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Opinion of College Students About Comprehensive Learning and Didactic Instrumentation in The Classroom

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ABSTRACT

This paper reports the opinion of a group of engineering students from the Polytechnic University of Pachuca, Mexico about the comprehensive learning and didactic instrumentation in the humanities courses within the university as an opportunity area for analysis of real situations. It was used mixed methodology: in the first part a questionnaire was applied and, in the second part, the focus groups technique was used. For this research were considered contributions of Delors (7) Morin (19), and Torroela (23). The discoveries of this research revealed the importance of the contents of humanities courses and some other essential factors in the didactic instrumentation that impact comprehensive learning.

Keywords: Students Opinions, Comprehensive Learning, Didactic Instrumentation

INTRODUCTION

Nowadays, educational policies shows the need of enhance students development in a holistic way. The impact of education process in the transformation of the individual has been emphasized. That's why it is very important to prepare the student for life.

In this context, the educational model of the Polytechnic University of Pachuca (Universidad Politécnica de Pachuca, UPP) includes among its objectives to promote a comprehensive education in their students. It identifies two main points to enhance the overall education of students. Cultural diffusion programs outside the school constitute the first one. The second one is about the curriculum of undergraduate programs. This research is focused in the last point.

Comprehensive education must have an impact on the development and performance of a highly competent professional on the field and not just only apply an administrative reform in the curriculum.

The process of comprehensive education requires an ethical commitment, and the effort of the entire university community, first of all, to understand it and apply it because depends of various factors and circumstances in the university life. Comprehensive education needs to transcend the whole educational process and educational practices by putting humanities as the principal educational objective.

The UPP educational model has six humanities courses in the curricula as strategy for comprehensive learning: Human values, Emotional intelligence, Interpersonal Skills, Thinking Skills, Organizational Skills and Professional Ethics.

These courses were designed in order to potentate meaningful learning, ethics, values, emotional and social intelligence, harmonious and productive relationships, leadership skills and teamwork. However, the multidimensional character of their contents does not imply that

they only will be taught as a subject, they must remain as values, principles, attitudes and behaviors throughout the educational program to be part of the student environment.

As a first approach to analyze the impact of these courses in the comprehensive learning of engineering programs, percentage of subject failure in the 2012-2013 period was checked and compared. The highest rate of failing was found in Interpersonal Skills (41%), Thinking Skills (29%) and Emotional Intelligence (27%). These courses cover a range of content that are focused on develop capabilities to build collaborative relationships with others, effective communication, teamwork, self-awareness, managing emotions, developing critical thinking and creative problem solving.

It is important to note that currently the training of university students should be multidisciplinary to develop skills that contribute to the pillars of education: learning to know, learning to do, learning to live together, learning to live with others, and learning to be. That´s why it is important listen to them. We asked to 280 students what they think about comprehensive training and the didactic instrumentation.

Research questions

Which themes in the humanities courses impact the comprehensive training of engineering students?

What are the opinions of a group of engineering students about the conditions that promote comprehensive training in didactic instrumentation of courses development human?

This article presents results of a mixed investigation, which shows the contribution of humanities courses in comprehensive learning of students of engineering. In addition to identifying which elements of the didactic instrumentation enhances integral formation. It is organized into five sections: general characteristics of the educational model of the UPP, theoretical approach, methodological design, results and discussion, conclusions and suggestions.

GENERAL CHARACTERISTICS OF THE POLYTECHNIC UNIVERSITY OF PACHUCA

In 2001 a new system of higher education in Mexico was created: Polytechnic Universities gave young people alternatives to study in graduate and undergraduate programs with the aim of meeting the educational demand, attend the needs of business, industry and services sectors in Mexico, and generate innovation through science and technology.

Mexico's Polytechnic University System (UUPP) as part of the Ministry of Public Education (Secretaría de educación pública, SEP), opens the first Polytechnic University in the Mexican state of San Luis Potosi, in September 2001. The educational model is based on competency-based learning, which aims to develop humanistic, scientific and technological capabilities in the student.

For Polytechnic University System, the concept of competence is defined "as the set of capabilities that is reflected in knowledge, skills and attitudes that are a priority in the professional context". It aims to develop humanistic, technological and scientific skills with the training process UPP (24).

The curriculum is divided into three stages that include a total of nine periods in college and one extra in different sectors. The goal of the curriculum is conduct the education process

focused on the development of meaningful learning, which requires the use of strategies such as cooperative learning and different teaching tactics and evaluation processes to identify the level of development of students skills.

The model has an intensive profile, in spite of students finishing the undergraduate program in 3.5 years. In the design process of each curriculum, professional performance is established with the advice of productive, social and academic sectors by the functional analysis method, to identify the specific skills needed to develop satisfactorily in any activity.

Curriculum of each undergraduate program at Polytechnic University System has the following criteria: ten periods, each one of four months (Named *"cuatrimestre",* in spanish); includes approximately 600 hours of training and the only academic requirement for certification is the entire conclusion of the curriculum.

The Polytechnic University System has established 50 polytechnic universities so far. Notably, the state with the largest number of polytechnic universities is Hidal7o with a total of five schools: Polytechnic University of Tulancingo (Universidad Politécnica de Tulancingo, 2002), Polytechnic University of Francisco I. Madero (Universidad Politécnica de Francisco I. Madero, 2005), Metropolitan Polytechnic University of Hidalgo (Universidad Universidad Politécnica Metropolitana de Hidalgo, 2008) Polytechnic University of Huejutla (Universidad Politécnica de Huejutla, 2012) and the Polytechnic University of Pachuca, founded in January 2004.

Comprehensive Learning and Educational Model of Upp

The 21'st Century Education requires tasks that are not only to provide knowledge, also to prepare for life, so their focus is directed towards the teaching of knowledge, skills, attitudes and values. This type of education goes beyond continuing vocational training; Delors (7) suggests that education throughout life "emerges as one of the keys to the twenty-first century" (p.112). ... "Must give each individual the ability to direct his destiny in a world in which the acceleration of change, accompanied by the phenomenon of globalization, tends to modify the relationship of men and women with space and time" (p.113).

The most important reform in Higher Technological Education is the competency-based educational model (EBC). Change is observed in the curricula of the technological subsystems, with each course identified as a necessary competence.

In this context, academic curriculum of engineering acknowledges that is necessary to learn solving exercises, which are also widely accepted as an appropriate instrument for learning evaluation Calllejas et al (4). However, the most important part in this process is the reflection that the student does and that it has to do with thinking skills.

The ubiquitous transmission of already developed knowledge, collections of solved exercises ("no excercises") and the "laboratory practices", with exercises developed like recipes and detached from the logical structure of the subjects. Nevertheless, the growth of the student population and academic failure is producing a social problem (Ibid).

In this context, exercise solving, is a way that can support the incorporation of concepts from different disciplines to student thinking, encouraging students to "take ownership" of them and achieve meaningful learning to assist them in decision making throughout life and not only consider this concepts a way to "approve" a course.

Previous knowledge of students is a specific tool with which they arrive to college, and when they use them in the classroom, promotes, sometimes, critical thinking to identify and solve a problem as the learner builds actively knowledge Driver et al., (8). But then, why should engineers acquire competences?

Being a good engineer is not only a matter of knowledge but also "know-how". There are traditional values such as efficiency, that defines the "engineering virtue" and they are reflected in the outcome of the activity. Those are values in technological education should not be neglected. Nowadays, when technology has gained extraordinary importance, there are other values that should also be present in the education of engineers to make them a professional adapted to their context. This is about educating to innovate and educate to participate López and Valenti, (18) (p. 56).

Transformation of society into “knowledge society” has certainly impacted all sectors. Morin (18) analyzes that human formation cannot be seen from only one aspect neither as the sum of unstructured efforts. The education has traditionally been entrusted to educators, but it is responsibility of society as a whole. The social complexity demands a kind of education that is taken from an inter and trans-disciplinary perspective, looking for synergy between the contributions from various fields.

Technology has changed relationships in work: In the past, up to twenty people were required to do an activity, nowadays a single person is enough. Social processes within work were performed with more people than now, so it is important to identify the role of engineers against technological innovation that require social participation to be viable and consolidated. This increases the need for professional training that prepares engineers for participation and technological innovation, the synergistic work, a critical attitude, autonomous and reflective required to apply it in different contexts.

Due to the last point, Hernández (12) (p.140) notes: " ... acquiring competences that would be associated with knowledge fundamentals, the ability to take on new situations and act with understanding, accountability and efficiency in different contexts [...] capable of appropriating new knowledge through active commitment to the intellectual work and adapt to relatively unpredictable social situations. "

In general, changes in the curriculum had been implemented, but the problem still exists in the process of teaching instrumentation. Most of the teachers were educated in the traditional way; they have some serious problems in breaking paradigms as to accept new teaching strategies. It´s a big challenge take complex problems in the classroom for develop certain competence.

Process of instrumentation is similar to the teaching - learning process Eusse, (9) says that this process involves addition of activities, techniques, resources and procedures that represent the operative part of the procedure as well as certain learning situations and different evaluation forms.

There are many proposals to create an environment that enhances teaching and learning. The Mexican System of Higher Technology Education (Subsistema de educación superior tecnológica. SEP, (22) suggests five aspects to consider in the process of teaching instrumentation; 1) Analysis and organization of content, 2) Clear learning concept, 3) Organization of learning activities, 4) Organization of teaching activities 5) Establishment of evaluation criteria.

In the same vein, UPP considered a teaching strategy as a chosen course of action among alternatives provided to obtain the objective of the task. Teaching strategies are the actions taken by the teacher to organize and present the contents of their subject so directly and indirectly promote student learning CUP,(6) (p.33).

Because of the last idea, student support is essential in teaching and learning process as a factor that allows feedback different viewpoints of stakeholders to generate an enriching dynamic between them. With this we can see that the personalization of education is emerging as one of the main objectives and challenges of the contemporary educational system. Therefore it is important to analyze the opinion of a group of students from several undergraduate programs at the Polytechnic University of Pachuca regarding factors that may favor their comprehensive training.

METHODOLOGY

Some researchers like Perez (19), Bolívar and Fernandez (1) agree when they address the topic of educational research saying that the production of generalizable knowledge is complex, and it never will be enough because the ones who participate in this process perceive the education phenomenon from different points of view and is nuanced by their own knowledge, behaviors and attitudes toward its object of study.

However, the visible characteristics of an event in the educational field are as important as the interpretation of those involved in it from their own point of view. "Therefore there is no single reality in the social sphere in general and to the educational in particular, but there are multiple realities that complement each other. From each of these realities, different perspectives are shown delineated for each singular individual or group. Individuals are active agents who construct in a conditional way, the sense of reality in which they live (Pérez, (20).
To achieve the goal of this research, a mixed methodology was used. About the last point Hernández, Fernández and Baptista (13) (p.21) argued that this type of research (...) represent the highest degree of integration or combination of qualitative and quantitative approaches, both are mixed (...) but provides all the advantages of each one.

Similarly, Johnson and Onwuegbuzie (16) (p.17) defined mixed designs as "the type of study where the research combines research techniques, methods, approaches, concepts or quantitative or qualitative language in one study ".

As a result of the point exposed in the last paragraph, a concurrent triangulation design was used, because it was organized in two stages simultaneously, quantitative data was collected and analyzed to identify contents that promote comprehensive training in engineering students. Also qualitative data were analyzed through focus groups technique to investigate engineering students opinions, thus comparisons of the two results were performed during the course of test interpretation Sampieri, (21).

During the research both paradigms supplemented each other, in the first moment (quantitative) data were obtained to continue the second one (qualitative). The steps were considered as processes, according to Cifuentes (3) in qualitative research, every process is built, written and rewritten, updated, qualified and makes in-depth analysis when new knowledge is addressed or when the researcher did reflection and has more information. The random sample was formed by 280 students of the UPP, of different programs who at that time were taking subjects detected with more reprobate students: Interpersonal Skills, Thinking Skills and Emotional Intelligence.

The following figure shows the research process:

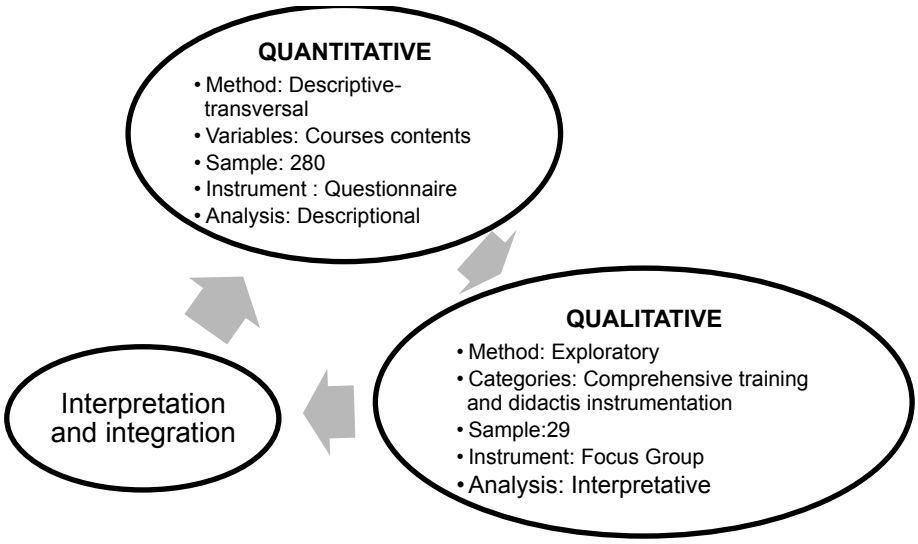

Figure No. 1 Methodological design**.**

As a part of a first approach in the first part of the research, a quantitative questionnaire was used to identify, in the opinion of 280 students, which humanities courses had content that promote comprehensive training. On the other hand, in the qualitative stage of the research, the use of focus groups technique allowed to identifying the factors that helps the comprehensive training of the students.

The focus group technique allows an approximation to the way a certain number of people with common characteristics build an approximation to the reality of a problem or social circumstances according to their experience. This context is characterized by a face-to-face communication, involving different aspects of social and cultural nature that form the perception of the participants and it had to be considered to achieve a wider comprehension of the factors that we want to know, in this case, the importance of comprehensive training for engineering students.

According to Korman (17), a focus group is "the meeting of a group individuals, selected by researchers, to discuss and elaborate, from their personal experience, a thematic or social fact that is under investigation." In the focus group, the emphasis was on interaction and makind in-depth analysis of the most relevant aspects of different topics that were the matter of interest among the researchers and the students. This process led the interaction, discussion and drawing conclusions, as a result of the opinion of participants.

In a methodological review of the focus group technique, four criteria of applicability that allow assessing the strategy used for data collection based on the purpose of the research were identified:1) focus and depth of the subject, 2) targeting and conformation of groups 3) targeting and characteristics of participants and 4) level of involvement of the researcher. Each of these criteria allows the establishment of data quality, and the validity of using the focus groups technique in order to get a greater depth and richness of qualitative information elements, achieving a deeper analysis of the problems identified.

Three student groups and teacher groups were formed from eight to twelve participants each one. From the data collected during fieldwork with the instruments applied to students, three categories of analysis are presented: 1) the meaning of the comprehensive training, 2) the importance of humanities for the comprehensive training and 3) positive aspects that strengthen the comprehensive training in didactic instrumentation of humanities subjects.

RESULTS AND DISCUSION

In the first part of investigation, the used questionnaire was validated with the cronbach's alpha test and a score of .82 was obtained, which means an acceptable degree of reliability. Contents of humanities courses that strengthen comprehensive learning were identified from the students' point of view, the results are shown in the following table:

Table No. 1 Contents of HD subjects favoring comprehensive training

Subject	Contents	No.	1 %	2 %	3 %	4 %
Interpersonal Skills	Communication	191	0			68.2
	Social Intelligence	134	0		48.2	
	Collaborative work	127	0	45.4		
Emotional Intelligence	Multidimensionality	98	0	35.2		
	Emotional Intelligence	126	0		45.2	
	Motivation	204	0			73.2
	Self-Regulation	163	0			58.3
Thinking Skills	Concrete Thought	100	0	35.8		
	Inferential thinking	169	0		60.4	
	Critical and creative thinking	182	0			65.3

Table No. 1 shows the percentage of answers of Likert scale: (4) Important, (3) Moderately Important, (2) Of Little Importance and (1) Not important. It can be observed that the first option (1) has no answers, this reflects the widespread agreement of humanities courses importance for the students' comprehensive learning.

The essential contents for the comprehensive learning according to students' opinion were: Motivation with 73.2%, Communication 68.2%, Critical and Creative thinking 65.3% and self – regulation with 58.3%.

In the other hand, content elected as moderately important were: Inferential Thinking 60.4%, Social Intelligence 48.2% and Emotional Intelligence 45.2%. Results in option 2 were: Collaborative work 45.4%, Concrete Thought 35.8% and Multidimensionality 35.2%.

With the findings identified in the first stage of the investigation was possible to elaborate a first asseveration: All contents of humanities courses are important for the comprehensive learning of students, however, opinions reflect different assessments according to content's characteristics. These results highlight the relevance of integrating humanities in engineering program curriculum.

Gonzalez (11) states that the comprehensive learning is a concept that has diffusely affected the curriculum, and it is often associated with areas of social and human sciences, something that it is still hard to integrate into the engineering curricula.

Derived from what was addressed above, it also was identified in the responses to open questions that some teachers and students consider the comprehensive learning as something

complementary and external to the curriculum. In this regard, Bravo de Nava et. al., (2) note that comprehensive training is a point where a variety of highly complex elements join together and this implicates certain aspects that make a network of specific and particular variables.

In the second stage of research, focus groups technique was organized into four stages in a semi- structured way: a) An introduction in which a document about comprehensive training was analyzed by researchers and the individuals of the group, b) Questions and answers session about humanities classes, their didactic instrumentation and their impact in comprehensive learning, c) identification of conditions that promote comprehensive learning in humanities classes instrumentation, and d) suggestions for improving their comprehensive learning.

To continue the analysis of the results of the questionnaire, as part of the second phase of research open questions used as a trigger for reflection in the focus group were prepared to identify categories, the percentages obtained are shown in the following table:

Table No. 2 Categories of analysis

Categories	Indicators	No.	2 %	3 %	4 %
Importance of humanities for comprehensive learning	Knowledge	13	44.8		
	Professional Development	14		48.2	
	Development as individuals	17			58.6
	Social development	10	34.4		
Meaning of comprehensive learning	Physical, psychological and spiritual balance	18			62.0
	Personal and professional development	22			75.8
	Own welfare	9	31.0		
	Shared experiences	12		41.3	
Teaching strategies that promote comprehensive learning	Relationship Theory - real life	19			65.5
	Teamwork	13		44.8	
	Taking into account the opinion of students	18			62.0

As it can be seen; 58.6% said that humanities are indispensable for development as humans in students' comprehensive training. 75.8% said that the personal and professional development, physical, psychological and spiritual balance reflect the true meaning of comprehensive learning. Teaching strategies that favor the comprehensive training are: 65.5% theory - real life relationship of contents and 62% keep in mind points of view of students. Another aspect that strengthened the above results were relevant comments by the degree of consensus on the importance of humanities. These opinions realized the need to address the different content globally. The students reflected that:

> *"Humanities are quite important, because they provide knowledge that is usually considered useless or not important in engineering"*

In this regard Yuz (25) (p.43) highlights the significance of globalization in education, which refers to how we approach knowledge of reality and how it is perceived, if it involves a totalizing intent regarding their elements. To implement an approach to globalization, proposals of organization of knowledge are important, as well as generate a challenge in teaching instrumentation. So that information can be transformed into knowledge and in turn

mechanism that enriches the quality of life of students. Students claimed that the contents of the subjects of human development:

> *"...Are important because they allow us to develop not only as professionals but also as individuals"*

Different ways to address the complexity of comprehensive learning can be found. From an anthropological dimension, it focuses in the development of physical, intellectual and moral faculties of man, from a psychological level is considered rational, cognitive, behavioral, sensitive and spiritual. These elements can be seen translated from pedagogy in the development of thought, actions and feelings.

From the approach of didactid methods, Zarzar (26) distinguish the components that promote comprehensive learning in teaching - learning process, integrated in knowledge, abilities, attitudes and ethic values.

Zarzar talks about a system that integrates: information, intellectual skills, psychomotor skills, methods of obtaining knowledge and work systems, habits, attitudes and ethic values. About that, students detected the need of complement various factors from the perspective of their specific curriculum and, with that, strengthen comprehensive learning:

> *"Personal and professional development of an individual, both should be 'together'; address weakness that could exist in both of them"*

Students' opinions showed the search of balance in their formation. Torroella (23) acknowledges the importance of "pedagogy of being", which consists in education for life, focused in two aspects: individual and social. It is addressed to comprehensive development of personality, potentiality, and plenitude of human being.

In this regard, different authors agree when pointing out the following guiding principles: student focused education; respect and acceptance of student, as a fundamental attitude of educator; a link with life, in the sense of "take school into life and bring life into school", school as a life lesson. Something that was reflected by students' opinions:

> *"Work with fisical, psychological and spiritual facets equally"*

In order to get this balance, students' academic side can be enhanced inside and outside school to favor teaching - learning process of the contents that derives in comprehensive learning, all of this through the outline of every course in curriculum and with scholar activities. From this perspective, humanities will become the cross-curricular topics that will be used to humanize scholar process. However, in order to do this, opinion of students is needed:

> *"Professors with enthusiasm and ethic values that use a wide variety of teaching strategies and technological tools inside the classroom"*

This, with the objective of plan, organize and implement curricula in a more humanistic and cross-curricular way, in order to link their contents with real life situations and students' personal development as human beings. That's why, all teachers need:

> *"We need enthusiasm and positive attitudes. An interactive way of teach themes, linking them with real life situations"*

In this regard, university education must offer a wide range of scientific, technological and humanistic experiences, all of them related to "real life". Is important to say that university education must not be under rules imposed by market dynamics: It has to contribute to independence of individuals and development of human being, in a permanent definition of pedagogic utopias and social, Inciarte, (15).

CONCLUSIONS

The findings show the challenge of technological higher education, which implies taking responsibility of being in educational field and try to take awareness in a more demanding world that requires individuals formed in a holistic way.

It is necessary orient curricula towards expectations of social, scientific and institutional context. This work requires that educational institutions consider they can not be passive and/or indifferent to social demands, which should promote reflection of society itself, and the institution as a social organization, whose essence are the formation processes inspired by the desired society Inciarte, (14).

To do this, it is necessary to generate a change in institutional culture that promotes solidarity work, so that promotes collaboration between disciplines and, ultimately, eliminate fragmentation in curricular contents. González [(10) (11)] "social problems analysis are necessary to consider in curriculum.

Besides this Morin (19) also says that addressing tomorrow education a re- attachment of knowledge resulting from the natural sciences to locate the human condition in the world, those resulting from human sciences to clarify the human multidimensionality, human complexities and the need to integrate the invaluable contribution of the humanities. This can reassert the value of the opinions of students that emphasize the importance of the subjects of human development for their comprehensive training, however they noted that there are still challenges to face because in these subjects is necessary to enhance empathy and collaboration with other subjects.

Under this approach university education requires expand its choices with the following levels: understanding the technical terminology of various disciplines, critical use of technology, mastery of symbolic languages, developing sensitivity to humanities and arts, and exercise the body through physical activity. All of this implies promote scientific and technological reasoning, ethical sense, personal responsibility, commitment to sustainability, diversity and social commitment. Learning would become a practical experience and not just an experience based on abstraction and theoretical discussion.

According Campo and Restrepo (5) when an educational organization is looking for Integral training of people, the teacher-student relationship should be exemplary, "model to" and "model for" think and understand other relationships in all areas of everyday life, work with colleagues, between different hierarchical levels between academy and administration.

Students perceived the importance of humanities as an indispensable part of their professional development. Motivation was also highlighted, as an important factor in learning, thinking, communication and cooperation process, so it is convenient to use different teaching strategies that promote students' interest in their development as individuals.

So it is essential planning and organize curriculuma and courses with a great humanistic sense, that's why is important the relationship between different disciplines and converge to real life situations, especially to experience lived by the student. When students link real life situations with school contents, it favor significant learning that could impact, in a good way, their academic performance and quality of life, in a way that an engineer will have acquired knowledge and attitudes of service and attention to others. There are elements that, nowadays, are lacking in graduates.

The results can generate a challenge to teachers to carry develop skills to work in a collaborative and multidisciplinary manner, that allows placed in the center of the educational process the comprehensive training of student.

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