

## EDITORIAL

### **Biophysical methods and engineering: transdisciplinary systemic perspective**

Under global human crisis that exists today, and the problem of hyper-specialization, there are about 8.000 scientific disciplines and sub-disciplines, with urgent needs of sustainability on the planet, it is imperative that engineering is integrated into other disciplines and seek solutions to real world problems, along with the technology continues to transform society as it has done for 150 years, but now with proposals and harmonious solutions, systemic solutions. Many of the findings have been novel, useful and surprising, but momentarily because later have caused new problems to solve. Thus, it is necessary to develop in teachers and students an attitude of *re-learn*. Re-learn to think in solutions, visualizing the present and its present and future solutions. For this it is necessary to encourage the engineering student a *transdisciplinary systemic thinking-a human thinking*, which allows him/her to suggest solutions that currently require the planet and is essential to continue to survive as a species.

Earth is facing the global warming phenomenon, which mainly affects on agricultural production in quantity and quality. So that it is urgent to contribute from different disciplines, including engineering, to stop destructive processes of the earth, the environment and consequently the production of human and animal food. -This is scientifically reported- which could impact on malnutrition and/or diseases of modern times such as cancer and obesity triggering other problems such as diabetes.

Thus, the Research Group of Systems Engineering, SEPI-ESIME-Zacatenco, National Polytechnic Institute, Mexico City, Mexico; is responsible for developing, researching and demonstrating the usefulness of different sources of electromagnetic radiation to be applied at different phenological stages of plants and food products in Mexico. This is developed in collaboration with other working groups, such as Solid State Physics, Cinvestav, Zacatenco, the Area of Improvement and Seed Quality Control of Graduate College at Montecillo, Texcoco, the Physics Department of University of Zacatecas, and the Experimental Unit of Grain and Seed School of Advanced Studies at Cuautitlán, UNAM; and cooperating with producers and farmers. Ionizing and non-ionizing electromagnetic radiation has been used in agriculture to produce mutation, biostimulation and sterilization, among other applications. These radiations are known as biophysical methods, such as gamma rays, laser, electro-magnetic fields and UV light, among others, which become increasingly important from the proposal of the rational use of agricultural land for groundwater contamination caused by agricultural chemicals, wear land, reduced nutritional quality of food and climate change.

Educators of future generations of engineers required to be transformed to re-educate towards a transdisciplinary perspective, which is a methodology that emerges in the 70's to generate knowledge, to go beyond the limits of the different areas of disciplinary knowledge, of subjects and objects belonging to those areas, of citizenship and the nature, that allows to observe a more comprehensive, integrated, real and true reality; where human beings SELF-OBSERVE, OBSERVE, TALK, KNOW, LEARN, CONTRIBUTE, JOIN TOGETHER AND PROVIDE HARMONIOUS SOLUTIONS TO THEIR SOCIETY in different problems, all of a COMPLEX nature.

It is necessary to know and recognize that as Latin American countries should evolve more rapidly, which is achieved to the extent that we can re-educate ourselves as teachers and invite re-educate students, committing and taking responsibility for oneself and others.

It is important to emphasize the great need to generate greater knowledge in Latin American countries, especially Mexico. The context to which reference is made, is the existing situation in relation to

publications reported by the area of knowledge in the study of Science of the Organization of the United Nations Educational, Scientific and Cultural Organization UNESCO (2010), which indicates that the area of Engineering and Technology for Latin America has 4.535 publications in 2008, compared with 28.572 U.S.A., with a difference of 84%. The development, growth and technological independence of a country depends on the generation of knowledge, in this way is necessary to generate science and knowledge, increasing scientific contributions in the field of engineering and technology, also in other areas such as biology, biomedical research, chemistry, clinical medicine, earth and space, mathematics and physics.

So it is vital that the teacher and student develop habits and disciplines to make AWARENESS on the pressing needs and the type of solutions that correspond to the area of Engineering, learning to make systemic decisions in each field of their lives.

Some ideas for achievement these objectives could be:

Regarding teachers is proposed to establish systems for updating and sensitizing to raise their epistemological level and to become aware of their work and restart their vocation as human and vulnerable teachers in this world that is ours; moreover it must also take up again that responsibility. In relation to the programs of the subjects taught in the engineering courses these must increase material designs that allow students to develop, create, innovate and invent. As teachers should guide and let their imagination develop, recover their freedom from prejudice, to achieve those moments of inspiration, only with that training of the brain to think ahead and act in the present, to observe and consider macro and act at the micro level. Teachers are responsible to create a broad academic culture, a culture of research and develop the sense of observation, learning to feel the world through inter-semester workshops that will lead to moments of peace and inspiration, the development of the virtue of patience, tolerance, making them aware of their own evolution as human beings. Research teachers must teach that knowledge is not only obtained at the laboratory in vitro level and with isolated objects, but also it is important to leave the laboratories and have contact with the real world (where we live and exist many needs), to work not only on the development on the left side of the brain, but also on the right, leaving the task and projects in the engineering area of unusual and unbelievable situations that may look unattainable, but let your imagination run. As responsible Hispanics, it is attainable by the students to gain knowledge, understand it, explain it, feel it and then have the culture to generate concern and above all to be applied to the society, teaching and constantly re-learning to assume the role as an element of change, transforming factor, and so knowing that serves society. This could be achieved at the moment of deciding to do something, reflected on the questions: What am I doing? Why and for whom I am doing it? And what impact might have on my environment, assessing the positive and negative of the activity developed in the present and in the future. In this way teachers should learn and teach systemic decision-making, not just through the use of mathematical algorithms, but also with the balance in their mind, body and soul; that leads to take action, re-think in the other, people and environment, placing different holistic levels (oneself, family, community, town, state, country, continent, ... planet) deciding and referring to what level of impact on the decision was considered when making decisions, and that is the corresponding evolutionary level to have; the understanding that if you do not take into account the most holistic level to decide on any act of life, to work for evolution and promoting greater awareness. On the other hand, when the research activity will be taught scientific rigor must be exposed, where not only accuracy should be considered, but also the implementation to be ethical and with values that make them not to forget of human beings around us. Interacting with others with respect, humility and to teach to discover in every moment of life. In the times we are living today, we must teach our students and research teachers to be resilient, to develop inner strength to stand up and always strive. Latin people need to give ourselves with passion in what we do.

In the transdisciplinary perspective must work the development of attitudes that allows joining with others, seeing in each moment in the rest of the people aspects that could unite us rather than divide us. This could also be applied to the logic proposed by Nicolesku Basarab, where people who re not be able to truly work together and with others, know that it is because there is lack of evolution, and then assume responsibility to evolve in spiritual and cultural way, etc., whatever the ways you choose apply, the results must reflect unification of the people so they can join forces and talents among the areas of engineering, at first, and then go beyond to other disciplines and then land on the needs of society, always linked with corresponding area to which would serve, by creating awareness of the field. Engineering programs must connect with the productive sector and create the necessary profile in its graduates so that they serve and care for the solution of problems faced. Engineering requires a reform to stop Latin American countries have the technological dependence on other countries, which some become richer and others poorer, opening a wide gap of inequality and access to an education level which leads to a different quality of life. The research teacher is relevant in this way making a transdisciplinary perspective to educate, he/she has his/her responsibility to work and take that path on behalf of the engineering student and therefore of the world which it belongs, in the strict sense of interconnection of all: complexity.

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