

Work Group: the Strategy to Improve the Pedagogical Performance of Engineering Teachers

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Abstract: Once the development of science and technology has brought many transformations into people's ways of living, professionals dealing with engineering education have been questioning about the characteristics, abilities and knowledge, besides the technical instruction, the engineer should have and develop for a successful career. So all these worldwide changes have been imposing important modifications into the engineers educational process. Many adjustments have already being done, but many more are needed. Among them we can point the importance of the engineering teachers pedagogical knowledge and skills because of the fundamental role they play in the teaching-learning process. This paper describes an strategy that can be used to improve the engineering teacher's pedagogical performance by making them to develop new concepts about teaching and learning, and also recognizing the importance of the educational process as individual and social transformation agent. The idea is to create conditions for the teacher's new conceptions about its docent activity. An activity that is very complex, needing planing and focusing on clear objectives and expected results. Also, realized by many actions that compose a dynamic process where not only the scientific and technical knowledge counts and were pedagogical knowledge and skills play a very important role. To achieve the teacher's transformations, the strategy is based on a interactive work, where the participants work together, with common objectives and tasks that are discussed, planned and executed for them. The interaction process affects the individuals and the group behavior. The tasks are executed aiming objectives achievement through a change on the participant's ways of feeling, thinking, perceiving and acting.

Keywords: pedagogic , knowledge, performance, engineering, teacher .

1. Introduction

The contemporary scenery presents a kaleidoscope of changes in many aspects, transforming the education task into one of the most important tool to assure a better society for the future generations. The pos-modern tendencies and conceptions show a rough path to be overcome. In this context, the UNESCO[1], analyzing the principles that should guide the High Education in the XXI Century, proposes that the efforts should be focused on three main aspects: quality, relevancy and internationalization.

The quality comprises all main functions and activities of the high education. It means to get better staff, students and programs, as well as, better infrastructure and academic environment.

The relevancy is related to the high education role in society and its importance in this society.

The internationalization is its inherent characteristic, or in other words, the universal character of the education and research.

In this paper we will point our focus and attention to the quality of the high education because we agree with the UNESCO[1] when in its document declares that the main educational source is the human capital and its relation with teaching, research and extension. The same document emphasizes that the high education quality should begins

with the improvement of the teachers pedagogical performance and scientific-technological knowledge. It makes clear that the teachers should acquire new, creative and interactive teaching methods, and should be stimulated and encouraged to research and work together or in groups, with a plurality of subjects and themes. It also explains that these aspects should be taken into account as one of the important conditions when any implementation of new curricula is needed or even for a team promotion and teachers hiring.

At the engineering schools, the Unesco's propositions have to be studied carefully, because some proposals present serious problems for their implementation. The need of a dynamic modernization and integration of the engineering subjects once they are expanding widely; the enormous change in the technology and its application; the need to give the students enough knowledge and tools so they can learn to learn, get proactive attitudes, work creatively and critically, are some examples that can point out the obligation of improving quality in engineering. Besides all these aspects the future professional has to understand and comprehend the ecological and social aspects involved in its profession knowing how to deal with them with wisdom and conscience. Considering that the achievement of these targets involve the teachers' activities, their responsibilities become enormous. The teachers have to search and get the best formation as they can.

Up to now, most engineering teachers have been working under strong influences of the modern conceptions. The technician and positivist conceptions have, since the beginning of the industrial era, great influence on the engineering teachers. These professionals have been working at the schools, believing that the structure of this science is the same of its learning. It means for them, that there is a straight relation between teaching and learning as cause and effect. Most of these professionals, get plenty scientific and technologic knowledge, which of course is indispensable for their skills as engineers, but these knowledge do not assure or promote better teaching and learning process. It is nowadays necessary for them to understand that besides being engineers they also are teachers, and for that is necessary to acquire the specific knowledge, abilities and values intrinsic to this profession.

Considering that the engineering schools can not only be the place for knowledge transfer and acquisition, but an environment for construction and production of new knowledge, we reaffirm the need of looking for ways that can promote and give to the engineers-teachers the appropriated pedagogical preparation.

So we propose a work strategy that can promote conditions for this necessary pedagogical skills improvement, reaffirming that the teaching-learning process does not end at the reproduction methods, but in its appropriation by recreation that pushes the student and the teacher in their individual and social dimension throughout any defies.

2. Describing the engineering teachers conceptions about teaching

Analyzing the engineering teaching, its paradigms, its implication with the science, technology and society, Bazzo[5], identifies the existence of important deviations of the scientific and humanistic culture, as well as in the formation and in the pedagogic practice of significant portion of those that act in this educational area.

Others studies accomplished in several Brazilian engineering schools, with the purpose of describing the educational practice understood as the 'activities accomplished by the teacher seeking to educate the student, through the process teaching-learning', show that most engineering teachers work without an adequate pedagogical formation[5,6,7].

In general, "... the teacher is characterized as a specialist in its field of knowledge... even so, this teacher do not necessarily dominate the educational and pedagogic area..., in its relationship with the student, as well as with other teachers and organisms of the school institution, he lives an educational situation."[6].

The engineering teachers act, in a general way, without appropriate knowledge of the relationship between the theory and pedagogic practice, accomplishing their activities without important reflections regarding the instructive and educational process. Its practice happens therefore without the basic knowledge that can help to get better formation of the future engineers by turning the educational process more motivating, active, conscious and integral.

Many factors can be found to justify and explain such behavior, but we will explore the ones that seems more significant.

- Starting from those problems begun with the decent profession:

As different researches[2] observed, the professions have developed and institutionalized, from the determination of the scientific and specialized knowledge that have being passed throughout time by the practices and systematic education. As a result of this knowledge transference, it was possible to have a formalized profession with a formal knowledge repertory capable to orient its practice. From this, for example, the medicine, engineering, law among others became professions after having their knowledge structured and institutionalized. For work with those professions it is necessary a diploma got from university or some another institution..

The docent work although being one of the oldest humanity duty up to now hasn't solved the problems with its formalization as profession. Many are the theories already analyzed to explain it, and among all, none seems so convincing as the need its knowledge and skills systematization. Once they are disperse and found much closer to the common sense than the scientific knowledge[3]. The teaching work can be done by anyone that feel capable of doing it and all find themselves capable. Everywhere in many different situations one can find a 'teacher' without a teacher diploma. This aspect creates many problems at different educational areas, being the engineering one of them.

- The second we point the Cartesian conception associated to conceptions positivists and thecnicists:

This conceptions started taking importance with the modern era at the beginning of the century when were assimilated and applied strongly in the teaching practice as well as in the engineering professionals' formation. These professionals started acting under those preconceived ideas transferring them to the students. Those students that also became 'engineers-teachers' assuming the docent profession, started working with the same resulting baggage of its own formation continuing acting with the same way. The schools on the other hand, reinforced such behaviors by hiring these professionals, requesting confirmation of academic diplomas, a commitment of 'good' intentions to research and teach and, a fast and simplistic ritual in class room as confirmation of 'didactic skills' [8].

Starting from this point, the great majority acts believing in its preconceived conceptions reproducing the old masters' behavior, as a simple transfer of characteristics, knowledge and know-how from one teacher to another and from them to the students. As a result, this professionals work aiming the transmission of the discipline program contents using as tools, the good sense, the intuition, an interior personal command and the innate talent of 'being born to be a teacher', talent that most believe to possess.

Allied to those requisites the 'experience' is considered very important and this aspect is so incrustated in almost every teacher, that the great majority affirms to have learned 'how to teach' from their own experience, to the flavor of the mistakes and successes[9].

It is important point out now something very important, in any moment, we are despising these aspects or we affirmed that they are unnecessary to the educational profession, a lot on the contrary, they are part of the repertoire of any profession. The main problem consists of considering them as the only ones, and to belittle the scientific aspects that characterize the docent profession and can give many tools that can transform the teaching-learning process and made it become much more efficient.

Recent researches[6,7] show that up to now a considerable portion of engineering teachers, believe that teaching is the transmission of subjects or matter (to execute the discipline program), with the teaching centered in the professor(transmitter) and with passive participation of the student (receptor). It is also verified that these teachers normally don't dialogue its didactics, its evaluation system, the interests and difficulties in class room. Only in little opportunities, the students are requested to use the reflexive reasoning, the creativity and the critical sense. The evaluation is normally considered as written test tests, that in their majority is accomplished by the students mechanically without the understanding of the meaning of them.

Beyond those problems, the division of the disciplines in basic sciences, basic of the engineering, professional and human subjects create a gap in the connection of several sciences. Also this division provokes a lack of association between the theory and the practice.

We observed therefore that the problems resemble not to summarize just "to the teaching methods, but also to the objectives, to the amount of matter, to the evaluation (...)", in association with "(...) the Cartesian conception of the engineering teaching, very useful to have an understanding about the engineering in terms of information. However, it is a misunderstanding to consider that the learning of the engineering (particularly, the acquisition of the capacity of solving problems) occurs second the same conception. The organization way of any knowledge branch is different from its learning way"[6].

The engineering teaching, up to now, has not made a pedagogic reflection on the proper and more adequate way that should engineering been taught. The “pedagogy” applied is nowadays entirely inadequate.

We are aware that the acquisition of a teaching scholarship or a proper Pedagogy, through an obligated institutional course, is far away from solving all the learning-teaching problems, but we do believe that it will bring the conscience, respect and quality for the profession by giving the knowledge and skills needed. It is widely known that a well structured teaching-learning process, using the appropriated knowledge, skills and values make a great difference in the whole educational process by improving the students’ behavior in acting, increasing of the motivation, decreasing of the school escape among many others transformations[4].

As result of that whole discussion, seems unquestionable the need of acquisition and domain of those pedagogic knowledge, skills and values for those who work in any educational area.

3. Interactive work as pedagogic training

Considering the tendencies of the education for the next century one can verify that the traditional and conventional engineering teaching is in crisis. The need of a deep and effective reformulation on the characteristics of these teachers' educational practice can already be considered as a road without setback.

Analyzing the new conceptions about pedagogic training in the present time, we found out some characteristics that, we considered, should be the rector for the engineering teacher’s pedagogic training process.

The training should take into consideration reflections on the educational practice that are accomplished by the participant teachers, that is to say, the training program should promote reflections and analyses regarding their own pedagogic practice;

The interactive training work of training *colegiado* among equal or kindred groups, it should be seen as essential dimension for the acting and professional improvement, because it allows the development of each one in interaction with the bus;

The program should be adapted to needs and the teachers' potentialities and you constantly stimulate them;

To confirm in the teachers the anticipation of the pedagogic successes;

To promote an atmosphere that allows the learning and the modifications proposals;

To create conditions for the teacher's *comprometimiento* in the planning and direction of the modifications.

Interdependence should exist among any administrative reform and its reforms of the teachers' training, that is to say so that there is change of the educational system it is necessary that there is the teacher's change;

This way, we believed that a program of pedagogic training that it takes in consideration everybody this factors, leaving of a need *internos* and with instruments that reflect the reality or the context in that the process, the engineering teacher is being given he/she/it will be mobilized to contemplate and to move. We shared Garcia Ramí s's thought that “the *autoperfeccionamiento y el desarrollo creativo*, roots in la búsqueda of los recursos y las potentialities of la personalidad, as whole un, hacia la pedagogic labor y en la realización of that process, en el group the pedagogic bus as form of *crecimiento en el own autotransformación proceso*.”

Pedagogic training of 'engineer-teachers' through interactive work

If the pedagogic training of educational of engineering appears in the current teaching as an important condition for the elevation of the quality of that teaching, and as the current models of training of educational look for in its majority “mejorar las pedagogic competences of educational los, to promote el exchanges of experiences among educational los y to answer the los problems reales of la life profesional educational del the través of la critical reflexión on su own labor profesional, ending en la búsqueda of you solve”,

he/she makes himself necessary to find a work strategy that answers to those needs.

A teacher should be looked for that knows, understand and contemplate on the complex mechanisms that they are activated during its educational activity, translated in its actions for efetivar the teaching-learning process. It is in the practice that the analyses and theoretical interpretations are summed up constituting a situation dialética among theory and practice, reflection and action.

To look for a form of improvement of the engineer-teachers' educational practice, he/she should be considered that these teachers, as individuals, are historical-culturally certain. This means to say that its activities are conformed by experiences accumulated along the time, in interaction with yours spill. The connections among the past, the present and social context that they conformed its current activities, they also promote the conditions for her to guide the actions transformadoras of the future.

To create appropriate conditions that promote that training it is necessary to undertake a work strategy with certain objectives, "...lo that implies to define y to prioritize los problems to solve, plantear solves, to determine los responsables for realizarlas, asignar resources for llevarlas to cable y establecer la forms y periodicidad to measure los you move forward" (Acle Tomasine).

A work strategy without ready formulas for fast application and imposed the participants, but a work where, the teacher is incited to contemplate on its own practices trying to know because he acts, he says and it adopts certain behaviors and attitudes.

A work that makes the teacher to use its knowledge and its experience to assume a critical attitude, stimulating its thought and its capacity to adopt intelligent strategies and adapted in different contexts. Acting in way to transmit cultural contents besides developing values. A teacher that at the same time that instruct it also educates.

In that search, we believed that a strategy interactive work where the participants, through actions and exercised influences, mutual or reciprocally, they look for the recognition and the understanding of the relationship between the theory and the practice of the manners of professional performance to promote its improvement, it can be used close to with success the engineering teachers for you take them behaving as educational reflexive that work for an education 'desarrolladora'.

In an interactive process, each individual's behavior becomes incentive for other, when generating conflicts, restlessness and reflections in deeper levels, it promotes reavaliações and readjust of the manners of performance. Through individual and collective activities of constant analyses of information on manners of acting, procedures and its motivations, the strategy of interactive work, promotes conditions so that the teachers (its re)conheçam educational practice, passing consciously, to understand the characteristics of yours to do newspaper. This internalização conciente, can drive the solemnity-evaluation processes and to actions solemnity-transformadoras promoting the teacher's solemnity-improvement, that, with new knowledge and the development of capacities and abilities raisin to execute its educational activities in elaborated levels.

This way the strategy of interactive work should look for a pedagogic training where the teacher acquires a considerable domain of the you know educational, in a such way could drive appropriate and consciously its activities related with him teaching-learning and get ready for the derived problems of the current changes of every process.

Thus, for "to take to cable an educational activity, in an effective way, the practical should develop not only the capacity to act - employment of technical aptitudes in its acting - but it should also evaluate the consequences of its actions, to

consider alternative developments of the action, to place and to solve idiosyncratic and appealing problems, and to use a series of conceptual marks in this cognitive and interactive process.”

The discussions regarding the experiences, problems, successes and potentialities of the members of the small group, for search of the repertoire of knowledge that you/they consider necessary for the improvement of its practice, during an interactive work they demand from those that participate in them, the development of the orientation sense and inquiry, analysis capacity and synthesis, as well as, flexibility, reflection, comparison and rationality.

4. Conclusion

The transformations of the education on this century XXI requests of the educational of engineering, the change and position taking with regard to its professional conceptions (educational) and those related to its practice that is to say, to the activities that it accomplishes for efetivar the process teaching-learning. Its current posture before the teaching meets inadequate and requesting the search of new alternatives urgently.

As well as one of the roads to promote new conceptual order postures and practices should be opted by a work of pedagogic training conceived under a reflexive and critical perspective of these educational ones on its own form of performance it drives to changes conscious of order it interns and external translated in a new one he/she practices educational.

A pedagogic training accomplished through a strategy of interactive work that uses the characteristics this way of working in group, where changing experiences, generating restlessness each individual moves for influence of the group and east modifies for the actions of each member.

This way, vivenciando this process the educational acquiring new manners of performance of the educational can drive to the improvement of the process teaching-learning turning it more conscious, effective, motivante.

Promoting these changes created more favorable conditions so that the future engineers truly go by an educational process desenvolvedor.

The our engineers' formation cannot be given without we take into account all the changes that are happening in the world, and at this time with larger importance the changes imposed by the new Law of Guidelines and Bases of the Superior Education, therefore to take to cable all the necessary transformations to place in practice this new educational project, a change of the he/she practices educational of the teachers it should be considered as factor of great relevance.

5. Bibliografy

In that sense, processes of pedagogic training that they look for to transform them of 'engineer-teachers' in 'teacher-engineers' with a new vision of its profession, they should be analyzed and studied as one of the points of larger importance for the improvement of the quality of the

higher education, because we considered that, the teachers act as connection bridges, among the pedagogic objectives and its efetivação in the practice, through the activities accomplished by these to drive the process teaching-learning.

Conceptions of the engenheiros–professores about its training as educational

In summary we can say that, the “engineer-teachers that assume the new professionals' formation, make it carrying I get an entire resulting baggage of its own formation. Until the moment, to be engineering teacher it is necessary to possess engineer's diploma, a masters degree and domain of the technical knowledge in the area in that will act.

If for an educational practice adapted in the engineering schools he/she makes himself necessary two qualification types: the technical qualification, indispensable for its performance as engineer, and the pedagogic qualification for the exercise of its profession as teacher, we can say that few are the educational ones that come exercising its profession in a critical and conscious way, because a minority possesses pedagogic qualification, and a great majority still believes that such qualification is desnecessária(Dantas,1990).

The numerous diplomas, the amount of courses and the years of study in the technician-scientific area, they do a highly qualified professional of the engineer-teacher, but they don't guarantee that its qualification as teacher-engineer is being given as consequence.

To provide the cash acting in its practice as teacher-engineer, it is necessary that formed an alliance with the those technician-scientific acquisitions, also associate those referring ones to the domain of the educational profession. Acquisitions reelecionadas to the repertoire of you know educational that should consist not only in you just know, but also in you know about the knowledge to do.

Without a critical referencial or a consistent pedagogic qualification, kindred of they opt for an or other road, the teachers believe and they don't pretend to have doubts that know about the something and as to teach. And he does with certainty, without contemplating on the reason, the so that and for who to teach, establishing a vicious circle, that reinforces not only the positive aspects but also this professional community's negatives. The technical

knowledge are, undoubtedly, indispensable but not enough so that he/she/it can consider an engineer paymaster to follow the educational career and to act in conditions of great changes as the ones that come happening at the present time world.

New LDB for the engineering courses proposes, dentre other things, that its egresso knows how to conceive, to project and to analyze systems, products and processes; to drift, to supervise, to project and to drive experiments and to interpret results, besides knowing to act in teams multidisciplinares, to communicate eficientemente in the forms writing, oral and graph and to evaluate the economic viability of projects and the impact of the activities of the engineering in the social and environmental context.

Explicit although, each engineering course should have a pedagogic project that demonstrates its objectives clearly and as the group of executed activities they will develop the characteristics and competences waited for the professional that is forming.

It proposes that the structures curriculares should be flexible, to be addressed to provide conditions for consolidation of the knowledge and for complementary activities, objectifying the student's intellectual autonomy; that synthesis works and integration of the acquired knowledge should exist.

And, that enterprising activities should be stimulated, with the objective of developing cooperation postures, communication and leadership.

Analyzing these proposed, it is evident that, several they are the necessary reformulações in the current picture of this teaching, in case one wants to reach with its success objectives. And, under our point of view, one of the existent problems that it can contribute sensibly to hinder the accomplishment of some of the objectives of this LDB, it is related with the characteristics of the teachers' educational practice that act in this teaching.

We believed that close to its implantação, should be efetivados programs of professional superação for the educational ones "... that possibilitan the los graduate university la adquisición, ampliación y

perfeccionamento continues of los conocimientos y basic abilities specialized y requested for un mejor desempeño of sus responsibilities y you work laborales, asi as for su integral cultural desarrollo."

Programs that promote a form of professional superação, through its pedagogic training, that is to say, actions that can propitiate the

appropriation of you know pedagogic that they refer to the knowledge, abilities, habits and necessary values to its activities as teacher. Creating conditions so that this training the light to a transformation, through the "domain y deep comprensión of los fines y la naturaleza of su actuación profesional", as educational.

A transformation based on the reflection and enfrentamento of its conceptions and previous knowledge, in the analysis of its problems and questionamentos, in way to produce the reordenamento and restructuring of its educational practice.

Taking the changes of conceptions, of identification of its practice and of its manners of acting, that is to say, to an improvement of all the activities made by the teacher in class room, being reflected ultimately in an aprimoramento of the process ensino-aprendizagem.

3. Interactive work for pedagogic capacitating

Although, researches accomplished at different countries, place in discussion the old idea that, "the more qualified the teacher, best would be its practice in class room. Teachers with more years of study, more courses, credits and diplomas not always they correspond to its students' best learnings." Or that, one cannot affirm the existence of an automatic relationship "between the teacher's knowledge and the student's learning, or enter the teacher's training and the school revenue"

On the other hand, a lot of researches also indicate that the teacher's performance in class room makes a lot of difference, once this is not only determined by the knowledge of the students, for the social classes, for government's politics or performance of the unions. Besides the social, cultural learning and of values, that happens in class room it cannot be measured with conventional tests not being able to not therefore to be considered as school revenue.

At the present time many works for training of educational come being accomplished with success, like Microcentros in Colombia and Chile, besides those accomplished in Argentina and Spain.

It cannot him still to mention Argentina, United States and Canada other ,dentre, where they meet consolidated works in the pedagogic area, kindred of qualifying university teachers of different areas.

In if being about the engineering teaching, the works developed by the Center of Studios for el Perfeccionamento of la Educación Superior are shown promising in Cuba.

In Brazil, the programs of pedagogic training are practically everybody driven for teachers of 1o and 2o degree. The projects in process for teachers' of the engineering courses training they come still embryonic and the few ones existent they are being accomplished independently by an or other department, of some institutions.

Unhappily, the great majority of the engineering schools as well as own MEC doesn't present nor they motivate, as an obligatory institutional project, the pedagogic training. Until the moment all the training projects for engineering teachers, are centered in specialization courses and masters degree in the technical and scientific areas, that is to say, in its technician-scientific training.

Analyzing the formation and the teachers' training along the last 40 years, we observed that have been going by different tendencies due to a great number of factors that you/they interfere in these processes.

Torres(1998), he/she affirms that in América Latina one cannot speak about the formation and of the teachers' training without considering it influences of demands of internal politics and of international organisms, dentre they Support it World.

Some of those tendencies don't bring a lot of novelties indeed for the formation or the educational training, and consequently for the education, because a lot than it is shown like ' new tendencies ' it is nothing else than old tendencies rehabilitated in new garments, with help of new technologies and of the new educational politics.

Another point for revolutionary changes, creating meantime, contradictory situations that you/they end for resulting in great problems, a lot of times of difficult solution.

In general the educational politics, implanted as developed products and ended from top to bottom, they suffer of the lack of a global vision and sistêmica of the problems, operational or practical, found in its application.

Stopping in the new tendencies of training pedagogic contemporaries observed that come convergent in many aspects. We have as development, professional superação and the professional's permanent or

continued formation still comes being used to designate the pedagogic training that are looking for for the engineering teachers.

Escudero(1998) it defines professional development as “procesos of several aprendizaje, localizables en un enlarges small fan that incluya from el análisis y reflexion on la own práctica hasta el significant acceso y el aprendizaje of nuevos contenidos and abilities to leave del conocimiento pedagogic disponible valuable y.” Affirming although the professional development should not be reduced to

courses, lectures, conferences or work groups, because the process teaching-learning is extremely complex deserving socialização, compartilhamento, critical thought and deep reflections, starting from reference marks to nurture these reflections and to relate theory and practice. Day(1998), it considers that the professional development should base on a perspective of the teacher as person respecting its needs, owing because to be a process of “interacción dinámica among las different stages del profesorado en las that caben sus biographical experiences, factores ambientales, carrera profesional, life y aprendizaje phases the wide lo of the la life.” He/she conceives because, as a process where if interrelacionem personal factors (needs, biographies), with factors of order grupal(outros teachers, the departments, close contexts of formation) and contextual (knowledge and professional resources, culture of the institutional centers, leadership), that is to say, as many authors affirm, a professional development, processed integrally on a personal focus, a social one or colegiado and a contextual.

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