participants, concerning the incorporation in the professional world of the student/with the social or environmental impact of the work of the students...) Do you consider that which are the potentiality or strong points of the directed performance in the training and in the final preparation around these attitudes?
10. Which type of limitations or obstacles have they found for the execution of the foreseen actions? And which measures have they taken for overcoming or palliating these restrictions, limits, boundaries or obstacles, impediments?

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11. Would you repeat this experience/performance again? In affirmative case: would you introduce any modification with respect to the experience/performance carried out?
12. Can a teacher with an interest in the formation in attitudes to link him/her to his/her project/service? In affirmative case: which type of help can they offer? (advice, information, orientation, development in attitudes in his/her classroom)
13. Can a student to be part of his/her project? That is, which type on duty they can offer to a student who is in the attitudes interested on being educated about those that labour?

6. The attention of several entities to some attitudes

The ICE (Institute of the Sciences of the Education) works in some attitudes related to the mechanisms of an interpersonal communication and of the disposition to the learning along all the life. It has developed this task during decades. The activities are destined to teachers of the university. The access is voluntary. The activities include talks, virtual platforms... The potential rests on the quality of the educational team and on the work produced in group. One negative aspect is the lack of recognition of the system to those who are been formed.

The GUNI (Global University Network for Innovation) attends to the attitude of the exercise of an interdisciplinary, critical and complex search for a vision interconnected of the things. Also the GUNI attends to the participation. It is dedicated to that since recent times. The performances are approached by the teaching staff. The access is direct and individual. The actions consist of projects, workshops and educational documents on the teaching in another way. A potential is the collaboration between different interuniversity agents and the cooperation between the professors. An obstacle is the lack of tools and of time for the teaching staff who wants to be innovative.

The Accessibility Unit approaches attitudes as the reminiscent of the understanding of the social frame and the responsibility. It makes this task since the year 2005, the year of its generation. Performances of formation of the teaching staff are made and also specific projects. The recipients are the staff of administration, the teachers and people of companies. A potential is the good disposition and the good temperament of the teaching staff and the amalgamation and the integration of disabled people.

More examples have been considered at the Technical University of Catalonia, which can offer the opportunity to transfer and to adapt in some new stages.



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Bibliography

- DE MIGUEL ed. (dir.) (2005). Adaptación de los planes de estudio al proceso de convergencia europea. Oviedo: Ediciones de la Universidad de Oviedo.
- DELORS, Jacques. (1996). Informe Delors. La educación encierra un tesoro. Madrid: Unesco-Santillana.
- GUITARD, R. M. (2001). El tractament de les actituds en el context escolar. Theses of doctorate in Pedagogy, Facultat de Ciències de l'Educació, Departament de Pedagogia Aplicada, Barcelona: Universitat Autònoma de Barcelona