Study of Generic Competencies and Performance Quality in Students by Multivariate Analysis

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***Abstract*– The objective of the research includes studying the relationship between generic competence and quality in the performance of engineering students by multivariate analysis model. In particular, the case of software engineers. The results explain the relationship between generic competences and quality in the performance of engineering students using multivariate analysis models. The conclusions students in the opinion of employers, teachers and students themselves; allowing higher education institutions to make timely decisions in order to strengthen the educational offer by providing students develop their generic skills there by achieving timely insertion in the workplace.**

Keywords—HighEducation, generics-competences, performance-quality.

I. Introduction

In recent decades, the concept of competency has been used in the development of education and vocational training. Weigel and Mulder (2006) noted that the first contributions to the academic field of competition assuming different names: skills training, curriculum-based approach competition; all direction to become an alternative education.

The institutionalized use of competencies in the development of vocational training is a phenomenon that has appeared mixed with other innovations such as the introduction of self-learning, integration of theory and practice, validation of prior learning and new learning theories such as authentic learning, social constructivism and knowledge construction. The concept of competency draws interest, therefore, towards significant objectives and content of learning that constitute the personal development of students and their position in the domain of knowledge that better prepares them to function effectively in society (Weigel, Mulder & Collings, 2008).

Possibly with this perspective, in the year 1998 it was held in Paris a meeting that was attended by four ministers of higher education representatives from England, Italy, France and Germany, with which a process of educational transformation starts; there analyze the evolution of higher education, promoting the need to create conditions that encourage mobility, cooperation and approval of credits in initial and continuing education.

The proposal of this group results in the Bologna (Italy) in 1999, with the participation of 30 European states, which in 2000 allows for the creation of a draft collective work of universities called Tuning Project Alpha and In 2004, Latin American universities, including those in Mexico, launched a similar project, the project Alpha Tuning Latin America, currently it has the participation of 19 countries and nearly 200 universities (Ramirez & Medina, 2008).

Deusto University in 2007 published a book about the Tuning Project in Latin America, it is possible to read about the differences between the two projects. The Tuning Europe has a more precise framework because it takes into account the guidelines established by Bologna, also in the more than 175 European universities, but also makes the rest of higher education institutions think about and discuss the results achieved, whose main goal is to share the same space of higher education by the year 2010, in a simplified manner it should be understood that from the agreed powers, there is a high mobility of students and academics, where diplomas and degrees will be valid throughout the European Community from the concept of transferable credit (Manriquez, 2012).

While, the Tuning Latin America although it also seeks to identify and exchange information and improve collaboration between higher education institutions for the development of quality, effectiveness and transparency education project does not have a clearly agreed policy framework as which it owns Europe and has a date to realize a Higher Education.

Following the methodology, Tuning - Latin America has four major lines: 1) competences 2) approaches to teaching, learning and assessment of these competences; 3) academic credits; 4) quality of programs. In particular, speaking of the competition model we have found that there are various definitions, due to the large amount of research that exist on the subject, some definitions are presented below:

Bunk (1994, cited in Mulder, 2007) described the formal competence as imparted responsibility and material competence is acquired capacity. Competition also defined as an underlying characteristic of a person, which is causally related to successful performance in a job (Boyatzis, 1982, cited in Gil, 2007).

McClelland (1973, cited in Capuano, 2004) mentions that competence is the ability to effectively develop work using the knowledge, skills and understanding required as well as the attributes that facilitate contingent situations and solve problems.

As the definition that most adheres to our research Martinez, Rioperez & Lord (2013) define competence as the ability to meet complex demands in a particular context

through the mobilization of knowledge, cognitive skills and practices, and social components and behavioral such as attitudes, emotions, values and motivations. The competences integrates and mobilizes resources acquired through experience and training, and all of it is relevant to the situation in which competition operates.

The concept of competence in education, is presented as a broad conceptual network, which refers to integral formation of citizens, through new approaches such as meaningful learning in different areas: cognitive (knowledge), psychomotor (knowhow, aptitude), emotional (knowing being, attitudes and values). In this sense, competition can not be reduced to the simple job performance, not a single appropriation of knowledge to know-how, but encompasses a whole range of capabilities, which are developed through processes that lead to the person responsible to be competent to perform multiple (social, cognitive, cultural, affective, labor, productive) shares, which designs and demonstrates its ability to solve a given problem, within a specific and changing context (Gomez, Gonzalez Ramos & Rodriguez, 2012).

Thus, the integral formation unfolds gradually, by level of complexity, in different types of competencies. The competence as intelligence, is not an innate capacity but, on the contrary, is likely to be developed and constructed from each internal motivations.

The Tuning project competences classifies into two basic types:

-Generics (Transverse, common to all professions). These skills include elements of cognitive and motivational order and are expressed through the so-called:

-Competencies instrumentals, methodological or procedural, such as the capacity for analysis and synthesis, organization and planning, and information management.

The personal competencies such as the capacity for team work, ability to manage interpersonal relationships, ethical commitment.

- The competencies systemic manifested in autonomous learning, adapting to new situations, creativity and leadership, among others. The specific competences are related to particular profession.

According to the above classification, we mention that in Mexico, the National Development Plan 2013-2018 PND defines one of the objectives "Raising the quality of education," proposing a strategy 3.1.3 Reforming the scheme and evaluation of plans educational programs of higher education; therefore, the University Autonomous of Nuevo Leon (UANL) has established the evaluation process at different educational programs (PE), one of them PE Technology Software Engineer TSE (UANL, 2012). This educational program is newly established and since its inception was designed under the scheme competency (UANL, 2008).

The Faculty of Mechanical and Electrical Engineering of the UANL offers 10 educational programs where one of them is the TSE. This paper focuses on studying the relationship between generic competencies TSE and quality in the performance of engineering students, which are linked to discipline and are what confers identity and consistency to the program.

Competencies Educational Program Technology Software Engineering

The generic competencies are taken from document university general education at the University Autonomous of Nuevo Leon and divided into three groups: Instrumentals, social interaction and integratives. These skills are not unique engineering as they are acquired in any profession (UANL, 2008). These competitions are promoted by the UANL to achieve the integral formation of students. They are described below:

1.Instrumental competencies: These skills include the abilities, skills and abilities that have an instrumental role in the current professional field and can be of linguistic, methodological, technological or cognitive, own professional profile required for international and local competitive nature.

2. Social Interaction competencies: These are skills that facilitate personal and interpersonal process of human development, social interaction and cooperation through the expression of feelings, criticism and self-criticism.

3. Integrative competencies: This type of competencies includes those related to the development of knowledge, skills, attitudes and values that integrate both instrumental skills and those of social interaction, and allow the graduate scope, together with the development specific skills of their profession, comprehensive training to do so competitive, both locally, nationally and internationally.

For this arise the following research questions: Are the generic instrumental competencies are directly related to the quality of student performance engineering? Are the generic skills of social interaction directly impact the quality with which our students perform? What generic skills they are directly related to integrating quality performance engineering students?.

That is why we set as an objective of the investigation to determine whether there is a direct relationship between generic skills that students develop during their professional training and the quality of their performance in a globalized

environment, international competition. Therefore, we propose a model of multivariate analysis where the independent variables are instrumental generic skills, social and inclusive interaction and the dependent variable quality in student performance. This research is limited to student evaluations TSE.

II. METHODOLOGY

Research is the explanatory correlational. It seeks to determine the relationship between generic competencies that students develop during their professional training and the quality of their performance in a globalized environment. Therefore, multivariate analysis performed by the regression model, in order to test the following hypotheses:

- *Instrumental generics competencies are directly related to the quality of student performance TSE.*
- *Social interaction generics competencies are directly related to the quality of student performance TSE.*
- *Inclusive generics competencies are directly related to the quality of student performance TSE.*

Next we define the independent variables:
-The Instrumental generic competencies are: verbal and written communication, self study, IT management, logical thinking, critical, creative and mathematician, communication in a foreign language. They are defined as:

VC: verbal communication. Opportunity to express clearly and ideas, knowledge and feelings through words, adapting to the characteristics of the situation and the audience to gain their understanding and adherence (Villa & Poblete, 2007)

WC: written communication. It is to relate effectively with others through the clear expression of what you think and / or feel, through writing and graphics support. (Villa & Poblete, 2007).

SS: Self study. It is to expand their ability to learn regularly improving their skills and increasing their knowledge. (Policy & Branch, 2005).

IT: IT Management. Ability to use computers and have computer skills (Policy & Branch, 2005).

LT: Logical thinking. It is the mental behavior that develops ways of thinking typical of knowledge in general and scientific knowledge in particular, paying attention to its structure (Villa & Poblete, 2007).

CT: Critical Thinking. mental behavior that questions things and cares about the grounds on which ideas, actions and judgments own and other (Villa & Poblete, 2007) are based.

CREAT: Creative thinking. mental behavior that generates processes of search and discovery of new and unusual solutions, but meaningful, in different areas of life (Villa & Poblete, 2007).

ML: Mathematical language. It is the ability to use and understand numbers (Policy & Branch, 2005)

CFL: Communication with native and foreign language. It is to understand and be understood verbally and written using the language and a different language itself (Villa & Poblete, 2007).

- Generic competencies of social interaction are teamwork, adaptation to the environment and management of ethical sense, defined as follows:

WIMT: Working inter, multi and transdisciplinary. It is integrated and collaborate actively in achieving common goals with other people, areas and organizations (Villa & Poblete, 2007).

AE: Adaptation to the environment. Is facing critical situations the psychosocial environment, maintaining a state of well-being and physical and mental balance that allows the person to continue to act effectively (Villa & Poblete, 2007).

SE: Sense ethical. Positively lean toward the moral good of oneself or others (ie, towards everything that means, experience of meaning, personal fulfillment, sense of justice good) and to persevere in that moral good (Villa & Poblete, 2007).

- Integrative generic competencies are: leadership, generation and application of knowledge, problem solving and decision making.

LEA: Leadership. Influencing individuals and / or groups anticipating the future and contributing to their personal and professional development (Villa & Poblete, 2007).

GAK: Generation and application of knowledge. It is to strengthen and renew existing knowledge and / or create new knowledge (Alles, 2004).

TRO: Troubleshooting. It is to identify, analyze and define the significant elements of a problem to solve it judiciously and effectively (Villa & Poblete, 2007).

DM: Decision making. It is to choose the best alternative to act, following a systematic process and taking responsibility for the scope and consequences of the choice taken (Villa & Poblete, 2007).

The dependent variable *quality in student performance* (QSP) is defined as the ability to constantly pursue excellence in personal or professional oriented to results or achievements directly related to his profession, committed to continuous improvement (Gonzalez, 2013).

For exploratory sampling a measuring instrument containing a total of 102 items, previously validated by Cronbach's Alpha index was designed. The measuring instrument designed is applied to students.

The universe is made up of the total TSE students of the first and second generation has 181 students (129 and 52 respectively). This research is part of Phase I of an investigation. Therefore we will only exploratory sampling for this research. The sample includes 103 students of STI. Handling and data analysis using SPSS software worked.

A total of 102 items, of which 96 items correspond to independent variables were included in the instrument; while only 6 items correspond to the dependent variable quality in performance (QP). 1-Without any objection, 2-One or two objections and inconsequential, 3-One or two objections but important, significant 4-Objections, abundant 5-Objections and 6: the following Likert scale (1-6) is proposed objectionable completely.

The methodology followed in the development of research only includes quantitative analysis. The methods and techniques used are: analysis of theoretical sources related to research, in order to clarify the background; justification of the study and prospective analysis. Construction and validation of questionnaire (using Cronbach's Alpha) applicable to students to investigate the degree of development of generic competences related to performance quality. In addition correlational analysis by the regression model are included to test the significance of the independent variables on the dependent variable.

III. DISCUSSION

Reliability of the instrument

For reliability analysis instrument applied to 103 students randomly cases in order to measure the rate of Cronbach's Alpha with the following results (see Table 1) were analyzed:

TABLE I
INDEX CRONBACH'S ALPHA , N = 103

Variable	Cronbach´s Alpha
VC	0.835
WC	0.895
SS	0.843
IT	0.901
LT	0.910
CT	0.899
CREAT	0.835
ML	0.785
CFL	0.826
WIMT	0.886
AE	0.855
SE	0.921
LEA	0.870
GAK	0.843
TRO	0.834
DM	0.877
QP	0.829

Reliability analysis of the items analyzed for each of the variables and dimensions indicated Cronbach's Alpha values acceptable for research to be greater than 0.7, where, according to Hernandez Sampieri *et al.* (2006) are considered acceptable for the instrument.

To test the hypothesis of this investigation the independent and dependent variables were weighted. The variables to be run in the regression model are variables:
INSTR. It is the average of the variables associated with the classification of instrumental skills: SS, LT, CT, CREAT, VC, WC, ML, CFL, IT.

SOCIN. It is the average of the variables associated with the classification of competencies of Social Interaction: SE, WIMT, AE.

INCLU. It is the average of the variables associated with the classification of integrative skills: GAK, LEA, DM, TRO.

The multiple regression model allows us to estimate the relationship between the constructs and the significance of the hypothesis of this research, the following results (see Table 2, Table 3 and Table 4).

TABLE II
SUMMARY OF THE MODEL, N=103

Model	R	Square R	R square adjusted	Standard error of estimate
1	.947[a]	.896	.892	0.5234
a. Predictors: (Constant), INSTR, SOCIN, INCLU				

R-squared coefficient obtained was 0.892 model which allows us to explain according to the literature review.

TABLE III
VARIANCE ANALYSIS, N=103

Model		Sum of squares	lg	Mean-square	F	Sig.
1	Regression	235.21	3	76.569	285.80	.000a
	Residue	25.244	99	0.372		
	Total	258.350	102			
a. DEPENDENT VARIABLE: QSP						
b. Predictors: (Constant), INSTR, SOCIN, INCLU						

TABLE IV
VARIANCE ANALYSIS, N=103

Model		Non-Standardized Coefficients		Standardized Coefficients	t	Sig.
		B	Standar Error	Beta		
1	(Constant)	-.706	.352		-2.103	.030
	INSTR	.324	.076	.345	4.451	.000
	SOCIN	.262	.154	.191	2.721	.030
	INCLU	.455	.096	.444	4.580	.000
a. DEPENDENT VARIABLE: QSP						

Taking into account the assumptions made in the investigation which stated that the higher the degree of development of generic competences instrumental, higher quality performance, support for same ($b = .076$; $p<0.05$) was found.

For the research hypothesis which stated that the higher degree of development of generic competences of social interaction, higher quality performance, support for same ($b = .191$; $p<0.05$) was found.

Taking into account the assumptions made in the investigation which stated that the higher degree of development of integrative generic competences, higher quality performance, support for same ($b = .444$; $p<0.05$) was found.

Whereas was taken perception of students there may be variation from the opinions of the employers themselves. However it will be possible to check after the next phase in the investigation.

Within the limitations of the research it is important to highlight that includes only the opinion of students Education Program Technology Software Engineer, which is recommended to validate the instrument and study again the assumptions made by determining its validity for engineers other disciplines in order to generalize the results and ensure quality training of engineering students able to face a globalized environment as demanded by society today. One of the recommendations and future short-term goal of this research is to include more variables in the later stages of this investigation in order to complete the study.

IV. CONCLUSIONS

In this research, an evaluation model based on generic competences associated with TSE is implemented. The University Autonomous of Nuevo Leon has made evaluation processes of its professionals in the workplace and in a global or international environment, however it is necessary to standardize these processes and tools (which are commensurate with the competences assessed) and the appropriate means for development or execution of each of the generic competences.

This type of periodic evaluations allow to the institutions feed back on the needs of each student so that those responsible for directing such educational programs to ensure comprehensive training preparing competitive professionals able to adapt to any environment labor market, achieving the goal of higher education in Mexico: Offer quality education.

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