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Artículo

THE EMOTIONAL AND INTELLECTUAL CAPITAL OF THE PEOPLE THROUGH OPERATIONAL MODELS AND MULTIVARIATE TECHNIQUES

EL CAPITAL EMOCIONAL E INTELLECTUAL DE LAS PERSONAS A TRAVÉS MODELOS OPERATIVOS Y TÉCNICAS MULTIVARIADAS

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RESUMEN

El artículo trata sobre el *problema de las emociones* en la persona como entidad organizativa, analiza y aporta los constructos de Inteligencia Emocional (EI), Capital Emocional (EC), Capital Relacional (RC) y Capital Intelectual (IC), considerando como base la aplicación de la escala TECER. La escala TECER (Test de Capital Emocional y Capital Relacional) fue diseñada y aplicada a una muestra de 892 estudiantes universitarios y graduados, recogiendo información cognitiva, emocional y relacional. Asimismo, se formularon los modelos operacionales IC_{om}^2 (Modelo Operacional de Capital Intelectual) y EI_{om}^2 (Modelo Operacional de Inteligencia Emocional) para el tratamiento IC y EI y mediante un proceso de contraste de hipótesis se validó un conjunto de hipótesis, considerando como base de la investigación los aportes obtenidos a partir de la revisión de la literatura y de un análisis bibliométrico y altmétrico. Finalmente, se aplicaron técnicas de análisis multivariante para formular modelos de conglomerados, escalado multidimensional, componentes principales y análisis discriminante, todo lo cual permitió mejorar los modelos operativos y proponer recomendaciones para la mejora de los constructos.

PALABRAS CLAVE: Inteligencia Emocional, Capital Emocional, Modelo de Capital Intelectual, Capital Relacional, Escala Emocional, Análisis Multivariante, Clúster, Componentes Principales, Análisis Factorial, Análisis Discriminante.

ABSTRACT

This paper examines the “*problem of emotions*” in a person as an organizational entity. It also analyzes and contributes the constructs of Emotional Intelligence (EI), Emotional Capital (EC), Relational Capital (RC) and Intellectual Capital

(IC) based on the application of the TECER scale. The TECER scale (Test of Emotional Capital and Relational Capital) was designed and applied to a sample of 892 graduates and university students, collecting cognitive, emotional and relational information. The operational models IC_{om}^2 (Intellectual Capital Model) and EI_{om}^2 (Emotional Intelligence Model) were formulated for the treatment IC and EI as well, and through a process of hypothesis contrast a set of hypotheses was validated, considering as the basis of the research the contributions obtained from the literature review and from a bibliometric and altmetric analysis. Finally, multivariate analysis techniques were applied to formulate cluster models, multidimensional scaling, principal components and discriminant analysis, which allowed improving the operational models and proposing recommendations for the improvement of the constructs.

KEY WORDS: Emotional Intelligence, Emotional Capital, Intellectual Capital Model, Relational Capital, Emotional Scale, Multivariate Analysis, Cluster, Principal Components, Factor Analysis, Discriminant Analysis.

INTRODUCTION

Nowadays, Emotional Intelligence has become such a crucial issue that, if we do not consider it in the analysis and in individual treatment of people it can diminish the importance in the personal and professional sphere of the values that contribute to the development of society in which organizations are built and sustained by and for the people.

Thanks to efforts of many researchers and professionals since the mid-1950s and in particular to great contribution made by them in the last decade, we can see a development, evolution and combination of concepts of emotion and intelligence that support the Human Capital

(HC) and its main components, the Cognitive Sphere (IQ: Intellectual Capital) and the Emotional Sphere (EI: Emotional Intelligence) and even though the scientific production at level of models, tools, applications and evaluation is significant, EI as a construct has not yet been consolidated.

The concepts that make up both HC and EI today cannot be excluded from the analysis of people's development. They show the importance of emotions in learning or in their relationship with "soft" or intangible skills of the human being (Lazarus 1991) or as a mental response to any psychological, experiential and cognitive event (Mayer et al., 2001), and even in studies referring to people's actions, in terms of the behaviors and motives that inspire them (LeDoux, 1999).

Thus, the evolution of concepts, in the context of knowledge management in which the study of intangibles is inserted and of which IC and EI are part, have reflected a variety of proposals and different perspectives that include not only environmental and situational dimensions, but also cultural and personal perspectives.

From the viewpoint of knowledge management, the Intellectual Capital of a person as an organizational entity is conceived as a component of intangibles and it is mainly composed of Cognitive Capital. This is characterized as the "academic capacity for training and development acquired before and after a formal or personal education program", together with the skills related to "doing" and which is part of the context of Intelligence and EI, which comprises the "set of intangible skills of emotional and relational type of a person" (Bisquerra & Perez, 2007 and Goleman, 1998).

At present it is difficult to give a consensus definition of EQ as a term and as a construct. In most cases, the answer will depend on who

you ask or which book you consult. After the success of Goleman's book (1995), a multitude of definitions, conceptions and components of the most varied claimed to be part of the concept emerged.

Among the numerous definitions that diverse authors have pointed out, in support of the formality of the EQ construct, the contributions of Salovey & Mayer (1990); Salovey, Mayer & Caruso (2001, 2002), Goleman (1995, 1999, 2001, 2006, 2021); Bar-On (1997); Boyatzis, Goleman & Rhee (2000); Extremera & Fernández-Berrocal (2002) and Stys & Brown (2004), among others, can be mentioned. In the spirit of their contributions, it is clear that EQ is not only an aptitude and that it is a mistake to contrast the management of emotions with the capacities usually associated with the concept of intelligence (Colom & Froufe, 1999).

If there is anything worth highlighting by scientific research on intelligence, it is the contributions made mainly by Gardner, Meyer, Salovey, Extremera, Goleman, Bar-On, Fernández-Berrocal, Coles, Damasio and Caruso, among others, that talk of a large number of aptitudes (Colom, 1995, 1997, 1997, 1999 and 2005; Juan-Espinosa, 1997). However, this variety of abilities is compatible with the existence of a general intelligence common to all of them. In the approach to the capabilities that improve the general and current development of people, the theories and models of intangible management have not assigned sufficient importance to emotional capital as a fundamental part of emotional intelligence, and although in the field of theories and models of competitiveness based on talent management, there has been a strong interest in the management and improvement of certain competencies to increase "success". In general, they are oriented towards increasing business value or increasing specific competencies, confirming the need for operational models to characterize, evaluate and

develop improvement initiatives but interacting at the individual level in the context of EI and complemented with the intangible capabilities of relationships.

Therefore, the ability to intelligently manage emotions would be distinguishable from all other skills, but it would also have elements in common with them. Consequently, that aptitude capable of managing emotions is Emotional Intelligence and its promotion should be done in a coordinated way with the promotion of the other abilities (Salovey & Sluyter, 1997). Emotional intelligence can be improved with better recognition of education, experience and emotions over time. Being aware of a person's capacity and strengths / weaknesses, being able to take responsibility, control their emotions and manage their relationships, reveals their talent in emotional intelligence (Balyan, 2021), a talent that allows controlling emotions, one's own feelings and the feelings of others with the intention of guiding thoughts and actions, allows the effective regulation of emotions in oneself and in others, and the use of feelings to motivate, plan and succeed in life (Moreno-Fernandez et. Al, 2020).

Specifically, considering as a basis the most accepted academic definition of EI made by Mayer & Salovey (2007), the contributions mentioned above and the considerations proposed by the main contributions in the context of the cognitive and emotional sphere, EI for the research conducted is understood as follows:

“It is the set of skills that allow us to recognize, value, express and control our own and others' emotions, generating feelings that facilitate thinking and promote emotional and intellectual growth, within a framework of harmonious and respectful social interaction, generating an atmosphere of trust and empathy” (Magna, 2016).

Intangible management theories and models have not assigned importance to emotional capital and although in the field of competitiveness theories and models based on talent management, there has been a strong interest in improving certain skills to increase “success”. The contributions, in general, are aimed at increasing business value or increasing specific competencies, confirming the need to have operational models that allow characterizing, evaluating and developing improvement initiatives but interacting at individual level in the context of EI and complemented with the CR.

In this context, the research carried out as part of the doctoral thesis in Business Administration and Management, at the Universitat Polytechnic de Catalunya, BarcelonaTech, Spain, helped formulate a proposal of an operational model to identify the CE of the people who study in the university and of graduates who develop professional activities; corresponding to specific programs and located in different campuses of the Technological University Metropolitan of Santiago of Chile (Magna, 2016), and considering its evaluation, to characterize the determining aspects of improvement that allow a better development of the human capital both the study process and in the professional life.

The research postulates, among other aspects, that the basis of the development of people is their emotional dimension and although in the theory it has been mostly referenced as EI (Mayer et al., 1999; Pérez et al., 2005; Smieja et al., 2014), from the point of view of the construct itself and its scope. It is clearer to postulate EI as a construct composed of two constructs at the same time, CE and CR, considering that its components represent personal emotions and relational personal emotions.

Considering the person as an organizational entity, the research allowed us to analyze and make contributions about EI, CE and CR as

well as in the cognitive context (CC: Cognitive Capital). The elaboration and application of a new scale (TECER) allowed to formulate models for the recording and the operational treatment of the constructs. Likewise, a set of recommendations was proposed for the improvement of the constructs, in particular, the CE, as a consequence of the review of the literature, the bibliometric analysis and altmetric, the validation of the hypotheses and the results and models multivariate obtained.

METHODOLOGY

TECER as a self-report instrument, was created to obtain emotional, relational and cognitive information and with the operational models of IE_{om}^2 and IC_{om}^2 (Magna, 2016), to identify the emotional intelligence, intellectual capital and emotional capital of undergraduate and graduate students. From the application of TECER and its evaluation with operational models, determining aspects of improvement are characterized for a better development of the human capital of people in university and professional life.

1. TECER'S FUNDAMENTALS

In the formulation of the structure and initial model of TECER, the models and scales contributed by the following authors and described in Magna (2016) and Goleman (1995, 2001 and 2006) and Boyatzis (2000) were considered as a reference framework. We also considered the components, subscales and emotional intelligence factors of the TMM-24/48 test (Fernández-Berrocal, 2004), the four-phase model (Salovey & Mayer, 1990), and Gardner's multiple intelligences models (1993 and 1995), EQi of competencies (Bar-On et al., 2000; Bar-On, 1997), ECI (Boyatzis et al., 1999, 2000; Hay, 2005; Goleman et al., 1999, Goleman, 2001) and

the EIA model (Bradberry & Greaves, 2009); the support guide for the IE EQ-six model (SixSecond, 2005), the Emotional Intelligence scales MSCEIT (Mayer et al., 2002), CIE (Mestre 2003), TEIQue (Petrides & Furnham, 2003) and TMMS-48 (Fernandez-Berrocal et al., 2004), the SSRI self-report measures (Schutte et al., 1998), Eq-Map Oriolo and Cooper (Rodríguez et al., 2005) and the multifactor scale MEIS (Mayer, et al., 2002) and the skills and abilities of the ELS emotional teaching system (Nelson & Low, 2003).

We also considered aspects of emotional intelligence models based on self-regulation based on Bonano's general self-regulation category (Bonano, 2001), model elements based on cerebral dominance considering the EQ Difference model (Lynn, 2001) and the model of levels of awareness and emotional expression for emotional intelligence (Lane & Schwartz, 1987).

As basic elements of the formulation, the cognitive areas of development and the subscales and factors of the MCEIT instruments (Mayer et al., 2002, 2003), EQ-Map by Oriolo and Cooper (Rodríguez et al., 2005) as well as aspects of the social or interpersonal and personal dimensions or self-consciousness of the Midas test (Shearer, 1996) and the subscales of the MEIS tests (Mayer et al., 2000), ECI (Goleman, Boyatzis, 1999), EQi (Bar-On, 1997), ISRI (Schutte et al., 1998), TEIQue (Petrides & Furnham, 2003), SEI (Six Second, 2005) and the skills and competences of the EIA test (Bradberry & Greaves, 2009) were considered.

2. WORK'S ORGANIZATION

The research work (Figure 1) contemplated three stages: Presentation, Development and Conclusion, on a design with quantitative methodological modality, a descriptive / co-

relational investigation, a non-experimental work strategy with trans-sectional temporality and correlational scope, with sample and period not probabilistic. This process allowed to characterize and analyze the CE in students and graduates, considering, in addition, age, sex and area of studies (social, administrative and

engineering) and it was established correlations with respect to CR and to the cognitive potential associated with the academic/professional capacity (CC).

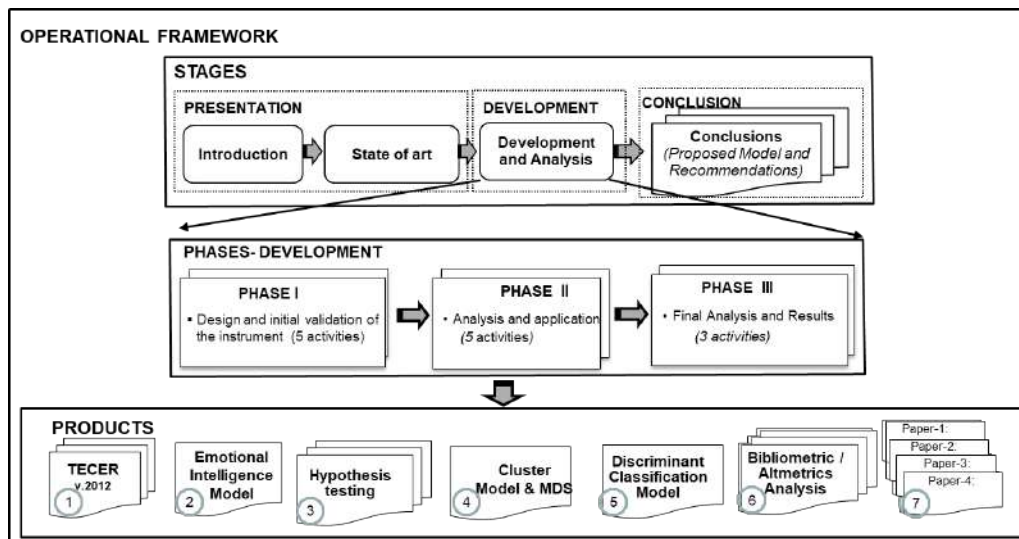


Figure 1: Investigation Process. Source: Prepared by the authors.

Operationally, the TECER research and implementation process was organized in three phases with 16 activities: design and pilot application phase (in 3 undergraduate programs with 176 students and 35 university graduates) and formulation of Initial IE model; application, analysis and improvement of TECER scale (92 items, 2 subscales, 4 dimensions, 18 factors and 158 statements that correlate the 92 items), application to final sample (827 students from 14 first and last year academic programs and 65 graduates, with anonymization of personal information) and final analysis phase that includes hypothesis testing, application of

multivariate analysis techniques (to support the formulation and improvement of the IE and CI models) and formulation of the results (Rencher, 2002).

RESULTS

The results obtained allowed to characterize the CE, the CR and cognitive antecedents (CC), to formulate a new scale (TECER), to formulate the models of EI_{om}^2 , IC_{om}^2 , to contrast six hypotheses and to formulate the cluster and discriminant models.

In addition, as part of the visibility of results of the doctoral process, four articles presented at two international conferences were prepared. Three of them were indexed in WoS and ProQuest.

Some of the results obtained are indicated below, according to considered topic.

1. CONSTRUCT'S CHARACTERIZATION AND MODEL FORMULATION

The model of EI_{om}^2 and its operationalization is presented in Figure 2, it is based on a structure of scale/subscales and component/factors (Figures 3 and 4), consisting of 13 emotional competencies. It presents a reliability statistic of more than 0.9 both at the scale level and the subscale level (PEC and SEC) and from the point of view of the four component factors (CP, RP, CS and RS), all have reliability greater than 0.79, which indicates an acceptable to excellent measure of internal consistency and a good degree of replicability.

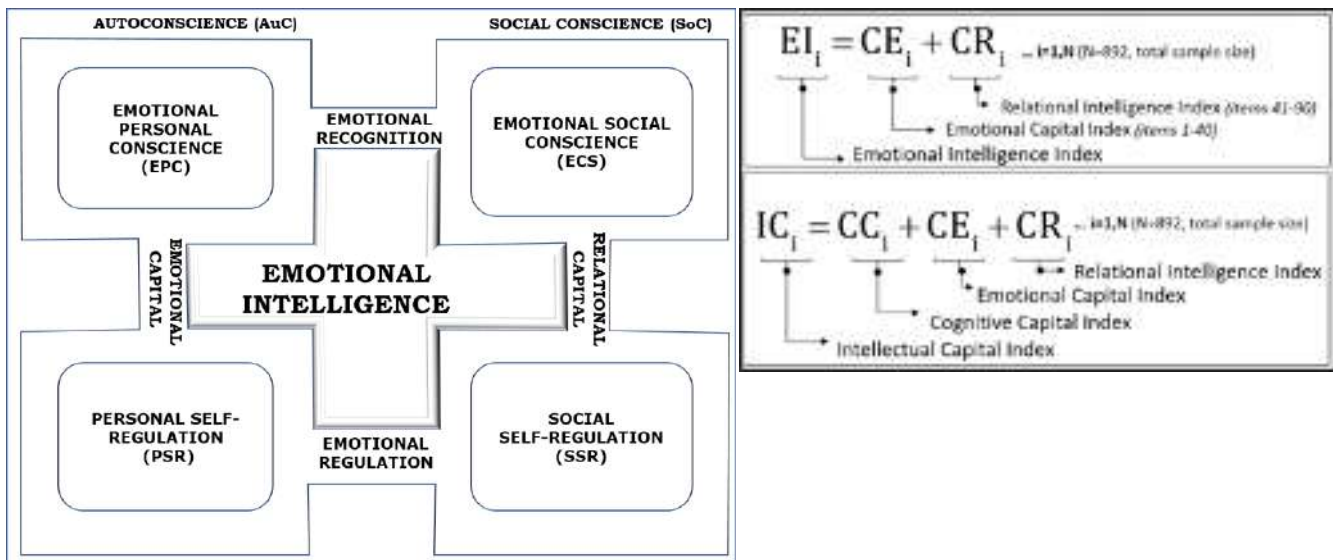


Figure 2: Models of Emotional Intelligence (EI_{om}^2) and Intellectual Capital (IC_{om}^2). Source: Prepared by the authors.

1.1 Structure according to “Recognition and Emotional Regulation” by emotional action and subscale.

COMPETENCES ACCORDING TO RECOGNITION AND EMOTIONAL REGULATION BY SUBSCALE			
EMOTIONAL PERSONAL CONSCIENCE (EPC) 2 competences-34 affirmations 1. Emotional conscience (19) 2. Self- esteem (15)	PERSONAL SELF-REGULATION (PSR) 4 competences-45 affirmations 1. Goal motivation (11) 2. Positive Attitude (6) 3. Adaptability (11) 4. Self-Emotional regulation (17)	EMOTIONAL SOCIAL CONSCIENCE (ESC) 3 competences-38 affirmations 1. Perception and Understanding Emotional (16) 2. Empathy (11) 3. Critical conscience (11)	SOCIAL SELF-REGULATION (SSR) 4 competences-42 affirmations 1. Leadership (8) 2. Effective Communication (9) 3. Management and resolution of conflicts (14) 4. Social Influence (11)
EMOTIONAL CAPITAL SUBSCALE (ECs) 6 competences / 79 affirmations		RELATIONAL CAPITAL SUBSCALES (RCs) 7 competences / 80 affirmations	
EMOTIONAL INTELLIGENCE (EI) - 13 competences / 159 affirmations			
COMPETENCES ACCORDING TO SUBSCALE			
		EMOTIONAL CAPITAL SUBSCALE (ECs) Emotional competences of personal type ECs - 79 affirmations	RELACIONAL CAPITAL SUBSCALE (RCs) Emotional competences of social type RCs - 80 affirmations
Competences according to area of emotional action (159 affirmations from 92 items)	Emotional Recognition (ERC) 72 - affirmations	Emotional Personal Conscience (EPC – 34 affirmations) 1. Emotional conscience (19) 2. Self- esteem (15)	Emotional Social Conscience (ESC – 38 affirmations) 1. Perception and Understanding Emotional (16) 2. Empathy (11) 3. Critical conscience (11)
	Emotional Regulation (ERG) 87- affirmations	Personal Self-Regulation (PSR- 45 affirmations) 1. Goal motivation (11) 2. Positive Attitude (6) 3. Adaptability (11) 4. Self-Emotional regulation (17)	Social Self-Regulation (SSR - 42 affirmations) 1. Leadership (8) 2. Effective Communication (9) 3. Management and resolution of conflicts (14) 4. Social Influence (11)

Figure 3: Emotional Intelligence Model (Elm2). Emotional Recognition (EPC and ESC) and Emotional Regulation (PSR and SSR) by subscale (ECs and RCs) - TECER. Source: Prepared by the authors. Note: A item (affirmation) is associated with one or more competencies. ECs: “Emotional Capital subscale”; RCs: “Relational Capital subscale”.

1.2 Structure according to characterization items (affirmations) by factor

Subscale and scope of emotional action	Factor	Emotional competence	Alpha Cronbach	Acbt	items	Emotional subscale	Emotional dimension	Related affirmations	Emotional Framework	Emotional Component
79 50% ECs	Fo6	Goal motivation	0,7300	0,7380	E26 E27 E28 E29 E30 E31 E35 R11 R27 R28 R38	ECs	ERG	11	PSR	ES
	Fo7	Positive Attitude	0,7404	0,7500	E08 E19 E20 E21 E23 E24			6		EA
	Fo8	Adaptability	0,7533	0,7582	E10 E14 E27 E31 E32 E33 E34 E35 E36 E37 E39			11		
	Fo9	Self-Emotional Regulation	0,7750	0,7850	E07 E08 E09 E21 E22 E23 E24 E25 E30 E32 E33 E34 E35 E38 E40 R45 R52			17		
	Fo1	Emotional Conscience	0,7030	0,7110	E01 E02 E03 E04 E05 E06 E07 E15 E24 E28 E37 E40 R08 R09 R10 R11 R12 R13 R14		ERC	19	EPC	
	Fo2	Self-esteem	0,7551	0,7603	E01 E08 E09 E10 E11 E12 E13 E14 E15 E31 R05 R35 R37 R46 R47			15		
80 50%	Fo3	Perception and Understanding Emotional	0,8990	0,9010	R01 R04 R07 R11 R16 R20 R21 R22 R23 R24 R25 R26 R27 R29 R30 R47	RCs	ERG	16	ESC	ES
	Fo4	Empathy	0,7656	0,7677	E07 R01 R02 R03 R04 R05 R06 R07 R10 R12 R14			11		
	Fo5	Critical conscience	0,7406	0,7500	E15 E16 R08 R09 R10 R11 R12 R14 R15 R16 R17			11		
RCs	F10	Leadership	0,8466	0,8451	R15 R32 R33 R34 R35 R36 R37 R38		ERC	8	SSR	
	F11	Effective Communication	0,7738	0,7835	R17 R18 R31 R41 R42 R43 R50 R51 R52			9		
	F12	Management and resolution of conflicts	0,7420	0,7510	E10 E16 E17 E18 R08 R10 R19 R36 R43 R44 R46 R47 R48 R49			14		
	F13	Social Influence	0,8060	0,8100	E36 R23 R24 R25 R26 R29 R36 R37 R38 R39 R40			11		
159 affirmations										

Figure 4: Emotional Intelligence Model (Elom2). Characterization of item matrix by factor – TECER.

Source: Prepared by the authors, considering that an item (affirmations) any is associated with one or more emotional competencies.

Note: - EPC: Emotional Personal Conscience; PSR: Personal Self-Regulation; ESC: Emotional Social Conscience; SSR: Social Emotional Autoregulation;

- ERG: Emotional Regulation; ERC: Emotional Recognition; ECs: Personal Emotional Competencies (subscale); RCs: Social Emotional Competencies (subscale).

- RP: Emotional Adequacy; FE: Emotional Strength.

- Acbt: Alpha of Cronbach based on typified elements. En, n = 01 to 40: Indicates the affirmation or item of the TECER scale with respect to the emotional Capital; Rm, m = 01 to 50; indicates the affirmation or item of the TECER scale with respect to the Relational Capital.

2. MULTIVARIATE ANALYSIS

The application of the Techniques of multivariate analysis (Pérez, 2004; Denis, 2015 and 2019) showed the following results:

2.1 Cluster and Principal Components Analysis.

The solution obtained shows that the emotional factors are mainly agglomerated around two clusters (Figure 6). Cluster 1 is formed with individuals with preponderant characteristics in the field of emotional strength, while cluster 2 is formed by individuals with preponderant characteristics in the field of emotional adequacy. The process of extraction of factors, through the Analysis of Principal Components (PCA), allowed to ratify and characterize the two main components (“Emotional Components”) defined below (Figure-5):

- **Component 1 (Emotional Strength- “ES”):**

Dynamic emotional capacity (trait) that allows us to lead emotional states to be functional to the actions that we have to perform. This capacity varies through time and circumstance and comprises the set of social emotional factors or resources (F13, F10, F12, F11 and F4) and personal (F3, F5 and F6). As a psychological trait, it is measurable and acquirable and will be associated with the degree of resistance or ability to positively and successfully confront the difficulties or circumstances of social interaction or emotional position.

- **Component 2 (Emotional Adequacy- “EA”):**

Dynamic Emotional Capacity (trait) that allows the adaptability of emotional states to be functional to the actions that must be performed. This capacity varies through time and circumstances and includes the set of emotional factors or resources that enable emotional self-knowledge of change (F7, F1 and F2) and emotional adaptability to change (F8 and F9). As

a psychological trait, Emotional Adequacy will correspond, then, to the emotional capacities required for a person’s adaptation to the change of certain pre-existing conditions, accept them and respond positively to them.

The spatial comprehension of the results through the perceptual map of variables and individuals by component (Figure 5) and the graph of point-variable and point-individual scores (Figure 6) shows that the emotional strength (fortress) combines to a great extent the emotional factors F13, F3, F10, F12, F11, F6, F5 and F4, and in lesser extent with the emotional factors F7, F9, F8, F1 and F2; whereas the emotional adequacy combines mainly the emotional factors F7, F9, F8, F1 and F2, and in less way with the emotional factors F13, F3, F10, F12, F11, F6, F5 and F4.

The interpretation of Figure-6 indicates that all variables are positively correlated between them. In other words, if a variable takes a strong value for an individual, all the other variables will take a strong value. This feature is called a size factor. That is to say:

- The individuals who are to the right of the plane factorial of the first component, correspond to individuals with a good level of emotional strength. Those that are located to the left of the plane factorial of the first component, correspond to individuals with an inappropriate (low) level of emotional strength.
- Individuals located in the top of the factorial map of the second component, correspond to individuals with a good level of emotional adequacy. While those from the bottom of the factorial plane of the second component, correspond to individuals with an inappropriate (low) level of emotional fitness.

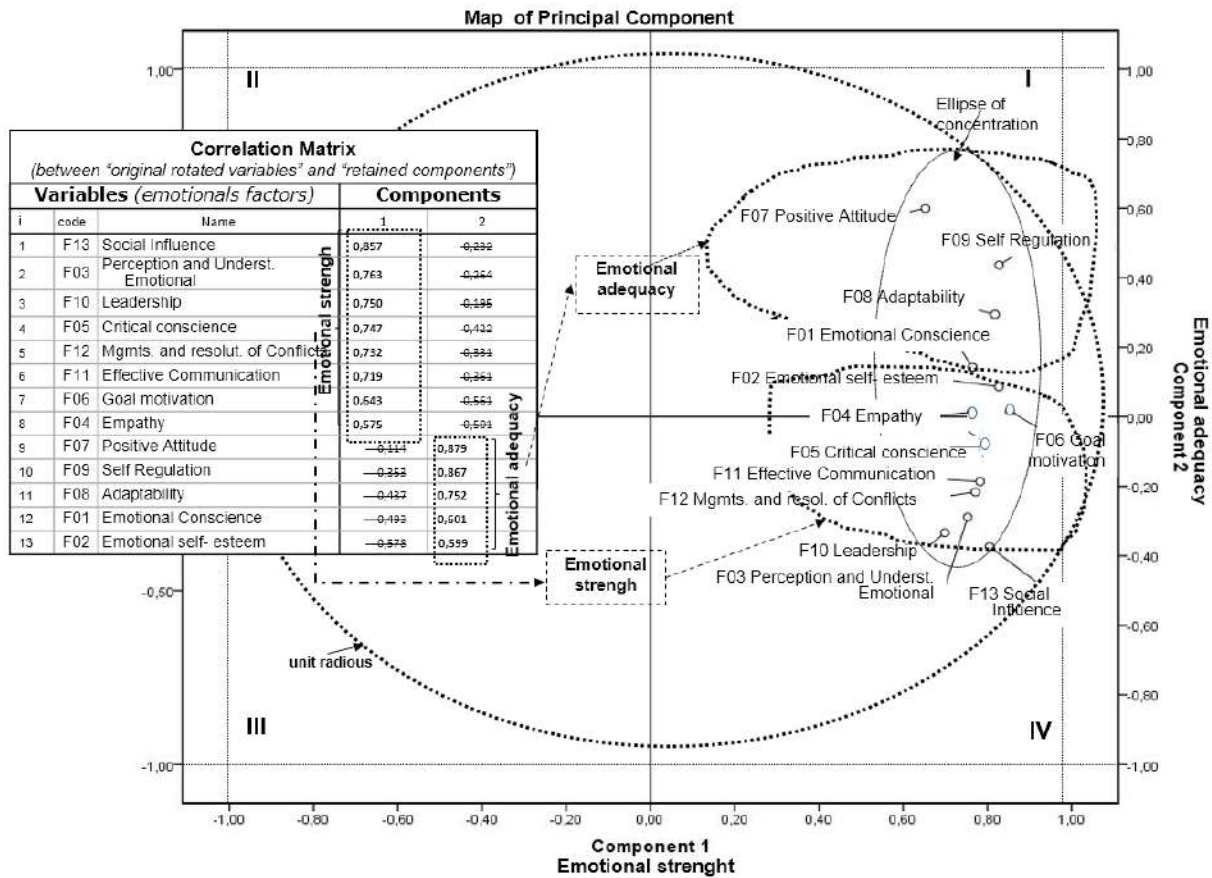


Figure 5: Analysis of Principal Components. Graph of Variables and Individuals vs Principal Components. Perceptual Map of Principal Components with grouping of factors (Graph of Punctuations - Variable Points).
 Source: Prepared by the authors.

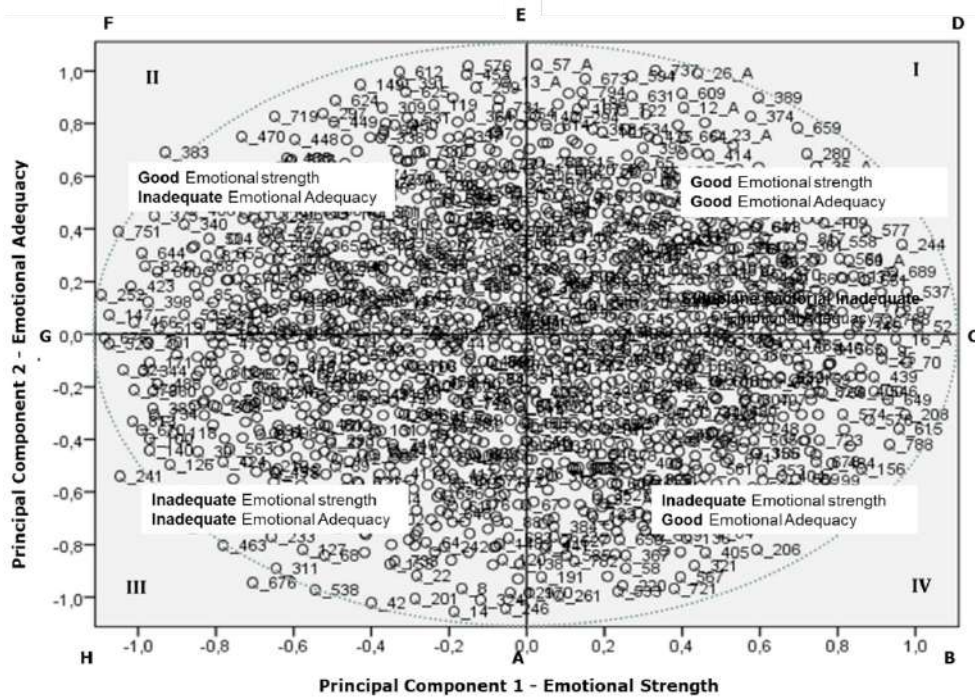


Figure 6: Principal components analysis. Diagram of variables and individual vs Principal Components. Perceptual Map of main components with grouping of subjects grouped (Graph of scores vs Individuals point). Source: Prepared by the authors.

From the point of view of potential of the main emotional attributes, figure-7 expresses the favorable or unfavorable condition in each quadrant of the factorial plane, considering the multivariate analysis of PCA technique and the number of conglomerates obtained with the analysis procedures of cluster both hierarchical and non-hierarchical. With this analysis, the main emotional attributes and emotional factors component in each of them were obtained and characterized for the group of individuals analyzed. The identification of principal component factors allowed to know which are the aspects that most affect the characterization of the emotional competences of the individuals.

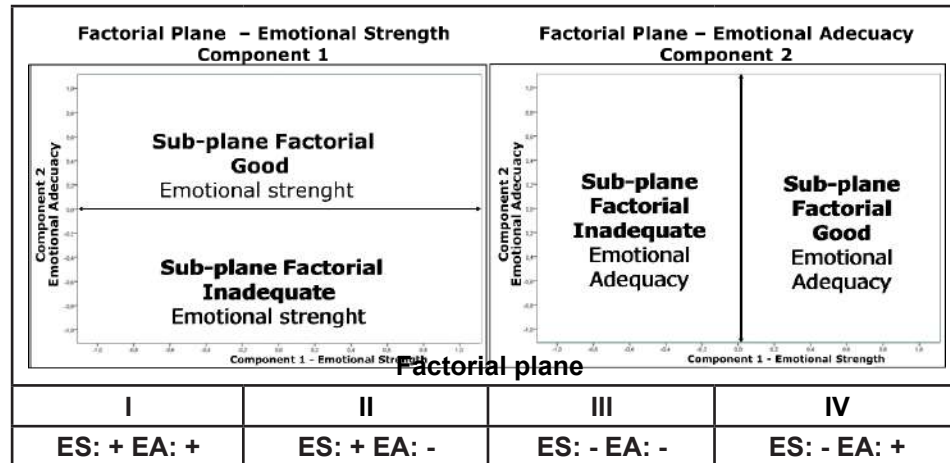


Figure 7: Factorial plane of interpretation of the Principal Components. Correlation variable Points Vs Individual Points. Potential of every component in the quadrants of the Factorial Plane for the analysis of the individuals. Source: Prepared by the authors. Note: ES: Emotional Strength; EA: Emotional Adequacy; “+”: High values; “-”: Low values”.

With PCA it has been found that the main attributes considered from the set of 13 emotional factors can be summarized in only two dimensions: F1: Emotional Strength (ES) and F2: Emotional Adequacy (EA), which allow eliminating redundant information according to characteristics of proposed emotional capital model, obtaining linear equations for each of main component factors, which offer the score that an individual would obtain in each component, according to corresponding values of their respective emotional attributes (emotional factors).

With these considerations, the institution to which the individuals belong presents a regular type index in both the ES and the EA, in all the levels of both university education (initial and final) and in the graduates. The university graduates present a better index in both dimensions and with a smaller difference in the ES dimension.

From the point of view of which faculty, the analyzed individuals belong to, all present regular and deficient indexes type. The faculty

with minor index in both dimensions was the Faculty of Construction (Construction and Territorial Planning), with regular index in ES and deficiently in EA. The students of this faculty present a lower index in the terminal academic phase for both dimensions when compared to initial academic phase. The best global indexes of type ES and EA corresponds to the Faculty of Administration and Economy. The faculties that present an improvement in indexes of both dimensions in every level are Sciences (Faculty of Natural, Mathematical Sciences and Environment), Humanities (Faculty of Humanities and Social Communication Technologies) and Engineering.

Considering the gender of the individuals, women present a slightly higher ES index (2%) with respect to men within the regular level, while men show a higher EA (5.9%) to women and the index of women present a deficient level.

2.2 Discriminant Analysis.

The application of the multivariate statistical technique of discriminant analysis of predic-

tive type allowed to elaborate the proposal of the discriminant model that is described in Figure-8. The model has two canonical discriminant functions with discriminant power, a conclusion determined from the results of the goodness-of-fit indicators and the statistical significance and discriminant power analysis (based on overall significance of discriminant function by Wilks' lambda, with the X^2 test and corroborated by two hypothesis tests applied which confirmed that p-values associated with chi-square statistic are below the significance level, confirming that functions are significant).

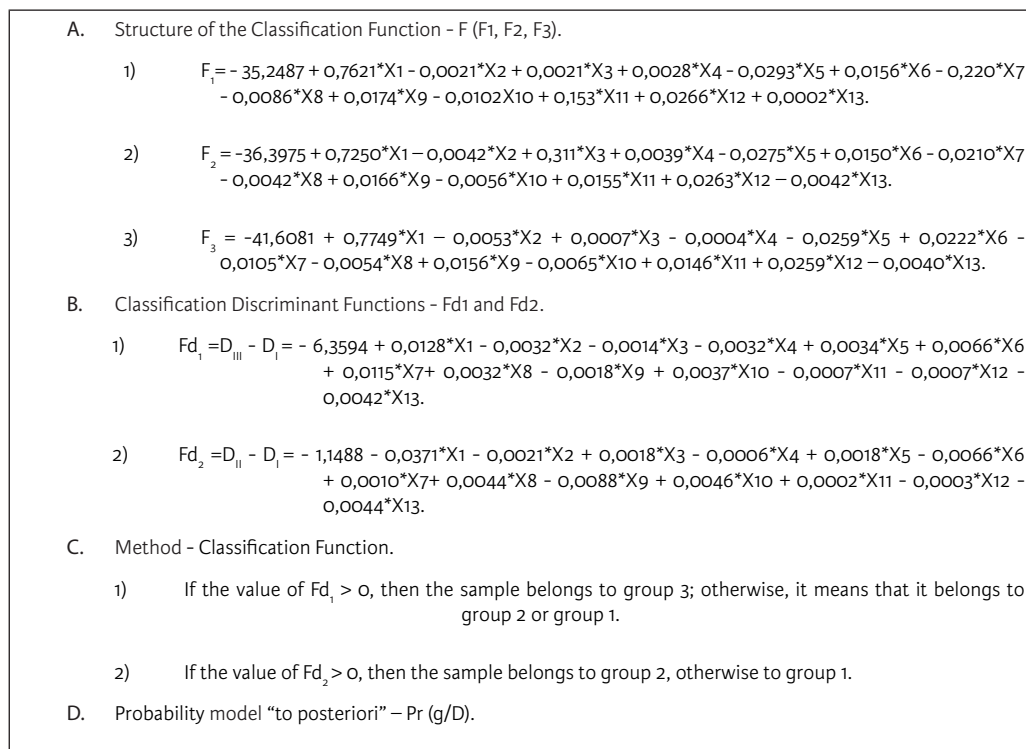


Figure 8: Discriminant Model. Source: Prepared by the authors.

Also, a classification function "F" composed of three canonical discriminant functions was determined and two base discriminant functions were formulated, a confusion matrix that presents a 62% classification capacity of the sample and a calculation model of the probabilities "to posteriori". The model is composed of

three classification functions and contemplates that an individual is classified in that group with a greater "posteriori" probability.

In order to evaluate the assertiveness level of the proposed model, a group of individuals used as test cases was considered in the calculation

procedure of the coefficients and discriminant functions of classification by group. The results show that the classification with probabilities procedures “to posteriori” presents a high level of assertiveness, which demonstrates the strength of the model.

3. HYPHOTESIS TESTING PROCESS

Hypothesis testing is the process of testing whether a statement about a property of the population can be maintained according to the available sample information or whether it should be rejected. In other words, hypothesis testing can be understood as the procedure that makes it possible to decide whether an assumed property in a population is empirically compatible with what is observed in a sample of that population.

Considering that the base phenomenon of study is the constructs of emotional intelligence and intellectual capital according to the models formulated in Figure-2, the research formulated nine hypotheses grouped in three processes or phases of hypothesis contracting (Figure 9), categorized according to the scope of analysis and the interaction between constructs: Cognitive Potential (CC) Analysis, Emotional Capital (EC) and Relational Capital (RC) Analysis, and Emotional Intelligence (EI), Emotional Capital (EC) and Intellectual Capital (IC) Analysis.

In general terms, the hypothesis testing process developed in the research can be summarized in the following three generic activities:

1. Statistically formulate the scientific hypothesis to be contrasted.

2. Order the hypotheses according to the scope of each one of them.

The purpose of this action is to divide the process into three stages (Figure 9) where

hypotheses of similar scope are tested. The purpose of each phase is the following:

- Phase I: To perform a testing process of Hypothesis No. 5, with a cognitive scope, aimed at verifying the cognitive potential (CC) as a construct at the gender level.
- Phase II: To perform a contrasting process at the subscale level, in the areas of CE and CR.
- Phase III: It comprises the testing process at level of Emotional Intelligence and also at level of Intellectual Capital's components of an individual (CE, CR and CC).

3. Perform hypothesis testing processes according to the analysis required for each phase.

Each phase of Figure 9 specifies the statistical elements and results required for each hypothesis analysis, considering first the exploratory analyses that determine the normal condition for application of corresponding parametric techniques and, if not, the most appropriate nonparametric techniques.

Phase / Analysis	Name	Null Hypothesis (H ₀)	Test	Type
I. Hypothesis testing - Analysis of Cognitive Potential (Ipc: Cognitive Potential Index)				
The degree of Ipc at the group level comes from a normal distribution.	H5 – H5.1	The degree of Ipc at the group level comes from a normal distribution.	Kolmogorov - Smirnov Normality Test (for one sample). Kolmogorov - Smirnov Normality Test (for three independent samples).	Correlational
The median Cognitive Potential's degree does not differ (is the same) from the level at which the subjects are.	H5 – H5.2	The median of Cognitive Potential's degree does not differ (it is the same) of the level in which the subjects are.	Kolmogorov - Smirnov Normality Test (for three independent samples). Kruskal-Wallis test (3 independent samples: 1: Insufficient, 2: Normal and 3: Outstanding). Application of "Dunn's Test" method, to know between which pairs of groups there is a difference.	
Analysis of the level of sufficiency of cognitive potential at the level of gender.	H5 – H5.3	The cognitive potential's degree is not different in men and women	Normality test Mann-Whitney U test (two independent samples: Men and Women).	
Relationship between the sufficiency of cognitive potential and the type of group (level).	H5 – H5.4	The variables "sufficiency of cognitive potential" and "type of group" (level) are not associated.	Chi ² test (independence of variables vs. association of qualitative variables). Pearson's R coefficient analysis.	
II. Hypothesis testing - Analysis of Emotional Capital and Relational Capital (Emotional Capital and Relational Capital Index).				
Analysis of the Sufficiency of Emotional Capital according to gender.	H3	The level of Emotional Capital's sufficiency is not similar in men and women.	Mann-Whitney U test (two independent samples: Men and Women).	Correlational
	H4	There are no significant differences in the Emotional Capital Index at the gender level (Men and Women).	Student's t-test and Levenne's test (two independent samples: Men and Women).	Group Difference
Analysis of the plausibility that the value of Relational Capital is of greater significance in graduates than at the student level (in the process of training).	H2 - H2.1	Hypothesis 2.1: There are no significant differences in the Relational Capital Index at general profile level (Students and Graduates).	Kolmogorov-Smirnov test for normality (two independent samples: Students and Graduates). Homoscedasticity analysis (equality of variance). Levenne's test	Group Difference
	H2 - H2.2	Hypothesis 2.2: There are no significant differences in the level of sufficiency of Relational Capital at the general profile level (Students and Graduates).	Mann-Whitney U test (two independent samples: Students and Graduates.)	
III. Hypothesis testing - Analysis of Emotional Intelligence (Emotional Intelligence Index, Emotional Capital and Intellectual Capital).				
Analysis of the plausibility that the value of emotional intelligence differs according to gender.	H1	There are no significant differences in the emotional intelligence Index at the general profile level (Students and Graduates).	T-student and Levenne's test (two independent samples: Men and Women).	Group Difference
Analysis of the plausibility that emotional capital is the most important coefficient of people's Intellectual Capital.	H6	Emotional capital (CE) does not differ significantly with respect to relational capital (CR) and intellectual capital (CC).	Kolmogorov-Smirnov test to verify the assumption of normality. The data to be tested (CEs; CR, CC and Gender) are not separated according to gender and the Kolmogorov-Smirnov test is performed for one sample. Test for a non-parametric contrast of three variables (CE, CR and CC) in order to verify if there are significant differences between the variables, via Mann-Whitney U test (non-parametric test), considering gender (Gsex, with values 0: Female; 1: Male) as an ordinal grouping variable. Kruskal-Wallis contrastive test: Data to be contrasted (CE; CR, standardized CC and Gender), ordinal grouping variable according to detailed profile (Gprofile withw values 1: Initial, 2: Final and 3: Graduates). Dunn's post-hoc test was also applied as a method for the comparison of multiple variables (generalizes the Bonferroni adjustment procedure), from the point of view of analysis of variance, based on the average ranges of each variable. The cases of post-hoc analysis via Dunn's test, in order to determine the existence of statistically significant differences, are as follows: - CE vs. Profile case, - CR case vs profile and, - Case CC vs Profile.	

Figure 9: Hypothesis Testing Process Steps. Source: Prepared by the authors. Note: "CC": Intellectual capital operationalized as cognitive capital.

In order to make the hypothesis testing process and its results visible, Appendix 3 presents the details of hypothesis analysis number two corresponding to phase III; that is, “Testing Process Phase III, No. 2: Analysis of the plausibility that emotional capital is the most important coefficient of people’s intellectual capital (based on the analysis of degree of each component of intellectual capital as standardized variables - EC, CR and CC - according to gender)”. The results of the analysis process of this case are summarized as follows:

- Hypothesis - H6: Emotional Capital (CE) doesn’t differ significantly with respect to Relational Capital (CR) and Cognitive Capital (CC).
- General analysis process: The assertion was based on the following considerations:

1. To verify the assumption of normality, the Kolmogorov-Smirnov test is used to test the hypothesis that sample data come from a normal distribution (usually used for quantitative variables). The data to be tested (CEs; CRs, CCs and Gender) are not separated according to gender and the Kolmogorov-Smirnov test is performed for one sample.

As the “p” (asymptotic sig. or “p-value”) for one of variables under study (CC) is < 0.05 (p-CC Female and p-CC Male= 0.000 < 0.050), Ho (null hypothesis) is rejected, which indicates that distribution of variable CCs differs from a normal distribution. Therefore, H1 is accepted; that is, the variables under study, as a whole, do not come from a normal distribution, given that one of the variables under study, “CC”, doesn’t have a normal distribution and parametric statistical tests could not be applied to it.

2. Test for a nonparametric contrast of three variables (CE, CR and CC) in order to verify

if there are significant differences between the variables, via Mann-Whitney U test (nonparametric test), considering gender as an ordinal grouping variable (Gsex, with values 0: Female; 1: Male).

The means of the emotional capital (EC) and Cognitive Potential (CC) indexes present differences (“ECs” and “CC”; 0.027 and 0.000, both < 0.05), at the level of the samples corresponding to gender (Men and Women), which means that there is a statistically significant difference between the average values of the Emotional Capital (“EC”) and Cognitive Potential (“CC”) quantitative variables.

In other words, the groups defined by the quantitative variables “EC” and “CC” come from populations with different averages.

3. Kruskal-Wallis contrastive test: data to be contrasted (CE; CR, CC and Gender), ordinal grouping variable according to detailed profile (Gprofile with values 1: initial, 2: final and 3: graduates), for Ho: $\alpha_1 - \alpha_2 - \alpha_3 \neq 0$. Method:

- Determine alpha-adjusted (α).
- Elaborate Matrix of Theoretical Differences between levels (groups) and determine the theoretical differences (Dtij).
- Develop Observed Difference Matrix between levels (groups) and determine the observed differences (DOij: calculation of absolute value of average difference between the group ranks compared to theoretical difference between the groups. If it is greater than theoretical difference, then: “the difference is significant”).

- Elaborate Total Difference Matrix, obtained based on the differences between the observed difference and theoretical difference between the levels (groups) and determine the observed differences (DT_{ij}).

- Elaborate Total Difference Signs Matrix, based on the differences between Observed Difference and Theoretical Difference between levels (groups) and determine the signs of observed differences (DT_{ij}).

- Analyze each of signs of Total Difference Sign Matrix (if Sign_{ij} is ">", then there is a significant difference between group i and group j).

- CE variable: Initial-Terminal: 8.88; Initial-Graduates: -120.37; Terminal- Graduates: -79.00. It is observed that between the initial and final groups with respect to Graduates, the difference is statistically significant.

- CR variable: Initial-Terminal: 8.94; Initial-Graduates: 14.99; Terminal- Graduates: 55.86. It is observed that there isn't statistically significant difference between the groups.

- CC variable: Initial-Terminal: -56.07; Initial-Graduates: -296.95; Terminal- Graduates: -328.48. It is observed that there is a statistically significant difference between all groups.

Result:

- The medians of all the indexes present significant differences with p-value < (CE: 0.00; CR: 0.042 and CC: 0.00), at the level of the samples corresponding to the detailed profile (Students in initial stage, Students in final stage and Graduates), which means that there are statistically significant differences between the average values of the quantitative variables of Emotional Capital ("CEs", Relational Capital ("CRs") and Cognitive Potential ("CCs").

5. Dunn's post-hoc test was also applied as a method for the comparison of multiple variables (generalizes the Bonferroni adjustment procedure), from the point of view of analysis of variance, based on the average ranges of each variable. The cases of post-hoc analysis via Dunn's test, in order to determine the existence of statistically significant differences, are as follow:

Result:

• **Conclusion:**

There are statistically significant differences between the average values of the quantitative component variables of EI. In other words, EC differs significantly with respect to RC and CC and the hypothesis is rejected.

According to the results, the main areas that should be considered to initiate the development of improvement interventions are CE and CC, so as to provide better competencies and skills to enable greater potential for success in students in the process of university education, particularly in areas of emotional strength and emotional adequacy.

DISCUSSION AND CONCLUSIONS

The conclusions and discussion of the research have been grouped into the following four themes:

1. EMOTIONAL INTELLIGENCE

The theoretical bases and the main models of EI stand out for the search for applications in the individual, organizational and environmental domains. New contributions present work in areas such as performance, crisis management, youth and academic leadership development, as well as in areas of emotional regulation and self-regulation (Gross, 2015; Hollensteing, 2018; Vohs, 2017 and Haag et al., 2021), and show that EI improvement efforts can lead to better extrinsic and intrinsic success in early and later stages of university education (Urquijo et. Al, 2019). In addition, it is recognized that the set of predictors of better professional success includes the recognition and knowledge of the state of EI in students, the increase in the capacity of EI components, the orientation of improvement actions towards a greater SE and EA potential, as well as the development of adequate cognitive skills and improvements in the maturity domains of personality.

Over the past thirty years, there has been an “affective revolution” (Barsade et al., 2003) in the workplace that has led scholars around the world to study emotional intelligence (EI) in management. The intelligent use of emotions has emerged as a challenge in both business and academic development of people where the role of emotion management is crucial and demanding (Ashkanasy et al., 2019; Ashkanasy and Daus, 2002; Caruso and Salovey, 2019; Côté, 2017; Haag and Getz, 2016; Humphrey et al., 2016; Magna, 2016), even more so today with the COVID-19 crisis (Brooks et al., 2020). Most theories of emotion agree that cognitive processes are a very important source of emotions and that knowledge and substantial mastery of EI are crucial tasks of people’s life and daily development tasks that can be learned, based on three fundamental capabilities: having the intention to do, selecting the most appropriate action to an emotional condition,

and achieving emotional empathy. This means to manage the cognitive and emotional conditions to accomplish more ideal orientated emotional profitability to develop a more integral and successful person.

2. THE OBJECTIVES

The methodology and operational framework formulated is a simple structure based on a scale model of self-report type, with quantitative variables that make up the component factors and emotional and cognitive competences, it allows to identify the IC and EI as substantial dimensions of a person, for a sample with university and professional profile and an empirical quantification framework based on the application of the TECER scale.

It is important to continue searching for more evidence and results that give more robustness to the formulated models, with applications in other university institutions or with simple adjustments, from the point of view of the formality and writing of the ad-hoc items to the field of application, in the structure that characterizes the cognitive component or the emotional and relational components to develop applications in non-university institutions. The operational results applied to the sample under study (Appendix 2, Figure A2.4) indicate that the Institution presents a level of regular sufficiency in the IC (56.1% undergraduate, 63.6% in graduates), EI (56.6% undergraduate, 63.5% graduates) and CC (52.9% undergraduate, 74.1% graduates) with greater value difference in all the coefficients at the level of the graduates.

Even when everyone is at the regular level, the CC coefficient stands out, which is close to the 75% level (Figure A2.4), the minimum value at the good level. However, clearly the applied methodology has shown the need for

intervention in all the considered areas, with greater emphasis on CR, particularly aspects associated with personal self-regulation (Figure A2.5) and factors such as Self-Emotional regulation (51.9%) and positive attitude to respond appropriately to environmental demands (51-9%).

Considering the formulated constructs of emotional strength and emotional adequacy, students and graduates present regular conditions in emotional strength and deficient index in emotional adequacy, which shows deficiencies in emotional capacities necessary to adapt to changes and difficulty in acceptance and positive response.

- Gender (Figure A2.1): women present a higher emotional strength (59.3%) and men a higher emotional adequacy (51.6%).
- Faculty (Figure A2.2): At the global level, the Faculty of Economics presents better sufficiency indexes at the level of emotional components (Emotional Strength: 61.7% and Emotional Adequacy: 52.3%).
- Undergraduate level: The highest sufficiency is 63.3% in the Relational Capital index in Faculty of Economics (Figure A2.7), presenting better indexes in emotional strength (62.6%, Figure A2.8), mainly in aspects of social emotional awareness (61.8%, Figure A2.6) in particular, in emotional factors of Emotional Perception and Understanding (69.5%: Figure A2.12, “PercyCoEmo”) and Effective Communication (69.5%: Figure A2.12, “EfecCom”).
- Graduate level: The graduates of Faculty of Humanities present the best sufficiency indexes (Figure A2.10) and one of them in the level of “good” (84.6%, Cognitive Capital Index) and from the point of view of the emotional components (new cons-

tructs, Figure A2.11), stands out Emotional Strength (74.1%) and Emotional Adequacy (71.9%). On the other hand, the graduates of Faculty of Construction present the lowest sufficiency indexes. Considering the emotional factors (Figure A2.13), the Faculty of Sciences presents the lowest sufficiency index in “Motivation to Achieve” (80.6%, “GoalMot”), in the emotional action area of “Personal Self-regulation”. The Faculty of Humanities stands out in “Emotional Conscience” (79.1%, “Econs”) in the emotional action area of “Emotional Personal Conscience”.

Considering the results, it’s necessary to develop programs to improve emotional and cognitive competencies at undergraduate level (Figure A2.12), especially in the emotional action areas of Personal Self-Regulation with emphasis on the emotional factors of Self-Emotional Regulations, Positive Attitude and Adaptability, and emotional action area of Emotional Recognition with emphasis on the emotional factors of Emotional Conscience and Self-esteem.

Personal improvement programs and those defined as “comprehensive training” should be designed and oriented towards the improvement of professional skills in a direct relationship with Emotional Intelligence, considering that emotional skills influence professional relationships, have repercussions on inter-relationships and intrapersonal and also in leadership capacities. The higher the levels of emotional intelligence of professionals in leadership roles, the higher levels of performance and professional satisfaction. The scientific and professional community has already recognized the importance of this connection and the emphasis should be directed and strengthened to improve EI (Vibhor et al., 2020).

The EI level of students should be recognized, as well as the elaboration of remedial plans and the development of further research on the predictors of success of professional ability and personality. In order to do this, active processes of improvement in learning based on social-emotional learning programs have to be considered, where each student develops their ability to integrate thinking, emotion and behavior to achieve and perform important social tasks. As a consequence of this, the individuals can develop skills that allow them to recognize, express and manage emotions, build healthy relationships, set positive goals and respond to personal and social needs as is the case of SEL-type programs (Ferreira et al., 2020; Gueldner et al., 2020).

Programs such as SEL should be considered as reference models, but adapted to the university environment with cognitive, behavioral, affective and motivational strategies, within the framework of self-regulated learning processes (Álvarez-Cruces et al., 2020; Urquijo, 2020). These processes should guarantee greater knowledge and personal management in terms of thoughts, emotions and behaviors to achieve goals (Frazier et al., 2021), with an important role of leadership skills in personality and management of skills to influence their environment (Lubbadeh, 2020). All of which would allow enhancing early professional and organizational success.

Finally, programs for the improvement and further enhancement of EI should be considered as part of the development guidelines of any academic institution, particularly in undergraduate education.

3. THE HYPOTHESIS TESTING PROCESS AND APPLICATION OF MULTIVARIATE ANALYSIS

To support the general objective and specific objectives of the research, referred to Emotional

Intelligence and the identification of the driving and hindering factors of people's Emotional Capital, the following conclusions were formulated according to the respective analysis phase and contrast process, considering:

- Analysis at level of university education as well as the level of graduates,
- A quantitative process for the assessment and determination of whether or not there is a difference between men and women with respect to importance of fundamental factors of emotional capital in students and professionals,
- Analysis of the importance of emotional capital in comparison with an assessment of relational capital and academic-cognitive capacity (related to Cognitive Capital).

The result of the testing process indicates that two of the six hypotheses formulated are rejected, according to the following detail and scope indicated for each hypothesis in Figure-9.

Process / Null Hypothesis (Ho)	Decision	Scope
<p>I. Analysis of Cognitive Potential</p> <ul style="list-style-type: none"> Hypothesis Ho-No5: The degree of cognitive potential is different between men and women 	R	<ul style="list-style-type: none"> The analysis of the degree of cognitive potential (Ipc) meant: validating whether the degree of Ipc at the group level comes from a normal distribution; if the median of the degree of Cognitive Potential Does not differ (is the same) from the level in which people are; if the level of sufficiency (degree) of the Cognitive Potential is not different in men and women, and if the variables "Cognitive Potential Sufficiency" and "type of group" (level) are not associated. In all cases the affirmations were rejected.
II. Analysis of Emotional Capital and Relational Capital		
<ul style="list-style-type: none"> Hypothesis Ho-No3: The level of sufficiency of Emotional Capital is not different between men and women. 	A	<ul style="list-style-type: none"> The level of Sufficiency of Emotional Capital is not different between men and women "(or in other words:" the level of sufficiency of Emotional Capital is similar between men and women ")
<ul style="list-style-type: none"> Hypothesis Ho-No4: The level of Emotional Capital is not different in men and women. 	A	<ul style="list-style-type: none"> There is no statistically significant difference between the means of the samples, which means that there is no statistically significant difference between the average values of the quantitative variable "Emotional Capital Index" of men and women.
<ul style="list-style-type: none"> Hypothesis Ho-No2: Relational Capital differs significantly in people who are in the process of studies with respect to those who develop professional activities. 	A	<ul style="list-style-type: none"> The analysis of the value of the relational capital index by profile meant validating the following statements if: There are no statistically significant differences in the Relational Capital index at the profile level (students and graduates); and if the degree of sufficiency of Relational Capital is not different in students and graduates. In all cases the affirmations were accepted; that is, there are no significant differences in Relational Capital at the profile level (students and graduates).
III. Analysis of Emotional Intelligence, Emotional Capital and Intellectual Capital		
<ul style="list-style-type: none"> Hypothesis Ho No. 1: The level of Emotional Intelligence is not different in men and women 	A	<ul style="list-style-type: none"> Considering the compliance of the homoscedasticity property, the contrast analysis indicates that there are no statistically significant differences between the average values of the quantitative variable "Emotional Intelligence Index" between men and women.
<ul style="list-style-type: none"> Ho Hypothesis No. 6: Emotional Capital does not differ significantly with respect to Relational Capital and Cognitive Capital. 	R	<ul style="list-style-type: none"> In the analysis of this hypothesis, it is found that there are statistically significant differences between the average values of the quantitative variables of Emotional Capital, Relational Capital and Cognitive Potential and based on the Dunn test, it is observed that there is a statistically significant difference between all the groups, for cases Emotional Capital vs. profile and Cognitive Capital vs. profile.

Figure 9: Results hypothesis testing process. Source: Prepared by the authors. Note: A: The null hypothesis is accepted; R: The null hypothesis is rejected.

4. THE VISIBILITY OF THE CONTRIBUTIONS ON EMOTIONAL INTELLIGENCE

The analysis of the visibility of the contributions referred to emotional intelligence by bibliometric and altmetric analysis, reflects that the

contributions and tools to support its analysis are relatively recent and very unusual in the area of administration and business management. The development of emotional intelligence begins to be discussed and visible in 1990 (Mayer et al., 1999); however, it marks a remarkable growth since 2010 with important and large “producers” of contributions at the level of authors and titles, mainly in Scopus, WoS and WoL, over the presence in altmetric-type environments. In the last five years with the highest number of contributions by new authors, it has allowed greater visibility of Emotional Intelligence. In addition, it is observed that the majority of authors cooperate frequently among themselves and the importance of collaborations between researchers from different institutions is emphasized, even though most of the contributions are concentrated in the USA and in smaller volumes, in the UK (Magna, 2016. Appendix 1).

From the point of view of the bibliometric tools associated with the management of bibliographic databases, they show a greater functional completeness from the first of the WoS functionalities and, subsequently, with the greater potential from Scopus that presents a better technological infrastructure of functionalities, greater coverage both in titles and articles and, therefore, a greater positioning and, secondly, by the nascent altmetric-type data platforms and indicators that are being developed (Salinas et al., 2013), such as Google Scholar (using Google Scholar Metrics –GSM) and Semantic Scholar (SSc: A free, AI-powered research tool for scientific literature) in conjunction with the software PoP/v7 (Publish or Perish version N°7) and Almetric.com.

The new visibility platforms, mainly GSM and SSc, are showing signs of wanting to be a reference in the metrics referred to social platforms, considering its alliance with another of the altmetric providers, such as “Impact Story”

and thanks to its two main characteristics, their data is stored and recorded permanently, allowing the reproducibility of the results and the retrospective analysis, thus providing a solution to the problem of the volatility of the altmetric data which together with the richness of the recorded data, opens the possibilities to carry out analyzes beyond the simple recount of the mentions. For example, it is possible to analyze the types of publics, the interests of the audiences and their relationships, among others, possibilities that are just beginning to be developed (Salinas et al., 2013).

Altmetric type indexes and antecedents are here to stay in a world where communications and relationships are managed through the internet considering the new informatics platforms where they are present and show social impact from news, tweets, blogs, Facebook type communications, videoconferences, scientific videos and even didactic or informative material. All of these are currently valid and useful measures to estimate the impact of contributions with distribution channels other than articles written in print or online journals, to measure the social impact of research and to offer a complementary view of scientific impact.

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Appendix 1: TECER SCALE

1. GENERAL BACKGROUND

1.1 UNDERGRADUATE STUDENT (first-year and last-year students)

GENERAL BACKGROUND				
YEAR OF ENTRY to the UTEM	AGE	SEX (mark an "X")		DEGREE (enter the name of the program of study)
<input type="text"/>	<input type="text"/>	Female <input type="checkbox"/>	Male <input type="checkbox"/>	<input type="text"/>
COURSE (at the time of answering this survey)				
Course Name		Section	Semester	
<input type="text"/>		<input type="text"/>	<input type="text"/>	
MUNICIPALITY OF ORIGIN AND RESIDENCE (indicate the name of the commune of residence and of exit of the high school)		Family residence commune (to the moment to enter to the University)		
		Commune of exit of the school (or Lyceum)		
		Present place of residence		
AVERAGE OF NOTES HIGH SCHOOL (or Technician Prof.)		Average PSU score when entering UTEM		
<input type="text"/>		Mathematics: <input type="text"/>	Verbal: <input type="text"/>	
Are you up to date with your courses? (Mark an "X" and complete for the "No" case)		<input type="checkbox"/> Yes		
		<input type="checkbox"/> Not	Indicate number of courses that are not up-to-date: <input type="text"/>	
			Indicate the number of times you failed courses: <input type="text"/>	

1.2. GRADUATES IN PROFESSIONAL ACTIVITIES – Part A

GENERAL BACKGROUND							
AGE	<input type="text"/>	DGREE <small>(enter the name of the program of study)</small>					
SEX <small>(mark an "X")</small>	Female <input type="checkbox"/> Male <input type="checkbox"/>	<input style="width: 100%;" type="text"/>					
YEAR OF ENTRY to the UTEM	<input type="text"/>	YEAR OF GRADUATION OF THE UTEM	<input type="text"/>				
COURSE		Section	Semester				
<input style="width: 100%;" type="text"/>		<input type="text"/>	<input type="text"/>				
MUNICIPALITY OF ORIGIN AND RESIDENCE <small>(indicate the name of the residence, graduation, middle school and current residence)</small>	Family residence commune <small>(to the moment to enter to the University)</small>						
	<input type="text"/>						
	Commune of exit of the school (or Lycium)						
<input type="text"/>			Present place of residence				
<input type="text"/>			<input type="text"/>				
AVERAGE OF NOTES HIGH SCHOOL (for Technician Prof.)	<input type="text"/>	Average PSU score when entering UTEM					
		Mathematics	Verbal				
		<input type="text"/>	<input type="text"/>				
Did you up to date with your courses <small>(Mark an "X" and complete for the "No" case)</small>	Yes <input type="checkbox"/>	Indicate number of courses that are not up-to-date					
		Not <input type="checkbox"/>	<input type="text"/>				
		Indicate the number of times you failed courses					
		<input type="text"/>					
POST GRADUATE STUDIES							
<small>Indicate the principal programs of improvement or studies carried out after having graduated from the university, or that currently it is developing. Also, indicate with a "X" for every program, the type of program it study: Qualified, Regular, Doctoral, the institution and the year in which it was realized</small>	NAME OF THE STUDY PROGRAM	Type (mark a "X")				PLACE	YEAR
		Coar	Dipló	Mas	Docto		
		se	ma	ter	rate		
	1						
	2						
	3						
	4						
	5						
	6						
7							
8							

1.3 GRADUATES IN PROFESSIONAL ACTIVITIES – Part B

<p>PROFESSIONAL ACTIVITY</p> <p><i>Indicate the background main the scope of their professional practice with an "X", as an independent or carrying out activities for a company. Complete the background in each case. If you do activities in both areas, complete all the background, and indicate in "remarks" what your main activity is.</i></p>	<input type="checkbox"/> Independent	ACTIVITY											
	<input type="checkbox"/> In a company	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; padding: 2px;">COMPANY NAME</td> <td style="padding: 2px;">COMPANY ACTIVITY</td> </tr> <tr> <td style="padding: 2px;">TYPE OF COMPANY</td> <td style="padding: 2px;">POSITION IN THE COMPANY</td> </tr> <tr> <td style="padding: 2px;">TIME WORKING IN THE COMPANY (years, months)</td> <td style="padding: 2px;"></td> </tr> </table>		COMPANY NAME	COMPANY ACTIVITY	TYPE OF COMPANY	POSITION IN THE COMPANY	TIME WORKING IN THE COMPANY (years, months)					
	COMPANY NAME	COMPANY ACTIVITY											
	TYPE OF COMPANY	POSITION IN THE COMPANY											
	TIME WORKING IN THE COMPANY (years, months)												
WORK CONTRACT			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 2px;">CONTRACTUAL QUALITY</td> <td style="width: 50%; padding: 2px;">CONTRACTUAL CONDITION</td> </tr> <tr> <td style="padding: 2px;"> On contract <input type="checkbox"/> Plant <input type="checkbox"/> </td> <td style="padding: 2px;"> Fees <input type="checkbox"/> Plant / Indefinite <input type="checkbox"/> </td> </tr> <tr> <td colspan="2" style="padding: 2px;">CONTRACTUAL MODE</td> </tr> <tr> <td style="padding: 2px;">Complete <input type="checkbox"/></td> <td style="padding: 2px;">Halfday <input type="checkbox"/></td> </tr> <tr> <td style="padding: 2px;">Hours <input type="checkbox"/></td> <td style="padding: 2px;"></td> </tr> </table>	CONTRACTUAL QUALITY	CONTRACTUAL CONDITION	On contract <input type="checkbox"/> Plant <input type="checkbox"/>	Fees <input type="checkbox"/> Plant / Indefinite <input type="checkbox"/>	CONTRACTUAL MODE		Complete <input type="checkbox"/>	Halfday <input type="checkbox"/>	Hours <input type="checkbox"/>	
CONTRACTUAL QUALITY	CONTRACTUAL CONDITION												
On contract <input type="checkbox"/> Plant <input type="checkbox"/>	Fees <input type="checkbox"/> Plant / Indefinite <input type="checkbox"/>												
CONTRACTUAL MODE													
Complete <input type="checkbox"/>	Halfday <input type="checkbox"/>												
Hours <input type="checkbox"/>													
REMUNERATION LEVEL Indicate (with an "X") the total liquid remuneration level (in CLS) that you receive monthly (on average).			<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; padding: 2px;">Level</th> <th style="width: 50%; padding: 2px;">Rank</th> </tr> </thead> <tbody> <tr> <td style="padding: 2px;">Less than a 400.000</td> <td style="padding: 2px;">between 1.400.001 and 1.700.000</td> </tr> <tr> <td style="padding: 2px;">between 400.001 and 700.000</td> <td style="padding: 2px;">between 1.700.001 and 2.000.000</td> </tr> <tr> <td style="padding: 2px;">between 700.001 and 1.000.000</td> <td style="padding: 2px;">between 2.00.001 and 2.500.000</td> </tr> <tr> <td style="padding: 2px;">between 1.000.001 and 1.400.000</td> <td style="padding: 2px;">Over 2.500.000</td> </tr> </tbody> </table>	Level	Rank	Less than a 400.000	between 1.400.001 and 1.700.000	between 400.001 and 700.000	between 1.700.001 and 2.000.000	between 700.001 and 1.000.000	between 2.00.001 and 2.500.000	between 1.000.001 and 1.400.000	Over 2.500.000
Level	Rank												
Less than a 400.000	between 1.400.001 and 1.700.000												
between 400.001 and 700.000	between 1.700.001 and 2.000.000												
between 700.001 and 1.000.000	between 2.00.001 and 2.500.000												
between 1.000.001 and 1.400.000	Over 2.500.000												
REMARKS Indicate (optionally), the information that should need to clarify or to complement the information delivered.													
<div style="border: 1px solid black; height: 20px; width: 100%;"></div>													

2. ITEMS – EMOTIONAL CAPITAL (items 1 to 40) AND RELATIONAL CAPITAL (items 41 to 92)

ITEMS			
Id.	ITEMS EMOTIONAL CAPITAL	Id.	ITEMS RELATIONAL CAPITAL
E01	Emotions have helped me achieve good performance in the student or work environment.	Ro1	I know how to distance myself from my point of view and put myself in another's place.
E02	I realize when I experience emotional changes during the day.	Ro2	Before criticizing someone, I try to imagine how I would feel if I were in his/her place.
E03	Faced with a distressing situation, I am able to describe what I feel.	Ro3	In general, I like to put people's interests before my own interests.
E04	I get angry when they work improperly.	Ro4	I try to understand the feelings of the person that I am listening.
E05	I realize when I have negative thoughts.	Ro5	Can easily stop daydreaming to connect with the reality of immediate situations.
E06	I care more about following my interests than getting practical results.	Ro6	I usually understand other people's opinions, even if I disagree with them.
E07	If my activities complicate myself, I try to calm down.	Ro7	People tell me that I am able to understand how they feel and what they are thinking.
E08	The uninteresting jobs I face them with a positive attitude.	Ro8	I say the things I think when people do not work at the same level.
E09	I have the ability to make decisions even when it affects other people's lives.	Ro9	In a working group, I often try to find out what the rest of me wants.
E10	I don't have trouble making decisions, independent of the place where I find.	R10	I realize when a person wants to make a constructive critique of me.
E11	The opinion that other people have of me does not influence my way of being.	R11	The positive reinforcements delivered by others towards me, they provoke me a great happiness.
E12	I never feel sad, since I have the appreciation of the people around me.	R12	I am able to accept from other people opinions different from mine without being irritated.
E13	It's more important to feel satisfied with myself, than to give attention to the opinions that others have on me.	R13	I scare to receive news that could harm my labor targets or of study.
E14	I have enough force to move forward, even when events become difficult.	R14	I offer constructive criticism and I point out ideas to improve people's behavior.
E15	I consider myself to be a person capable of expressing the feelings in a guessed right way.	R15	I am able to propose specific changes in the way of doing things.
E16	If someone has spoken bad of me or indicate facts that do not correspond, I try to talk to the person as soon as possible to clarify it.	R16	I recognize and reward the virtues, achievements and progress of other people.
E17	I express what I really think when my opinion does not coincide with that of others.	R17	I identify and use the language with which I know I will get a better answer.
E18	I say to the others when his conduct creates trouble for me.	R18	In a meeting, I have the ability to easily understand others ' viewpoints.
E19	Even when I'm angry, I can express myself without showing my irritation, my frustration or my disappointment.	R19	I am faced with prejudice and intolerance.
E20	I can proceed before the conflicts of constructive form.	R20	I care what happens to other people.
E21	I can orient my feelings in the face of conflict situations.	R21	I can feel when a friend needs to talk about his problems.
E22	I care about having a good state of mind.	R22	I understand well the needs and wishes of others.
E23	I keep calm when other people scold me as a result of their anger.	R23	I help and give timely advice to encourage and strengthen the performance of others.
E24	In stressful situations, I recognize my emotions and I can handle them.	R24	I know how to give help and give advice to others when necessary.
E25	I avoid hurting other people's feelings.	R25	I encourage and motivate other people after a problem.
E26	To do a job well, I don't need any support.	R26	I encourage and teach others, making them feel strong and important.
E27	When I can't find a way out of a problem quickly, I'm persistent until I find a solution that satisfies me.	R27	I feel satisfaction in helping my fellows when they need it.
E28	By entering a learning activity, I show an interest in learning the new topics.	R28	I am capable of asking for help when I do not understand certain topics in my daily activity.
E29	I try to do my best to stand out in every activity I do.	R29	One of my priorities has been to attend to the needs of the others.

E30	I tend to see more opportunities than problems.	R30	It's easy for others to count on me.
E31	To be involved fully in what I do, I do not need that they stimulate me.	R31	I act in a manner consistent with the needs and expectations of the working groups in which I participate.
E32	Adversity has helped me grow as a person.	R32	At the time of being in contact with working groups, I feel more comfortable directing them.
E33	In the moments that I do not feel well, I am able to modify my mood to continue the day.	R33	I manage to handle the complicated situations at the moment of integrating a group.
E34	I check my decisions and actions with my personal mission and make the appropriate adjustments.	R34	In a workgroup, I prefer to define the "what to do" before another person does it.
E35	I am capable of developing new and more productive conducts.	R35	I'm more of a leader than a follower.
E36	I anticipate myself and prepare myself for the reactions of the people.	R36	When important matters are discussed, I prefer to express my differences immediately.
E37	I can easily adapt to the new conditions or situations that arise in the daily activity.	R37	I'm able to influence other people.
E38	I try to avoid offending the feelings of other persons even when they have disturbed me.	R38	I adapt the presentation or discussion to attract the interest of others.
E39	I can perform jobs that require a lot of patience and pressure.	R39	I think in advance about the effect that an action will produce in the image that the persons have of me.
E40	I do not feel bad if someone with a certain authority shouts or reprimands me for not finishing a job on time.	R40	I carry out actions especially thought to produce a certain impact.
		R41	I try to speak well and clearly.
		R42	My body language and gestural is consistent with what I express verbally.
		R43	I strive to understand what other people tell me.
		R44	I give attention to the non-verbal language of others.
		R45	When I am in disagreement with someone, I generally prefer to remain silent before starting a discussion.
		R46	I consider myself a good negotiator with people.
		R47	I am capable of acting like mediator opposite to conflicts between the persons.
		R48	Sometimes I avoid expressing opinions that could create controversy.
		R49	When I disagree with someone, I am capable of saying it.
		R50	I have good relations with others.
		R51	People think I'm sociable.
		R52	I try to maintain the relationships that can bring me some benefit in the future.

Appendix 2: UTEM - Performance results of indexes and emotional components with IE_{om}^2 and IC_{om}^2 Models

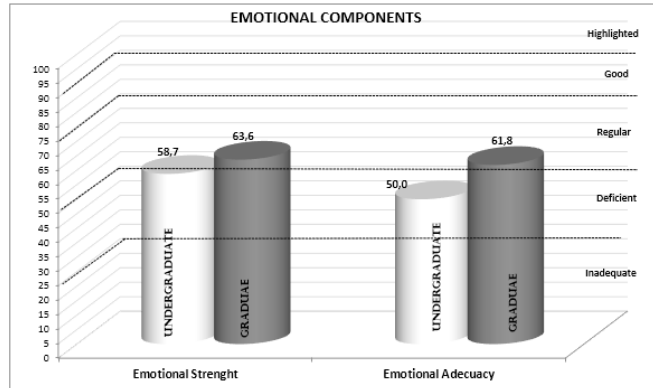
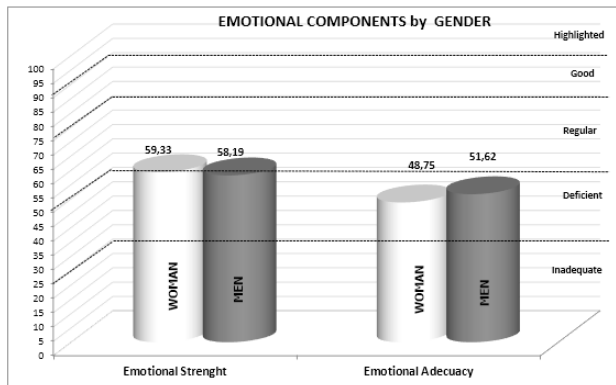


Figure A2.1: Emotional Components - Total and Gender indexes. Source: Prepared by the authors.

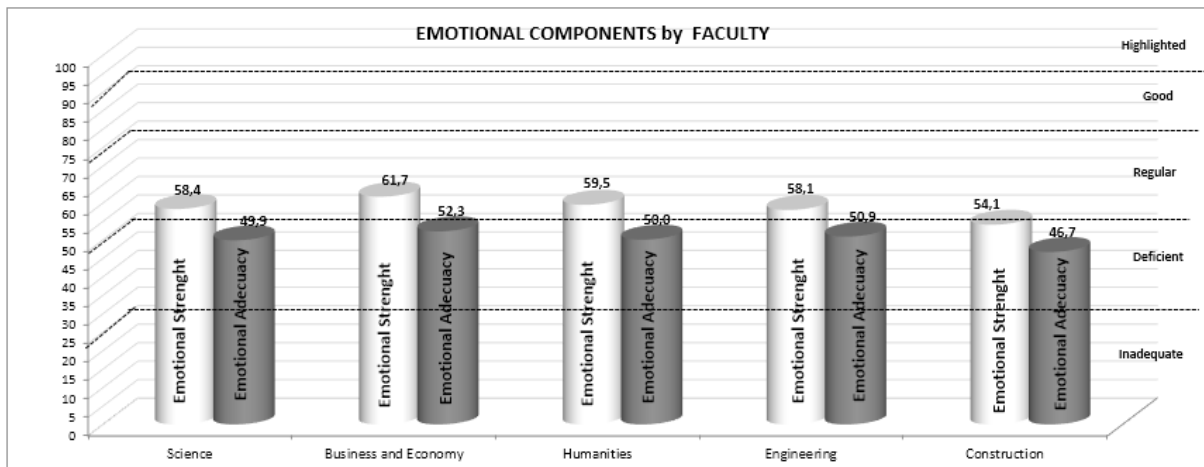


Figure A2.2: Emotional Components by Faculty. Source: Prepared by the authors.

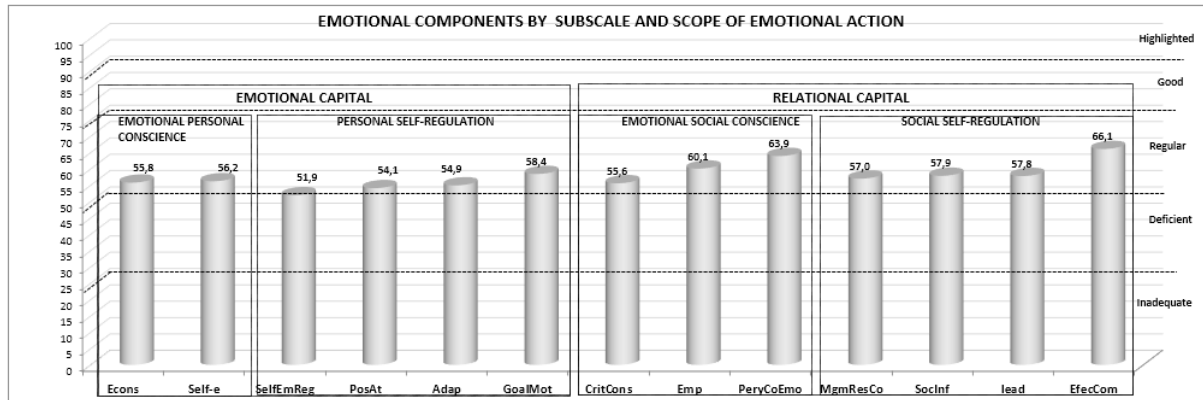


Figure A2.3: Emotional Components By subscale and scope of Emotional Action. Source: Prepared by the authors.
 Note: Econs: Emotional conscience; Self-e: Self- esteem; SelfEmReg: Self-Emotional regulation; PosAt: Positive Attitude; Adap: Adaptability; GoalMot: Goal motivation; CritCons: Critical conscience; Emp: Empathy; PeryCoEmo: Perception and Understanding Emotional; MgmResCo: Management and resolution of conflicts; SocInf: Social Influence; Lead: Leadership; EfecCom: Effective Communication.

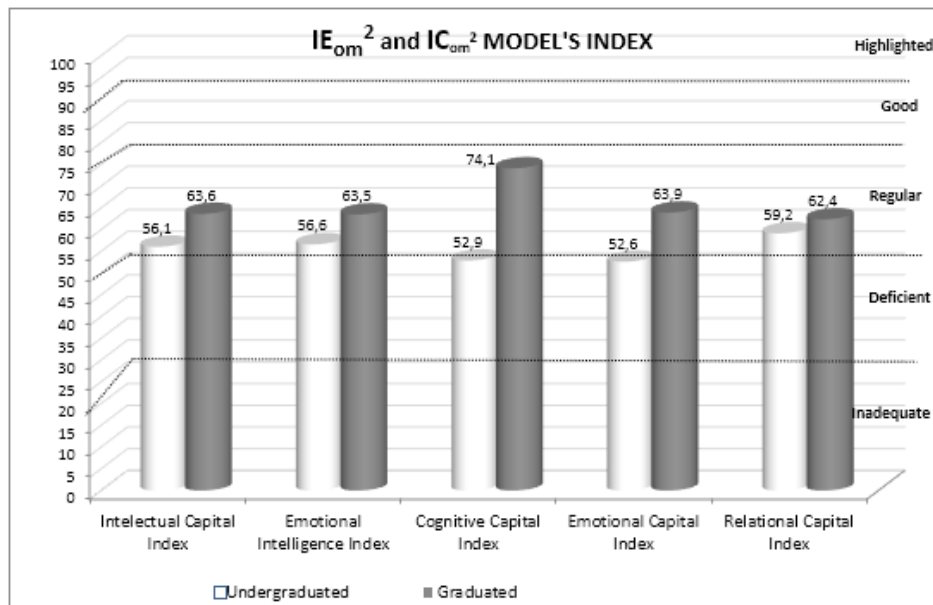


Figure A2.4: Emotional Intelligence and Intellectual Capital Model's Index. Source: Prepared by the authors.

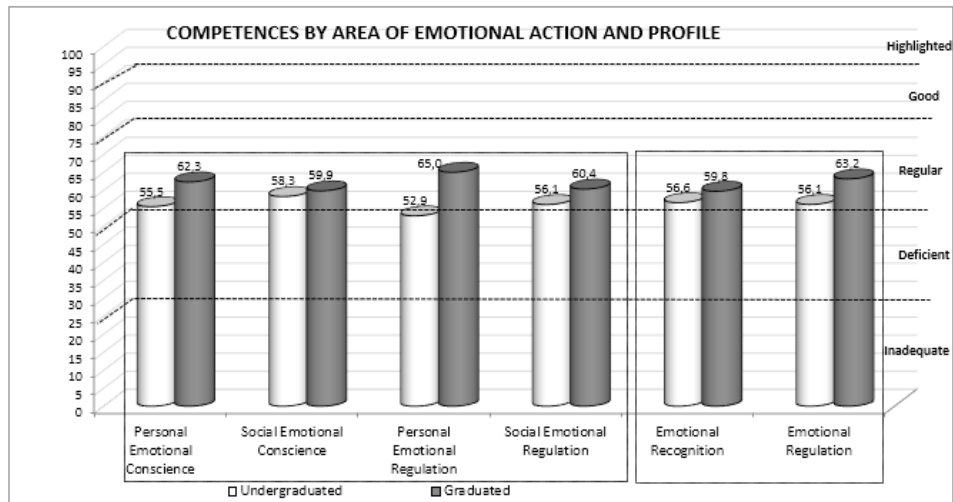


Figure A2.5: Competences according to area of emotional action and profile. Source: Prepared by the authors.

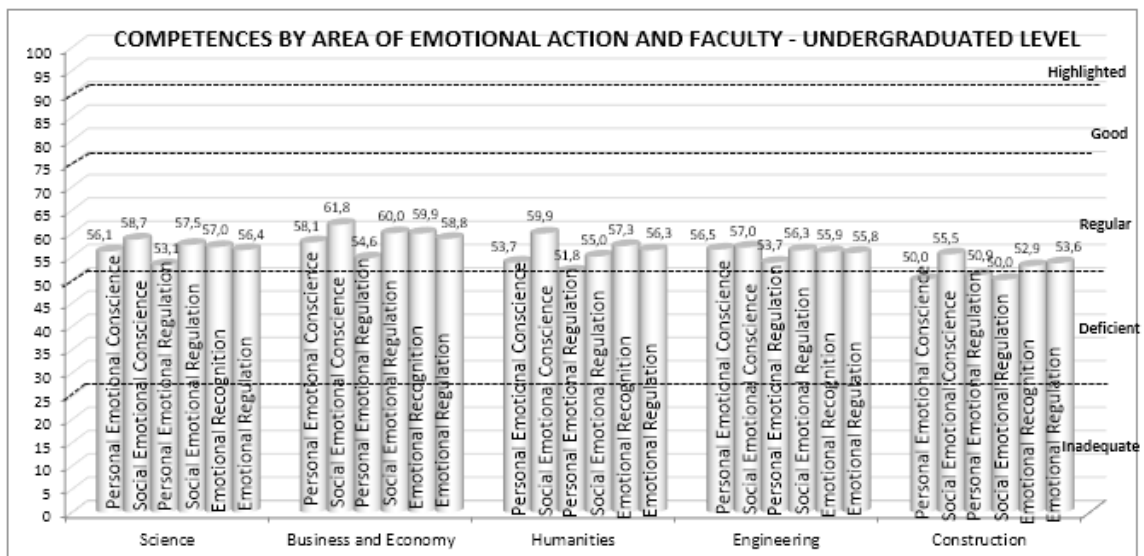


Figure A2.6: Competences by area of Emotional Action and Faculty - Undergraduate Level. Source: Prepared by the authors.

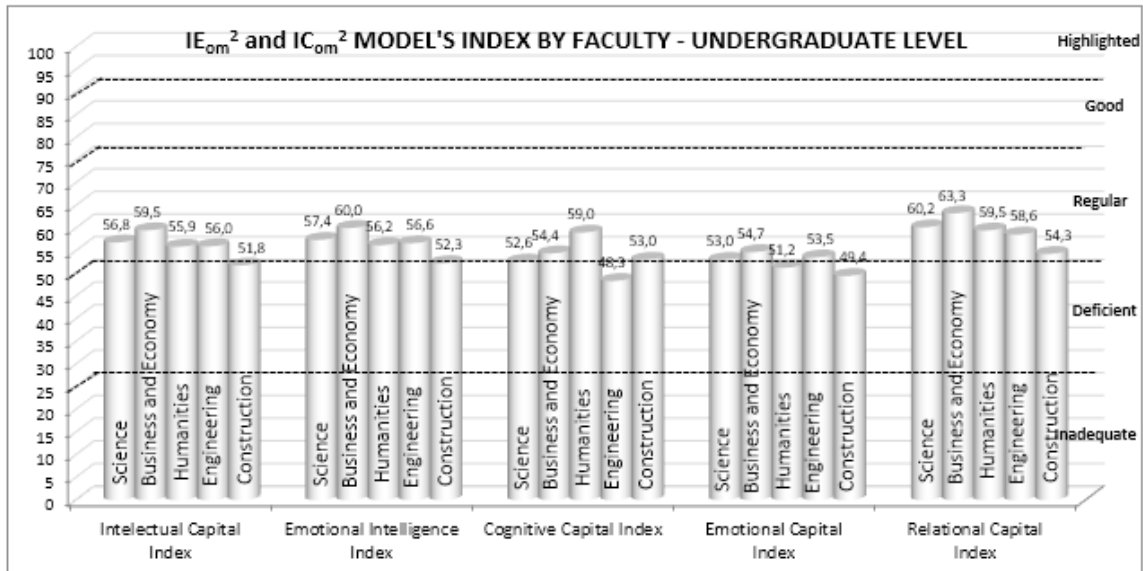


Figure A2.7: IE_{om}² and IC_{om}² MODEL'S index by Faculty-Undergraduate Level. Source: Prepared by the authors.

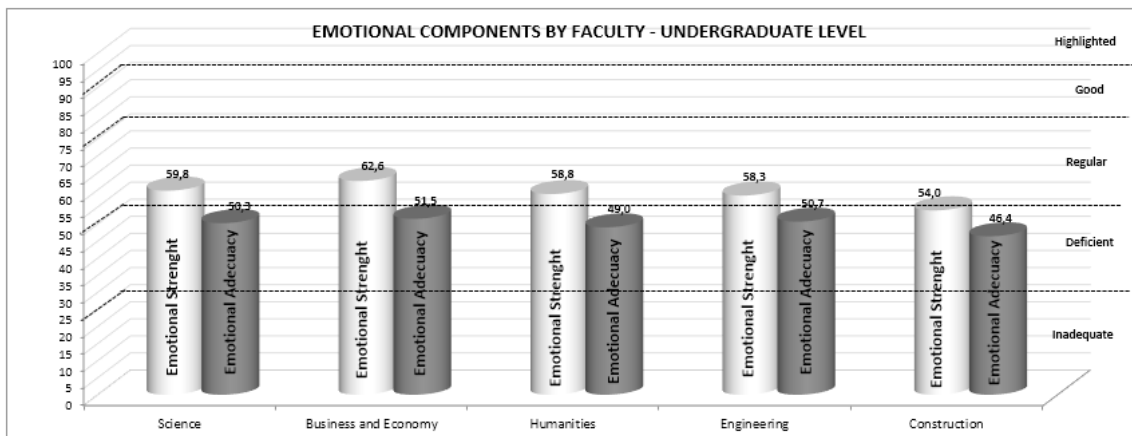


Figure A2.8: Emotional Components by Faculty - Undergraduate Level-. Source: Prepared by the authors.

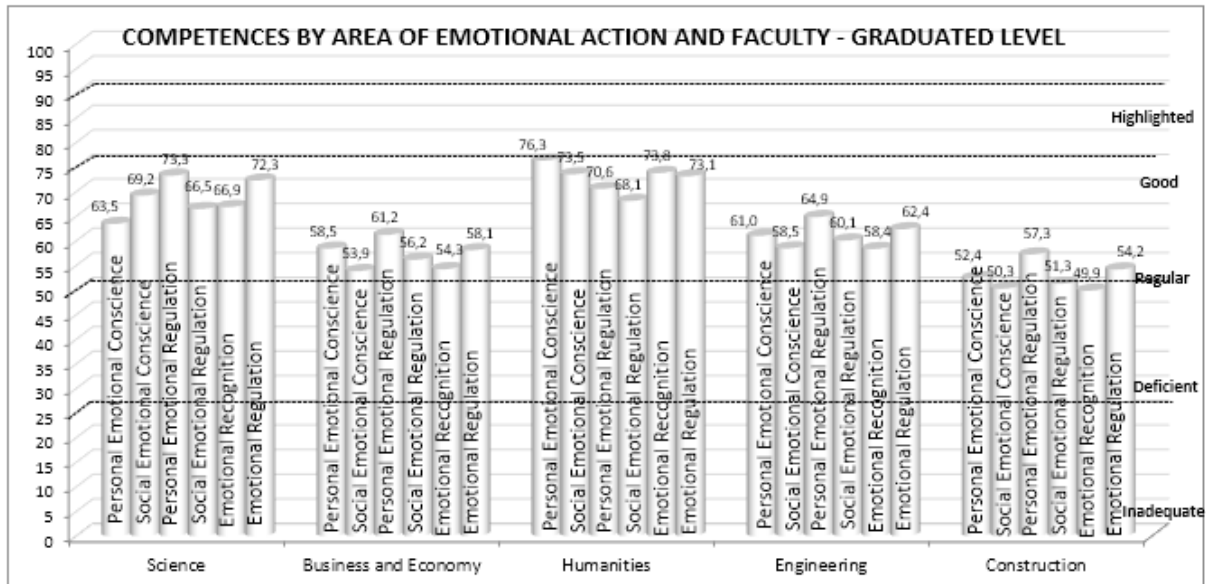


Figure A2.9: Competences by area of Emotional Action and Faculty - Graduates Level. Source: Prepared by the authors.

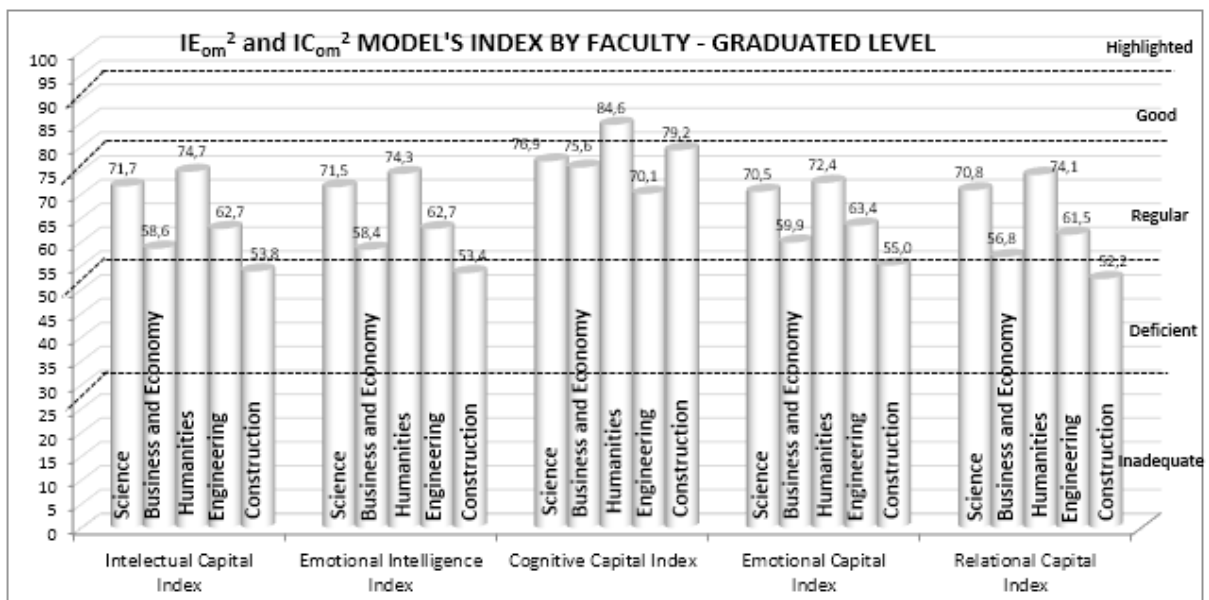


Figure A2.10: IE_{om}² and IC_{om}² MODEL'S index by Faculty- Graduates Level. Source: Prepared by the authors.

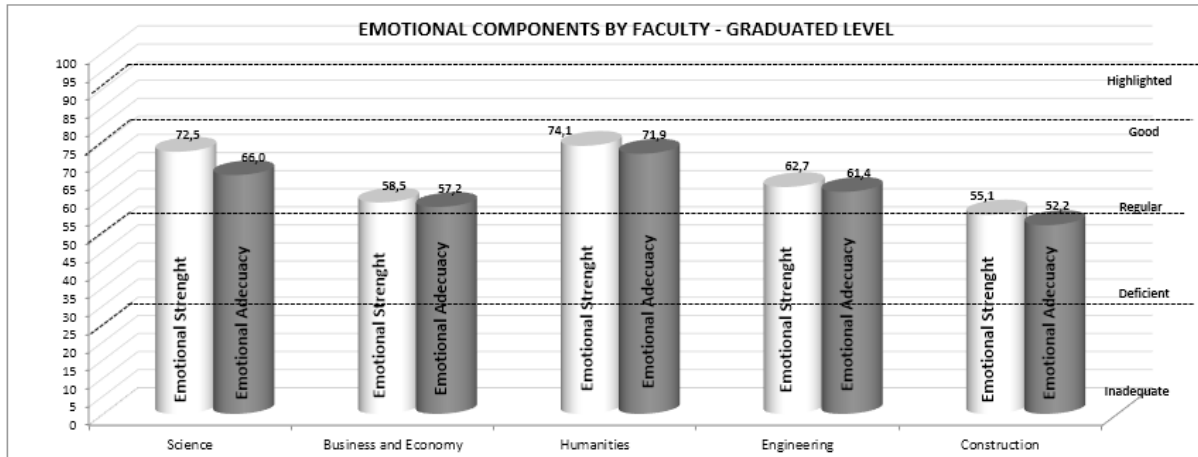


Figure A2.11: Emotional Components by Faculty - Graduates Level. Source: Prepared by the authors.

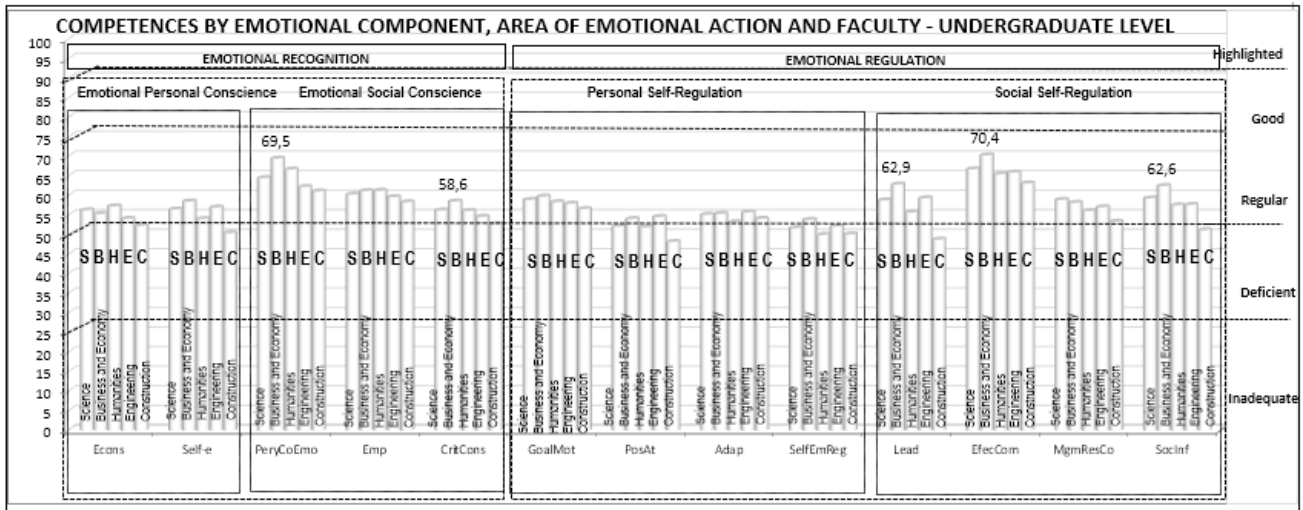


Figure A2.12: Emotional competences by Faculty, Emotional Action Area and Emotional Component - Undergraduate Level. Source: Prepared by the authors. Note: Econs: Emotional conscience; Self-e: Self- esteem; PeryCoEmo: Perception and Understanding Emotional; Emp: Empathy; CritCons: Critical conscience; GoalMot: Goal motivation; PosAt: Positive Attitude; Adap: Adaptability; SelfEmReg: Self-Emotional regulation; Lead: Leadership; EfecCom: Effective Communication; MgmResCo: Management and resolution of conflicts; SocInf: Social Influence. S: Science Faculty; B: Business Faculty; H: Humanities Faculty; E: Engineering Faculty; C: Construction Faculty.

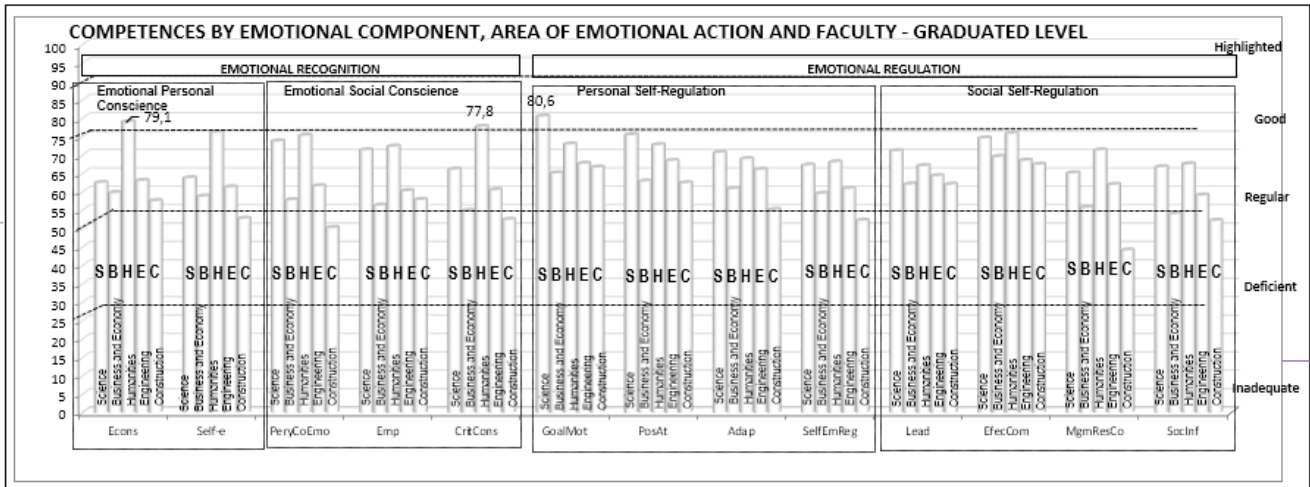


Figure A2.13: Emotional competences by Faculty, Emotional Action Area and Emotional Component - Graduates Level. Source: Prepared by the authors. Note: Econs: Emotional conscience; Self-e: Self- esteem; PeryCoEmo: Perception and Understanding Emotional; Emp: Empathy; CritCons: Critical conscience; GoalMot: Goal motivation; PosAt: Positive Attitude; Adap: Adaptability; SelfEmReg: Self-Emotional regulation; Lead: Leadership; EfecCom: Effective Communication; MgmResCo: Management and resolution of conflicts; SocInf: Social Influence. S: Science Faculty; B: Business Faculty; H: Humanities Faculty; E: Engineering Faculty; C: Construction Faculty.

Appendix 3: Contrasting Process No. 2:

Analysis of the plausibility that shows that Emotional Capital is the most important coefficient in people's intellectual capital (*based on the analysis of the degree of each component of the standardized intellectual capital - "CE", "RC" and "CC" - according to gender*).

A. INITIAL CONSIDERATIONS:

- The index of Cognitive Potential (Ipc) is composed of two subindexes: general Cognitive Potential Index (Ipc-g), oriented to potential of capabilities at undergraduate level and professional Cognitive Potential Index (Ipc-p), oriented to potential of capabilities acquired as a product of professional practice and continuous training.
- The process of analysis and contrast of hypotheses to verify the importance of emotional capital (CE), with respect to components of relational capital (RC) and cognitive capital (CC) at level of gender (women and men) and profile (undergraduate university students at initial, terminal and graduate levels), has been divided into two parts, according to gender and profile.

B. ANALYSIS:

B.1. Analysis by gender

B1.1. Analysis of initial condition according to gender and non-parametric test:

The process of hypothesis testing of continuous variables CE, CR and CC vs gender of subjects (considering the study groups: women and men), verifies a condition of non-normality for case of CC, whereby the variables as a whole do not come from a normal distribution ($p_value > 0.05$ in samples of CE and CR and $p_value < 0.05$ in CC). Since there is a condition of non-normality

and considering that scope of hypothesis testing study includes a cross-sectional study with 2 independent samples (female and male groups) and that variables to be analyzed, CE, CR and CC, are standardized quantitative indexes, the samples were subjected to the nonparametric Mann-Whitney U test having previously verified the condition of non-normality for one of samples and normality for two of them, which implied the following contrast analysis (with $\alpha = 0.05$), finally verifying the H_0 hypothesis.

- $H_0 (p > \alpha)$: Emotional capital (CE) does not differ significantly with respect to relational capital (RC) and cognitive capital (CC).
- $H_1 (p \leq \alpha)$: emotional capital (CE) differs significantly with respect to relational capital (RC) and cognitive capital (CC).

The results of the application of the test, according to gender, are summarized in Figure A3.1.

B.1.2. Results and Interpretation:

Since the p-value for one of the variables under study (CC) is < 0.05 ($p_CC\ Female$ and $p_CC\ Male = 0.000 < 0.050$), H_0 is rejected indicating that the distribution of variable CC differs from a normal distribution. Therefore, H_1 is accepted; that is the variables under study do not come from a normal distribution, given that one of the variables under study, CC, does not have a normal distribution and parametric statistical tests could not be applied to it.

Analysis level		Information level									
Standardized Index	Scope (Gsex)	Statistical Summary							Normality Test		
		Valid Cases	Mean	Median	Variance	Standard deviation	Skewness	Kurtosis	Z of K-S	Asymptotic sig. (bilateral)	Hypothesis
CE	1. Woman	539	51,659	50,300	256,974	16,030	0,155	-0,476	0,785	0,568	Ho
	2. Male	353	53,947	54,270	321,590	17,933	-0,130	-0,215	0,696	0,718	Ho
	Global	892	53,041	52,825	296,954	17,232	-0,018	-0,298	0,820	0,510	Ho
CR	1. Woman	539	59,889	60,190	260,518	16,141	-0,014	-0,469	0,684	0,737	Ho
	2. Male	353	58,427	58,320	292,768	17,110	-0,162	-0,128	0,574	0,896	Ho
	3.Global	892	59,006	58,910	280,211	16,740	-0,116	-0,226	0,660	0,770	Ho
CC	1. Woman	539	57,285	60,540	122,613	11,073	-0,082	1,044	2,990	0,000	H1
	2. Male	353	54,384	57,780	169,543	13,021	-0,702	2,608	2,742	0,000	H1
	3.Global	892	55,532	59,090	152,827	12,362	-0,569	2,420	3,820	0,000	H1
Hypothesis Testing											
"Likelihood analysis that value of Emotional Capital is coefficient of highest importance in Intellectual Capital, according to gender"											
Hypothesis										Verified Hypothesis	
<ul style="list-style-type: none"> Ho: Emotional capital (EC) does not differ significantly with respect to relational capital (RC) and cognitive capital (CC). H1: Emotional Capital (EC) differs significantly with respect to Relational Capital (RC) and Cognitive Capital (CC). 										H1	
<p style="text-align: center;">Box plots</p>											

Non-Parametric Analysis Results									
Test: Mann-Whitney U test (Cross-sectional study, 2 independent groups: Women and Men).					Contrast variable: CE, CR and CC				
Testing of Hypotheses									
<ul style="list-style-type: none"> · Ho: The mean values of CE, CR and CC indices show no significant difference; that is, there is no significant evidence of a difference between the mean values of quantitative variables CEs, CRs and CCs. · H1: The mean values of the CE, CR and CC indices are significantly different; that is, there is significant evidence of difference between the mean values of quantitative variables CEs, CRs and CCs. · Significance level: 5% (0.05) 									
Testing Statistic Non-Parametric Test									
Standardized indexes	Average rank		Average rank sum		Mann-Whitney's U	Wilcoxon's W	K-S's Z	Asymptotic sig. (bilateral)	Verified Hypothesis
	Woman	Man	Woman	Man					
CE	422,858	461,983	149.269,0	249.009,0	86.788,000	149.269,00	-2,218	0,027	H1
CR	458,548	438,609	161.867,5	236.410,5	90.880,500	236.410,50	-1,130	0,258	Ho
CC	486,316	420,424	171.669,5	226.608,5	81.078,500	226.608,50	-3,735	0,000	H1
Contrast Result: <ul style="list-style-type: none"> • The means of emotional capital (EC) and Cognitive Potential (CC) indexes present differences at level of samples corresponding to gender level (Males and Females), which means there is statistically significant difference between the average values of Emotional Capital ("EC") and Cognitive Potential ("CC") quantitative variables. In other words, the groups defined by quantitative variables "EC" and "CC" come from populations with different averages. 									

Figure A3.1 Hypothesis Testing Process. Analysis of Emotional Intelligence and Emotional Capital: "Analysis of the importance of Emotional Capital in Intellectual Capital according to gender - Results". Source: self-made. Note: K-S: Kolmogorov-Smirnov.

Since it has been verified that there is no normality in the set of variables under study, parametric methods cannot be applied and nonparametric methods must be used. The appropriate test for a nonparametric contrast of three variables (CE, CR and CC) in order to verify if there are significant differences between the variables at gender level (two groups), is the Mann-Whitney U test (nonparametric test, considering gender as an ordinal grouping variable: Gsex, with values 0: female; 1: male). The results of application of Mann-Whitney U test show that means of emotional capital (CE) and Cognitive Potential (CC) indexes present differences (CE = 0.027 and CC= 0.000, both < 0.05), corresponding to samples at gender level, which means that there is a statistically significant difference between the mean values of Emotional Capital and Cognitive Potential quantitative variables.

In other words, the groups defined by quantitative variables CE and CC come from populations with different averages.

B.2. Profile analysis results:

B.2.1. Analysis of initial condition according to gender and non-Parametric test:

The process of hypothesis testing of continuous variables CE, CR and CC vs. profile of subjects (considering the study groups: initial, terminal and graduates), verifies a condition of non-normality in case of CR and CC, so that variables do not come from a normal distribution (p_value < 0.05 in the samples of CR_initial and CC_graduate). Considering that scope of contrastive study comprises a cross-sectional study with three independent samples (initial, terminal and graduate groups) and variables to be analyzed, CE, CR and CC, are standardized quantitative indexes, the samples were subjected to the Kruskal-Wallis nonparametric test, which implied the following contrast analysis (with = 0.05), finally verifying hypothesis H1.

- Ho (p > α): Emotional capital (CE) does not differ significantly with respect to relational capital (RC) and cognitive capital (CC).

- H1 ($p \leq \alpha$): Emotional capital (CE) differs significantly with respect to relational capital (RC) and cognitive capital (CC).

In order to analyze between which groups there are statistically significant differences, the samples are additionally subjected to post-hoc test, using Dunn's test, which shows differences in initial and final groups, in case of emotional capital, and between all groups in case of cognitive capital.

The results of contracting process hypothesis and post-hoc test are summarized in Figure A3.2

Analysis level		Information level									
Standardized index	Scope (Gsex)	Statistical Summary							Normality Test		
		Valid Cases	Mean	Median	Variance	Standard deviation	Skewness	Kurtosis	Z of K-S	Asymptotic sig. (bilateral)	Hypothesis
CE	1. Initial	553	51,315	50,630	299,239	17,299	0,025	-0,264	0,025	0,200	Ho
	2. Terminal	274	53,943	53,165	288,510	16,986	0,097	-0,329	0,037	0,200	Ho
	3. Graduates	65	63,928	65,430	172,962	13,151	-0,586	1,699	0,107	0,061	Ho
	Global	892	53,041	52,825	296,954	17,232	-0,018	-0,298	0,027	0,112	Ho
CR	1. Initial	553	57,928	57,730	293,038	17,118	-0,116	-0,347	0,044	0,012	H1
	2. Terminal	274	60,380	60,190	264,746	16,271	-0,107	-0,092	0,033	0,200	Ho
	3. Graduates	65	62,377	61,380	214,647	14,651	0,220	0,235	0,096	0,200	Ho
	Global	892	59,090	58,910	280,211	16,740	-0,116	-0,226	0,022	0,200	Ho
CC	1. Initial	553	56,362	59,660	65,850	8,115	-0,974	0,170	0,179	0,000	H1
	2. Terminal	274	49,450	50,310	206,797	14,380	-0,843	0,610	0,102	0,000	H1
	3. Graduates	65	74,105	74,480	162,880	12,762	0,107	-0,471	0,058	0,200	Ho
	Global	892	55,532	59,090	152,827	12,362	-0,569	2,420	0,128	0,000	H1

Hypothesis Testing							
"Likelihood analysis that value of Emotional Capital does not differ significantly with respect to Relational Capital (RC) and Cognitive Capital (CC), according to profile"							
Hypothesis						Verified Hypothesis	
<ul style="list-style-type: none"> • Ho: Emotional capital (EC) does not differ significantly with respect to relational capital (RC) and cognitive capital (CC). • H1: Emotional Capital (EC) differs significantly with respect to Relational Capital (RC) and Cognitive Capital (CC). 						H1	
<p style="text-align: center;">Box plots</p>							
Non-Parametric Analysis Results							
Test: Kruskal-Wallis (Cross-sectional study, three independent groups: Initial, Terminal and Graduates)				Contrast variable: CE, CR and CC			
Testing of Hypotheses							
<ul style="list-style-type: none"> • Ho: The median of the CE, CR and CC indices show no significant difference; that is, there is no significant evidence of difference between the medians of the quantitative variables CE, CR and CC. • H1: The median of the CE, CR and CC indices are significantly different; that is, there is significant evidence of a difference between the medians of the quantitative variables CE, CR and CC. • Significance level: 5% (0.05). 							
Testing Statistic Non-Parametric Test							
Standardized indexes	Average rank			Kruskal-Wallis test			Verified Hypothesis
	Initial	Terminal	Graduates	Chi ²	gl.	Asymptotic sig. (bilateral)	
CE	420,564	457,257	621,808	36,176	2,000	0,000	H1
CR	430,448	467,078	496,323	6,326	2,000	0,042	H1
CC	454,990	353,350	766,931	136,959	2,000	0,000	H1
Results: <ul style="list-style-type: none"> - The medians of all indexes present significant differences with p-value < α (CEs: 0.00; CRs: 0.042 and CCs: 0.00), at level of the samples corresponding to detailed profile (students in initial stage, students in final stage and graduates). - There are statistically significant differences between the average values of quantitative component variables of Emotional Intelligence ("CEs": Emotional Capital, "CRs": Relational Capital and "CCs": Cognitive Potential). 							

Figure A3.2: Hypothesis Testing Process. Analysis of Emotional Intelligence and Emotional Capital. Analysis of importance of Emotional Capital in Intellectual Capital according to profile – Results. Source: self-made. Note: K-S: Kolmogorov-Smirnov.

B.2.2. Results and Interpretation:

Since the p-value for two of variables under study (CR and CC) has a p_value < (initial CR_value = 0.012 < 0.050 and initial and terminal CC = 0.000 < 0.050), the null hypothesis is rejected, indicating that set of all variables

differs from a normal distribution. Therefore, H1 is accepted; that is, the variables under study do not come from a normal distribution, since two of variables under study, CR and CC, do not have a normal distribution and parametric statistical tests could not be applied to them. Since it has been verified that there is no normality in the set of variables under study, parametric methods cannot be applied and non-parametric methods must be used. The appropriate test for a nonparametric contrast of 3 variables (CE, CR and CC) in order to verify whether there are significant differences between the variables at level of three study groups is the nonparametric Kruskal-Wallis test, considering the level of subjects (Glevel, with values 0: initial; 1: terminal and 2: graduates) as an ordinal grouping variable.

The results of the application of Kruskal-Wallis test show that:

- The medians of all indices present significant differences with $p\text{-value} < \alpha$ (CE: 0.00; CR: 0.042 and CC: 0.00), at level of samples corresponding to detailed profile.
- There are statistically significant differences between the mean values of quantitative component variables of emotional intelligence (CE, CR and CC).

Based on the above, the null hypothesis, H_0 is rejected, accepting the alternative hypothesis; that is, emotional capital (EC) differs significantly with respect to relational capital (RC) and cognitive capital (CC).

In order to determine between which profile levels there are differences, Dunn's post-hoc test was also applied as a method for the comparison of multiple variables (generalizes the Bonferroni adjustment procedure), from the point of view of analysis of variance, based on the average ranges of each variable. The cases of post-hoc analysis via Dunn's test, in

order to determine the existence of statistically significant differences, are as follows:

- CE vs. Profile case,
- CR case vs profile and,
- Case CC vs Profile.

B.3. Post-Hoc analysis.

The general procedure for application of Dunn's test includes the following actions and results according to cases analysis:

B.3.1. Actions

- Determine alpha-adjusted (α).
- Elaborate Matrix of Theoretical Differences between levels (groups) and determine the theoretical differences (D_{tij}).
- Develop Observed Difference Matrix between levels (groups) and determine the observed differences (DO_{ij}): Calculation of absolute value of average difference between the group ranks compared to theoretical difference between the groups. If it is greater than theoretical difference, then: "the difference is significant".
- Elaborate Total Difference Matrix, obtained based on the differences between the Observed Difference and Theoretical Difference between the levels (groups) and determine the observed differences (DT_{ij}).
- Elaborate Total Difference Signs Matrix, based on the differences between Observed Difference and Theoretical Difference between levels (groups) and determine the signs of observed differences (DT_{ij}).
- Analyze each of signs of Total Difference Sign Matrix (if $Sign_{ij}$ is $>$, then there is a significant difference between group i and group j).

B.3.2. Results:

1. Difference matrices by case analysis:

1.1. Difference Matrices - CE Case vs Profile

(Figure A3.3).

Theoretical Differences Matrix between levels (groups: ΔI_I)					
Average Rank	Average Rank	Groups	Initial	Terminal	Graduates
420,5642	420,5642	Initial		45,57	80,87
457,2573	457,2573	Terminal			85,10
621,8077	621,8077	Graduates			
	η^2		553	274	65

Observed Differences Matrix between levels (groups: ΔO_{II})					
Average Rank	Average Rank	Groups	Initial	Terminal	Graduates
420,5642	420,5642	Initial		36,69	201,24
457,2573	457,2573	Terminal			164,55
621,8077	621,8077	Graduates			

Total Difference Matrix between levels ($\Delta I_I - \Delta O_{II}$)					
Average Rank	Average Rank	Groups	Initial	Terminal	Graduates
420,5642	420,5642	Initial		8,88	- 120,37
457,2573	457,2573	Terminal			-79,00
621,8077	621,8077	Graduates			

Theoretical Matrix vs. Observed matrix between levels					
Average Rank	Average Rank	Groups	Initial	Terminal	Graduates
452,05	452,05	Initial		<	>
343,29	343,29	Terminal			>
834,38	834,38	Graduates			

Figure A3.3: Hypothesis Contrasting Process. Analysis of Emotional Intelligence and Emotional Capital. Post-Hoc Analysis via Dunn's Test - CE Case Results vs Profile (median analysis). Source: self-made.

1.2. Difference Matrices - CR Case vs Profile
 (Figure A3.4)
 1.3.

Theoretical Differences Matrix between levels (groups: $\Delta\eta_{ij}$)				
Average Rank	n_i	Groups	Initial	Terminal
430,4476	553	Initial		45,57
467,0785	274	Terminal		80,87
496,3231	65	Graduates		85,10

Observed Differences Matrix between levels (Groups: ΔO_{ij})				
Average Rank	Groups	Initial	Terminal	Graduates
420,5642	Initial		36,63	65,88
457,2573	Terminal			29,24
621,8077	Graduates			

Total Difference Matrix between levels ($\Delta\eta_{ij} - \Delta O_{ij}$)				
Average Rank	Groups	Initial	Terminal	Graduates
420,5642	Initial		8,94	14,99
457,2573	Terminal			55,86
621,8077	Graduates			

Theoretical Matrix vs. Observed matrix between levels				
Average Rank	Groups	Groups	Initial	Terminal
420,5642	Initial		<	<
457,2573	Terminal			<
621,8077	Graduates			

Figure A3.4: Hypothesis Contrasting Process. Analysis of Emotional Intelligence aFind Emotional Capital. Post-Hoc Analysis via Dunn's Test - CR Case Results vs Profile (median analysis). Source: self-made.

1.4. Difference Matrices - CC Case vs Profile
(Figure A3.5)

Theoretical Differences Matrix between levels (Groups: Δ_{ij})					
Average Rank	Average Rank	454,9901	353,3504	766,9308	
	n_i	n_j	553	274	65
	n_j	Groups	Initial	Terminal	Graduates
454,9901	553	Initial		45,57	80,87
353,3504	274	Terminal			85,10
766,9308	65	Graduates			

Observed Differences Matrix between levels (Groups: $\Delta_{O_{ij}}$)				
Average Rank	Average Rank	454,9901	353,3504	766,9308
	Groups	Initial	Terminal	Graduates
454,9901	Initial		101,64	311,94
353,3504	Terminal			413,58
766,9308	Graduated			

Total Difference Matrix between levels ($\Delta_{ij} - \Delta_{O_{ij}}$)				
Average Rank	Average Rank	454,9901	353,3504	766,9308
	Groups	Initial	Terminal	Graduates
454,9901	Initial		-56,07	-296,95
353,3504	Terminal			-328,48
766,9308	Graduates			

Theoretical Matrix vs. Observed matrix between levels				
Average Rank	Average Rank	454,9901	353,3504	766,9308
	Groups	Initial	Terminal	Graduates
454,9901	Initial		>	>
353,3504	Terminal			>
766,9308	Graduates			

Figure A3.5: Hypothesis Contrasting Process. Analysis of Emotional Intelligence and Emotional Capital. Post-Hoc Analysis via Dunn's Test - CC Case Results vs Profile (median analysis). Source: self-made.

2. Display Trees (Figure A3.6).

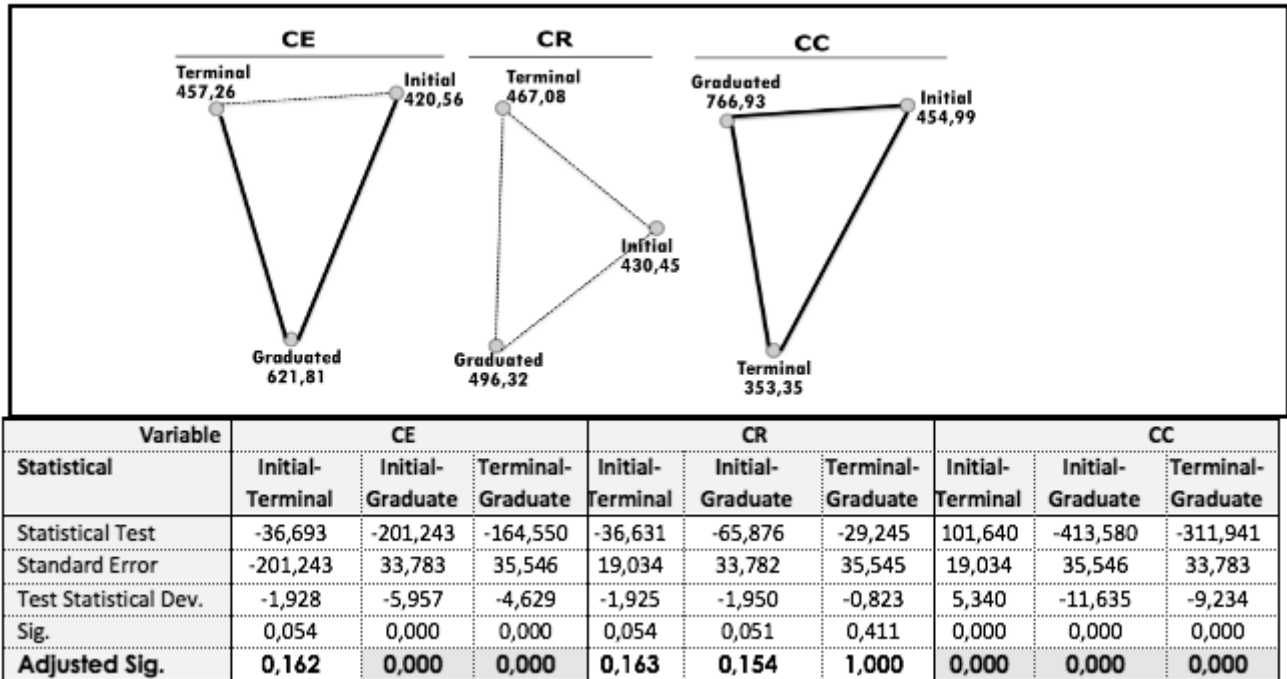


Figure A3.6: Hypothesis Contrasting Process. Analysis of Emotional Intelligence and Emotional Capital. Post-Hoc Analysis via Dunn's Test - Display trees (analysis of medians) - Sample vs Profile). Source: self-made.

Notes:

- Each column tests hypothesis Ho that distributions of Sample-1 and Sample-2 are the same.
- Asymptotic significances (two-sided tests) are shown.
- The significance level is 0.05.
- Each node of visualization tree shows the range of sample means of variable Gniv (profile).
- Sig: Significance "two-sided" test.
- Adjusted Sig: Adjusted significance ("Adjusted Sig." for two-sided test).

B.3.1. Conclusion Post-hoc Analysis:

- CE vs profile case: It is observed that between the initial/entitled and final/entitled groups, the difference is statistically significant.
- CR vs profile case: It is observed that there isn't statistically significant difference between all groups.
- CC case vs. profile: It is observed that there is a statistically significant difference between all groups.

Difference profile (Figure A3.7).

Variable	CE			CR			CC		
	Initial-Terminal	Initial-Graduate	Terminal-Graduate	Initial-Terminal	Initial-Graduate	Terminal-Graduate	Initial-Terminal	Initial-Graduate	Terminal-Graduate
Differences	8,88	-120,37	-79,00	8,94	14,99	55,86	-56,07	-296,95	-328,48

Figure A3.7: Hypothesis Contrasting Process. Analysis of Emotional Intelligence and Emotional Capital. Post-Hoc Analysis via Dunn's Test – Difference Profile. Source: self-made. Note: 1: From total Difference Matrix between levels, for each case.



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