



Multiple intelligences and learning styles in psychology students of a course in virtual education modality

Inteligencias Múltiples y Estilos de Aprendizaje en Estudiantes de Psicología de un Curso en Modalidad de Educación Virtual

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ABSTRACT

We aim to describe the profile of students based on Multiple Intelligences and learning styles. The study is framed within a quantitative research, with a descriptive design, in which two questionnaires were applied (Multiple Intelligences Inventory, adapted by Walter McKenzie and the Integral Diagnosis of Cerebral Dominance (DIDC) adapted by Omar Gardié), which were applied through the Google Forms platform. 107 psychology students enrolled in a course of first registration in virtual education in the UNAD Psychology program participated. 89.7% of the participants were women, the average age was 26.72 years (SD 9.06) and the academic performance was between 0.02 and 4.9, being 5.0 the highest. The null hypothesis states that there is no statistically significant difference between the students learning styles and multiple intelligences.

The results suggest that the predominant learning style according to Hermann's whole brain theory, corresponds to quadrant B with an average of = 66. It was found that the predominant intelligence was the intrapersonal with an average of = 79.21. Finally, when performing the variance analysis of the study variables, we found statistically significant relationships between Quadrant C and age ($p < .009$), visual-spatial intelligence with quadrant AF ($24.82 = 1.78, p < .029$), bodily-kinesthetic intelligence with quadrant BF ($25,81 = 1.69, p < .040$), Linguistic intelligence with the average grade F ($57,45 = 1.68, p = .036$).

Keywords: Multiple intelligences, learning styles, virtual education.

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RESUMEN

Se pretende describir el perfil de estudiantes basado en las Inteligencias Múltiples y los estilos de aprendizaje. El estudio se encuentra enmarcado dentro de una investigación cuantitativa, con un diseño de carácter descriptivo, en el cual se aplicaron dos cuestionarios (Cuestionario de Detección de las Inteligencias Múltiples, adaptado por Walter Mckenzie y el Diagnóstico Integral de Dominancia Cerebral (DIDC) adaptado por Omar Gardié), los cuales fueron aplicados por medio de la plataforma Google forms. Participaron 107 estudiantes de psicología inscritos en un curso de primera matrícula en modalidad de educación virtual del programa de Psicología de la UNAD con 89.7% mujeres, el promedio de edad fue de 26.72 años (DE 9.06) y rendimiento académico entre 0.02 y 4.9 siendo 5.0 el más alto. Como hipótesis nula se plantea la no existencia de diferencia estadísticamente significativa entre las inteligencias múltiples y los estilos de aprendizaje en los estudiantes.

Los resultados sugieren que el estilo de aprendizaje predominante? según la teoría del cerebro total de Hermann, corresponde al cuadrante B con una media de $\bar{x} = 66$. Se encontró que la inteligencia predominante fue la intrapersonal con una media de $\bar{x} = 79.21$. Finalmente, al realizar el análisis de varianzas las variables del estudio, se encontró relaciones estadísticamente significativas entre el Cuadrante C y la edad ($p < .009$), la inteligencia visoespacial con el cuadrante A $F(24,82) = 1.78, p < .029$, Inteligencia física cenestésica con el cuadrante B $F(25,81) = 1.69, p < .040$, Inteligencia lingüística con el promedio de calificaciones $F(57,45) = 1.68, p = .036$.

Palabras Clave: Inteligencias múltiples, estilos de aprendizaje, educación virtual.

INTRODUCTION

The constant evolution of the educational processes and understanding of the various factors related to learning have the expansion of educational proposals in the university context, for strategies consistent with the diversity and specificity of the educational needs of the students.

From this perspective, the UNAD adopted A Universal Design for learning which is conceived as “an educational approach that aims to apply its principles to the design of the curriculum for different levels of education” (Yunda, 2016). This model recognizes the diversity of the students, especially regarding learning styles, to facilitate this process in every student.

For this reason, it is essential to inquire about dominant learning styles as well as multiple intelligences that excel in students, since investigations reflect that, in the first year of university studies, the largest number of desertions occur, which are associated with poor performance, but also to

familial economic situations and vocational problems. (Centro de Microdatos [CMD], 2008; Olani, 2009; Rodriguez, Fita & Torrado, 2004; Donoso & Schiefelbein, 2007, cited in Esguerra, 2009). This is why that, to arrive at these strategies, it is necessary to inquire about how students learn and resources they may have, in order to address in an appropriate manner, any academic difficulties that may arise throughout the process of adaptation, and thus, can give tools allowing them to maintain and be successful within the educational system. Therefore, this research poses the following question:

What is the profile of psychology first-time registered students enrolled in a course of the UNAD psychology program from multiple intelligences and learning styles?

To enrich the understanding of the formation of this group of students, this study will take into account variables to be explored such as academic achievement, age, and geographic location, taking into account that the students are natio-

nally distributed with cultural diversity, gender, and occupation due to the fact that of the student population, the vast majority are adults who belatedly began their university education.

The general objective is to describe the profile of the students of the introductory psychology course in virtual education in the program of psychology of the UNAD from multiple intelligences and learning styles. Specific objectives are: i. identify principal multiple intelligences of newly registered psychology students. ii. recognize the dominant learning styles of the newly registered psychology students. iii. describe significant relationships between the variables proposed in the study. The null hypothesis states that all the means of the population (means of the factory levels) are the same while the alternative hypothesis states that at least one is different.

Finally, note that, in the bibliographic review on the psychology students' profiles, in terms of intelligence and learning styles, specific literature with this population is limited. However, it was found that for Carrasco & González (2018) students do not have a predominant learning style but have a moderate preference towards each of the learning styles. For their part, Escobar & Llumiquinga (2018) conclude in their research that the learning style selected by the students is the reflective

E-learning styles

Each individual through their uniqueness creates a learning style to interact with their environment and create knowledge. From this perspective, it is important to highlight that each person brings with them a "style" or personal mechanism for the acquisition of knowledge and consolidation of learning that makes up just part of their personal characteristics, through which they recognize and interacts with the environment that surrounds them and in which they develop.

Learning style is understood as the cognitive style that each individual manifests when confronted with a learning task in which each person shows his or her favorite, usual, and strategies in the moment of learning (Vásquez, 2011, p. 162).

Learning style is one of the more stable and defined concepts in each human being, as well as being one of the most used in their constant interaction with the environment and through which they relate to it, learn from it, discover it, and significantly explore it (Sachún, 2017).

Reviewing the learning styles in psychology training, we have found in Carrasco & González's study, 2018, who evaluated the profile of psychology students in the Universidad Autónoma de Chile (Independent University of Chile), that they do not possess a distinctive learning style, but have a moderate preference in toward each of the learning styles, highlight the importance of generating appropriate methodologies for the best academic performance in students.

In the same way in another exploration carried out by Escobar & Llumiquinga, (2018) with psychology students of the University Central de Ecuador in Quito, it was concluded that the learning style selected by the students of first, fourth, and ninth semester is the reflective, the evaluation is developed by the institution from the early years of training to the professional field, on the basis of observation and research.

The chosen theoretical proposal of this research on learning styles is oriented towards understanding the interaction between the brain and some aspects related to learning from the contribution given by neuroscience, for this the proposal taken is called the Model of the Whole-Brain or Brain Quadrants of Ned Herrmann. The author develops the model based on brain structure. He proposes the learning styles from cerebral dominance.

This model is based on the fact that each hemisphere processes information differently, so there are different ways of thinking associated with the operation of each hemisphere (Montes & Gutiérrez, 2017).

The whole-brain model contains two proposals: made by Sperry (1961), posed by the split-brain theory of the right brain and left brain that proposes that the two hemispheres are associated with different forms of thinking, due to which each hemisphere process information in particular way, favoring different styles of thought.

Precisely, the left hemisphere dominates digital, linear sequential processing, it is logical, rational, think in words and numbers, learns from the part to the whole and quickly absorbs details, facts, rules, and analyzes the information step by step, contrary to the right hemisphere which specializes in management of analogous, holistic, simultaneous information, prefers to find patterns, and processes information in a comprehensive manner, starting with a full understanding in order to understand the various parts. In addition, it is memorial, spatial, sensory, intuitive, synthetic and subjective.

Another theory proposed by MacLean, (1990) called the “Triune Brain” that complements Sperry’s theory, since it considers that there are three brains in one: the basic, related to automatic behaviors that are based on the survival of the individual; then the affective or emotional brain and lastly; the neocortex, formed by the left and right hemispheres where higher intellectual processes are conducted.

In this way, Herrmann sought to articulate the functioning neocortex with its right and left hemispheres of the cerebral cortex and the limbic system and fractionated them into four quadrants which are related and which at the same time keep their particularity in the operation of processing information and they can act either individually or combined, both sequentially or simultaneously, in the different processes of brain function.

He found that each quadrant displays its functions as well:

- Left Cerebral Hemisphere (quadrant A), expert, thinking, logical, analytical, critical, logical, quantitative and based on facts.
- Left Limbic System (quadrant B), the organizer, sequential thinking, organized, planned, detailed and controlled.
- Right Cerebral Hemisphere (quadrant C) strategist, style of emotional, sensory, humanistic, interpersonal, musical, symbolic and spiritual thought; holistic-intuitive, synthesizer-integrator, idealistic.
- Right Limbic System (quadrant D) Communicator, conceptual thinking style, holistic,

integrative, global, synthetic, creative, artistic, spatial, visual, metaphoric, interpersonal, feelings, emotional aesthetic.

This theory poses that each person has one or several forms of cerebral dominance, therefore processes the information that comes with this dominance and to this extent would use functions of one or another hemisphere for this purpose and to interact with its environment.

An instrument of psychometric assessment was created to identify cerebral dominance, and was applied validly and reliably to diverse populations and from this is derived a profile that offers four modes of thought:

- a. Realistic and common sense of the left hemisphere (Quadrants A and B);
- b. Idealist and kinesthetic, characteristic of the right hemisphere (quadrant C and D);
- c. Pragmatic (Quadrants A and D);
- d. Instinctive (Quadrants B and C) (Segarra, Estrada & Monferrer, 2015).

This theory proposes that each individual displays one or more dominances and that this form of operation influences personality, skills, and creates pathways for the learning of each individual (Montes & Gutierrez, 2017).

Multiple intelligences

For Gardner, and cited in Villamizar & Donoso (2013), intelligence is considered a potential biopsychology that allows you to process information, which can be activated within a cultural framework facilitating the resolution of problems or in the generation of products that have significance within a culture. Similarly, it sees intelligence as a cognitive competence covering a number of talents, skills and mental abilities, which are regulated and differentiated according to individual interests and the context (Orozco, 2010).

Gardner presents the theory of multiple intelligences (MI), which is based on this study, and questions the validity of the concept of intelligence as a dependent skill exclusively consisting of unique factors and research has contributed

significantly to advances in understanding the operation of the brain based on the acquisition of new knowledge and its relation with creativity, attention and memory. Therefore, the MI theory is an analysis of intelligence, which offers a wide range of resources and tools, from the particularity of each subject, using different brain mechanisms, which operate according to external and internal agents of the individual (Prieto, 2014). In this sense, this theory is considered an alternative to the traditional classroom design taking into account that it considers the diversity of how people learn and understand a subject. Similarly, when the author recognizes more than two intelligences, they make a significant contribution to cognitive science where a philosophy is constructed that is based on the student and also, to be more assertive in the understanding of individual differences and their approaches and in the teaching-learning environment (Sener & Cokcaliskan, 2018).

A definition of each intelligence proposed by Garner cited in Prieto (2014):

Linguistic intelligence

This type of intelligence is related to the use of the written and spoken word, to communicate and connect with the surrounding world. People who develop this intelligence use language as a tool for interaction with the environment and develop the competence to carry out activities such as to describe, narrate, observe, compare, relate, value and summarize.

Bodily-kinesthetic intelligence

Related to the capacities and abilities to recognize and manage the body itself, such as the practice of sport, as well as the ease of creating new things. It stands out mainly for specific skills of coordination, balance, strength, speed, etc., which are the cognitive characteristics use of the body.

Logical-mathematical intelligence

This intelligence is known for the ability to carry out calculations, complex mathematical operations, and establish and test hypotheses. It facilitates the ability to establish logical relationships, manage propositions and has the

facility to classify, categorize and solve problems.

Interpersonal intelligence

Considered the fundamental basis for the establishment of human relations and involves the ability to interact and relate to the outside world, through assertive strategies, empathy, solidarity, and excellent communication. It brings with it the ability to listen to and understand others. People with this kind of intelligence tend to have a high self-esteem and self-knowledge.

Musical intelligence

Related to the ability to appreciate and produce different musical tones and rhythms and with the ability to play instruments, some of its symbolic systems are the musical notations and Morse code, handles different ways to of manifesting musical expressions.

Intrapersonal intelligence

People who normally live in their inner world and develop an important inner wisdom, Gardner recognized this as an important source of knowledge. They tend to be very self-motivated, with great capacity to recognize themselves; reflective.

Visual spatial intelligence

People who have this kind of intelligence demonstrate great skill with the handling of images, as well as the ability to perceive the spacial world and represent an abstract and visual experience. This intelligence also involves a very sensitive sense of colors, lines, shapes and space analysis.

Naturalistic intelligence

It is the manifestation of a high sensitivity to the natural world, interest in research and exploration of the environment. People who have this kind of intelligence expressed great interest in the natural environment, its observation and recognition of species that are part of it.

After defining each of the multiple intelligences, it is important to highlight that these may or may not be seen in meaningful activities, depending

on various cultural and environmental factors. At the same time, may also be related to experience, age and the formation of each person (Armstrong, Kennedy & Coggins, 2002;) Furnham, 2014, cited in García, 2018).

For an effective functioning, another essential feature present in all types of intelligence is the “memory”, without which every act would lead to a new problem. The different types of memory are present in each intelligence in a specific way and enhance its development. For example, the sensory memory present in the musical, visual, and kinesthetic intelligence uses peripheral sensory receptors: sight, hearing, taste, touch, and smell, to receive stimulation from the environment; and for the processing of the information in each different level of memory some of the structures involved are: the hippocampus, the amygdala, entorhinal cortex, and the frontal lobes, among others (García, 2018).

Verbal and linguistic intelligence are articulated with language function to enable their comprehension and expression, some of the neuroanatomical structures that sustain it are: the left hemisphere of the brain where: structures as the Broca's area, Wernicke's area, arcuate fasciculus, angular gyrus, supramarginal gyrus, supplementary motor area, prefrontal lobe (mountain & Brigard, 2005).

In the base of musical, Visual-spatial, and bodily-kinesthetic intelligences are also executive functions, which are related to the organization of reeducate processes, i.e., the gnosis and praxis, since these cognitive functions that are established to perceive and recognize the shape and physical properties — Visual, auditory, olfactory, gustatory, somesthetic — of people and objects in the environment. These functions are the result of a physiological learning, depend on the social environment for their development, and are essential to learning processes. These functions are biological in nature and social by genesis. The brain regions involved in the recognition of stimuli derived by the sensory channels -Gnosis - are the limbic cortex, lingual gyrus, fusiform gyrus, anterior temporal cortex, parietal, and occipital lobes. Motor activities are organized through a process

of learning, given by the interaction of the senses and muscle activity (Géromini, 2000).

In a student-centered learning process, it is important to explore the skills that each person has to resolve situations or to create knowledge. The above refers to intelligence, a term which has a breadth of meanings given by authors such as Binet, 1908; Jensen, 1980; Sternberg, 1985; Wechsler, 1944 and who have submitted different proposals to understand this concept. For example, Wechsler cited in Ardila (2018) defines intelligence as the overall capacity of an individual to act deliberately, think rationally and effectively manage in their environment. Other definitions were limited to refer to this construct as the ability to provide a single, correct answer to a precise question as proof of a theorem (Simon, 1973, cited in Jaarsveld & Lachmann, 2018).

Taking into account the above, it can be stated that intelligence combines factors typical of the mental faculty and capacity of people, in conjunction with all the stories of interaction, resulting in skills of reasoning, comprehension, understanding, planning, and communication within the surrounding environment and which are needed to enrich the learning styles and therefore the construction of new knowledge.

With regard to the measurement of multiple intelligences, it is suggested to not only assess the person, but to collect the perceptions about the capabilities and skills of a student. This information may be provided by other colleagues, parents, teachers and relatives (Pfeiffer, 2015). However, it could be that the information supplied does not reflect the student's reality, and could be influenced or biased (García, 2018).

Finally, reflection upon the measure of the multiple intelligences in educational settings suggests that curricula integrate the teaching-learning processes and assessment with the development of intelligences, as a result of an integrated and significative process (Fogarty & Stoehr, 2008, cited in Diaz-posada, Varela-Londoño & Rodriguez-Burgos, 2017).

MATERIALS AND METHODS

Participants

The participants were students enrolled throughout the nation, in the course of Epistemology of Psychology of the two first academic periods of 2018, who belong to the UNAD Psychology program reaching a total of $N = 2423$ students, distributed in the eight regional zones of the UNAD organization in the national territory.

The sample used was intentionally non-probabilistic as Hurtado expresses (2007). As inclusion criteria for this study, it was taken into account that the selected participants were starting their academic process and were enrolled in the introductory course to the program. As exclusion criteria, students not taken into account were those with more than 25 credits passed, since they wouldn't be first-time registered students from. In this way, we achieved a participation of $n = 107$, with students from all eight zones.

Confidentiality

The population was contacted online, the purpose of the investigation was shared with them, as well as the confidentiality of the information provided by the students, the handling of the data, the voluntary nature, which were specified in the instruments published online.

Instrument

In order to optimize time and broaden the geographical spectrum according to Amat (2017), the two instruments used in this study were digitized, facilitating the national implementation. Each is described:

Questionnaire for the detection of the multiple intelligences, adapted by Walter Mckenzie in 1999.

This test in its eight phases, aims to assess each of the intelligences proposed by Gardner (Naturalist, Musical, Linguistic, Intrapersonal, Viso-spatial, mathematical, interpersonal, physical and kinesthetic) which are made of ten phrases that describe situations related to the intelligence in particular.

The instrument is adapted to the population in elementary, middle and high school for both male and female genders. It is recognized as a tool for easy application and adjusted to measure the types of intelligences of students (Hajhashemi & Bee, 2010). The various adaptations for high school students raise different questions, each participant responding according to their level of identification, in every one of the contexts for each intelligence (Athanassopoulos & Lopez, 2017).

Regarding the validity and reliability of the instrument, Morales (2013) considered it an instrument of analysis near the theoretical base of multiple intelligences which descriptively enunciates situations that are related or in the context of the intelligence in focus, the subject must then answer according to the perception obtained at the moment in which the test is developed and in correspondence with their personal interests. However, consider that the individual may vary their perception, and that their preferences may be modified over time, causing a reduction in the reliability of the instrument.

For his part, Garcia (2014) in his research has identified that the instrument adapted by Walter McKenzie, has a level of reliability between 77 and 85%. However, to make the method of reliability, Cronbach's alpha, for this sample, a score of 0.773 was obtained. In the following link you can see the applied questionnaire. <https://docs.google.com/forms/d/e/1FAIpQLSdTpILLMSjg-MVuy6WJsbCMeG4qiXXbbPBN0Pk2pL137i-4MW7w/viewform>

Comprehensive diagnosis of cerebral dominance (DIDC)

This survey, carried out by Omar Gardié (2000), is an adaptation for the Latin American population of the Herrmann Brain Dominance Instrument (HBDI) from the model of the cerebral areas of Ned Herrmann (whole-brain). Its objective is to quantify the degree of preference of a person through specific modes of thought: an indicator of cerebral dominance. It is worth noting that Ruiz Bolivar et to the. (1994) began the adaptation and validation of the Venezuelan population, a study that was completed by

Gardie (1995). This adaptation retains the same theoretical support of the whole-brain of Herrmann (1989) and assesses the profile of hemispheres and quadrants casting the application of the HBDI determining the degree of preference which is assigned to the quadrants A, B, C and D of the brain, according to a particular score for each item and a numbering also determined for each quadrant, in every part of the instrument.

The instrument is composed of 48 items divided into four parts. The first, evaluate expressions relating to work and everyday activities. The second refers to behaviors, attitudes and beliefs of the personality. The third represents themes or issues of interest to social life. In addition, the fourth, the participant selects the adjectives that best describe their personality.

For the interpretation and assessment of each quadrant the following categories are assigned, in which the term Dominance is used to refer to Primary Preference, Secondary Preference or Indecision and Tertiary Preference or Rejection. Profiles of the quadrants are represented by the numbers 1, 2 and 3, in accordance with the score obtained by each in the sequence A, B, C, D.

Regarding the validity and reliability, Gardié (2000) ensures that the instrument has been subjected to a validation process, since it was applied to approximately two-thousand subjects in several samples from different regions of Venezuela.

For their part, Rojas, Salas & Jiménez (2006) applied the instrument two times in a group of students from University Mayor, in Temuco, Chile, with an interval of one month between applications and on average obtained a Cronbach's Alpha of .8130.

This reliability coincides with the one carried out by Torres & Lajo (2009) in their study, where the Cronbach's alpha fluctuated between 0.74 and 0.87, considering the test as dependable and furthermore valid based on the exploratory factor analysis carried out. It presented adequate evidence of construct validity. For this study, the Cronbach's alpha was 0.603, slightly lower the acceptable minimum of 0.7 considered in this article. In the following link, you can see the instrument

applied. https://docs.google.com/forms/d/e/1FAIpQLSeHFc-XYtaCB_Je-QuoqWQluglGR-7TojiFCThA_Y0awDYc-w/viewform

Type and Design

This research is quantitative, extrapolating the data related to the profile through 2 psychometric instruments: multiple intelligences (adaptation Mc Kenzie, 1999) and Cerebral dominance (Gradie, 2000), applied to a sample made up of 107 students of an introductory course in the virtual psychology program at UNAD — National Distance Open University. Large amounts of data were provided and measured in an objective and neutral manner (Amat, 2017).

The design of the study was descriptive and sought to explore and recognize the characteristics of the student population related to the learning styles from the Ned Hermann's Cerebral dominance and multiple intelligences; furthermore, to discover the extent of existing association or lack thereof between these categories and some socio-demographic variables of the population without finding a causal relationship. The null hypothesis considers the nonexistence of a statistically significant difference between students' learning styles and multiple intelligences. It does not intervene or manipulate the factor of study, but observes what happens under real conditions. (García, 2004).

Procedure

- In the first phase, we identified the problem of study which showed the need to identify the learning style and predominant multiple intelligences in the first period students of the psychology program at the UNAD.
- In the second phase, study variables were picked, as well as the categories and scales of measurement of the variables. Instruments were selected in order to collect the information about the object of the study categories, which were digitized in a Google form. The questionnaire link was sent to students via e-mail, in which informed consent was also obtained, since it explained that participation was volun-

tary and that the information was only going to be manipulated by the researchers, which characterized it as confidential and exclusively for research purposes.

- In the third phase, the collected data was analyzed using the Statistical Package for the Social Sciences (SPSS). Parametric analyses were performed and took into account the normal distribution of the data. Variance analysis (ANOVA) Snedecor's F: a method to test the equality of two or more population means analyzing sample variances, (Amat & Rocafort, 2017, Hurtado, 2007). Pearson correlation: a method to reveal if one variable is related to another.

RESULTS

Descriptive statistics of two of the socio-demographic variables were then related (see table 1). There is evidence that the average age of the students was of = 26.72 with a standard deviation of 9.06 years and academic average of 3.7 on a scale where 5.0 is the highest rating.

Table 1.

Statistical description of the variables of age and grade point average

	N	Average		Standard deviation
	Statistical	Statistical	Standard error	Statistical
Age	107	26.72	.876	9.058
Average	103	3.7423	.12710	1.28991
N valid (per list)	103			

These results show that the majority of participants are women who are found beginning the course of Epistemology of Psychology. Other variables considered in this research were the level of studies, taking into account; the population entering college is heterogeneous and not only students who had recently graduated high school. Similarly, the UNAD students are nationally distributed, so this study looked at this category as an element of analysis given the diversity of each of the regions. In this category, it was evident, that 28.24% of students are in the zone Centro

Bogotá-Cundinamarca (downtown Bogotá-Cundinamarca), an area in which a greater concentration of the student population of the UNAD is found. However, all areas of the country were represented in the sample. In addition, as reflected in the values according to the quadrants A, B, C, D related to the location of the participant, a statistically significant difference is not reflected, that is to say:

- Quadrant A is $F(7.99) = .85, p = .545$
- Quadrant B is $F(7.99) = .88, p = .528$
- Quadrant C is $F(7.99) = 1.00, p = .435$
- Quadrant D is $F(7.99) = .86, p = .538$

After exploring multiple intelligences from the proposal of Gardner, the predominant intelligence was intrapersonal with an average = 79.21, which is associated with self-knowledge, realistic self-image, handling of feelings, the capacity for introspection and personal acceptance, and the ability to make decisions about their own lives, characteristics of people with preferences towards occupations engaged in mental health, education or spiritual development, deploy this type of skill or intelligence. Likewise, a comparative analysis was conducted between men and women regarding the multiple intelligences, finding similar gender results, although there is evidence that men score higher than women in intrapersonal intelligence with $\bar{x} = 82.73$ and women $\bar{x} = 78.8$, and intelligence in visuospatial in which men score $\bar{x} = 77.27$ and women $\bar{x} = 70.47$. In turn, the study identified the difference through the statistical analysis of variance (ANOVA) Snedecor's F for the genre with the types of intelligences from Gardner's approach (see table 2).

On the other hand, a second instrument (DIDC) was applied to participants, which was intended to identify the brain dominance of each student on the basis of Ned Hermann's theory of the model of the cerebral areas, where you could see that the dominant quadrant in the sample is quadrant B: with an average $\bar{x} = 66$, related to the left hemisphere characterized by processing the information, planning, prioritizing the shape, structure, method, organized, detailed, a bit innovative; However, the other quadrants had close scores. Likewise, a comparative analysis was con-

ducted between men and women regarding cerebral dominance, finding that women have no dominance, while men have two dominances: in the B quadrant with an average of $\bar{x} = 68$ and C with a quadrant average of $\bar{x} = 66$. Similarly, the results of the statistical variance analysis (ANOVA) between cerebral dominance and gender, did not identify any value less than 0.05, demonstrating that statistically significant differences in this group do not exist (see table 3).

Table 2. Distribution of means according to Gardner’s Multiple Intelligences

Intelligence	\bar{x}			F	Sig.
	Complete sample	Female	Male		
Naturalist	75.5	75.47	71.36	0.659	0.419
Musical	66.68	66.61	67.27	0.012	0.915
Mathematical logic	72.66	72.92	70.45	0.275	0.601
Interpersonal	71.4	70.68	77.73	1.283	0.26
Physical and kinesthetic	67.94	67.97	67.73	0.002	0.966
Linguistic	72.78	72.45	72.73	0.003	0.959
Intrapersonal	79.21	78.8	82.73	0.836	0.363
Visuospatial	71.17	70.47	77.27	1.556	0.215

Table 3. Distribution of means according to the Ned Hermann’s model of the cerebral areas

Brain quadrant	\bar{x}			F	Sig.
	Complete sample	Female	Male		
A	62	63	61	.074	.786
B	66	65	68	.583	.447
C	65	65	66	.080	.777
D	54	53	55	.286	.594

The Kolmogorov-Smirnov test performed for normality of functions discovered the behavior of the variables (See table 4).

Table 4. Kolmogorov-Smirnov test with correction for normal distribution

Brain		Quadrant A	Quadrant B	Quadrant C	Quadrant D
N		107	107	107	107
Normal Parameters	Mean	62.41	65.61	65.01	53.68
	SD	12.28	11.79	12.18	11.57
Most Extreme Differences	Absolute	0.07	0.08	0.12	0.09
	Positive	0.07	0.05	0.07	0.07
	Negative	-0.07	-0.08	-0.12	-0.09
Kolmogorov-Smirnov Z		0.77	0.78	1.21	0.98
Asymp. Sig. (2-tailed)		0.589	0.58	0.088	0.294

To expand the analysis of the various categories, we sought to identify possible relationships between variables and the Pearson correlation statistic considering the results (see table 4) was used to perform the normality test. Direct and significant correlations were found between:

- Quadrant B and Musical intelligence ($p < .039$ *)
- Quadrant B with Physical intelligence, and Kinesthetic ($p < .013$ *)
- Quadrant A and age ($p = .229$ *)
- Quadrant D with age ($p = .219$ *)

On the other hand, it was found that the correlations between all the intelligences are much more powerful and significant, considering that it approaches + 1 and a bilateral significance of ($p < .01$). Similarly, a Pearson Correlation was found between:

- Academic average and geographical location ($p = .204$ *)
- Age and logical mathematical intelligence ($p = .252$ *)

Additionally, a statistically significant difference was not found in relation to multiple intelligences and the variables of age, gender, or location, in terms of average scores also failed to reveal a significant difference statistic in relation to the quadrants however in terms of multiple intelligences (see table 5) a statistically significant difference was unveiled between the linguistic intelligence and average, $F(57.45) = 1.68, p = .036$.

Table 5.
Relationship between average and multiple intelligences

Intelligence		Sum of Squares	df	Mean Square	F	Sig.
Naturalist	Between Groups	13134.48	57	230.43	0.84	0.739
	Within Groups	12388.33	45	275.3		
	Total	25522.82	102			
Musical	Between Groups	20091.83	57	352.49	0.88	0.672
	Within Groups	17941.67	45	398.7		
	Total	38033.5	102			
Mathematical logic	Between Groups	13897.88	57	243.82	1.38	0.13
	Within Groups	7928.33	45	176.19		
	Total	21826.21	102			
Interpersonal	Between Groups	21756.9	57	381.7	1	0.504
	Within Groups	17177.08	45	381.71		
	Total	38933.98	102			
Physical and kinesthetic	Between Groups	20119.74	57	352.98	1.38	0.133
	Within Groups	11516.67	45	255.93		
	Total	31636.41	102			
Linguistic	Between Groups	20339.74	57	356.84	1.68	0.036
	Within Groups	9546.67	45	212.15		
	Total	29886.41	102			
Intrapersonal	Between Groups	8810.92	57	154.58	0.71	0.888
	Within Groups	9775	45	217.22		
	Total	18585.92	102			
Visuospatial	Between Groups	17794.46	57	312.18	1.08	0.396
	Within Groups	12992.92	45	288.73		
	Total	30787.38	102			

Table 6.
Multiple intelligences relationship with Quadrant A

Intelligence		Sum of Squares	df	Mean Square	F	Sig.
Naturalist	Between Groups	4218.45	24	175.77	0.64	0.89
	Within Groups	22456.32	82	273.86		
	Total	26674.77	106			
Musical	Between Groups	8985.35	24	374.39	1.03	0.445
	Within Groups	29911.85	82	364.78		
	Total	38897.2	106			
Mathematical logic	Between Groups	5374.01	24	223.92	1.05	0.418
	Within Groups	17491.87	82	213.32		
	Total	22865.89	106			
Interpersonal	Between Groups	10265.78	24	427.74	1.15	0.308
	Within Groups	30373.94	82	370.41		
	Total	40639.72	106			
Physical and kinesthetic	Between Groups	6260.15	24	260.84	0.83	0.694
	Within Groups	25887.51	82	315.7		
	Total	32147.66	106			
Linguistic	Between Groups	8718.96	24	363.29	1.38	0.144
	Within Groups	21599.73	82	263.41		
	Total	30318.69	106			
Intrapersonal	Between Groups	3716.62	24	154.86	0.82	0.706
	Within Groups	15540.85	82	189.52		
	Total	19257.48	106			
Visuospatial	Between Groups	10733.15	24	447.21	1.78	0.029
	Within Groups	20545.82	82	250.56		
	Total	31278.97	106			

The following table shows the relationship between the B quadrant and multiple intelligences noticing (See table 6) that there is a statistically significant difference between the quadrant and physical and kinesthetic intelligence.

We found that there is a significant difference between visuospatial intelligence and quadrant A with $p = .029$ (See table 7).

Table 7.
Multiple intelligences relationship with Quadrant B

Intelligence		Sum of Squares	df	Mean Square	F	Sig.
Naturalist	Between Groups	6600.94	25	264.04	1.07	0.4
	Within Groups	20073.83	81	247.83		
	Total	26674.77	106			
Musical	Between Groups	6229.05	25	249.16	0.62	0.913
	Within Groups	32668.14	81	403.31		
	Total	38897.2	106			
Mathematical logic	Between Groups	5069.62	25	202.78	0.92	0.574
	Within Groups	17796.27	81	219.71		
	Total	22865.89	106			
Interpersonal	Between Groups	9281.59	25	371.26	0.96	0.528
	Within Groups	31358.12	81	387.14		
	Total	40639.72	106			
Physical and kinesthetic	Between Groups	11036.16	25	441.45	1.69	0.04
	Within Groups	21111.51	81	260.64		
	Total	32147.66	106			
Linguistic	Between Groups	7668.52	25	306.74	1.1	0.365
	Within Groups	22650.17	81	279.63		
	Total	30318.69	106			
Intrapersonal	Between Groups	4830.27	25	193.21	1.08	0.379
	Within Groups	14427.2	81	178.11		
	Total	19257.48	106			
Visuospatial	Between Groups	8229.31	25	329.17	1.16	0.305
	Within Groups	23049.66	81	284.56		
	Total	31278.97	106			

DISCUSSION AND CONCLUSIONS

Given the results above, it can be inferred that the intelligences and dominance present in this group, correspond from the neuropsychological base where linguistic intelligences and the quadrant B and C dominance involve interaction between the left hemisphere and the limbic areas. This means that students who possess a dominance in quadrant B are left hemisphere based with characteristics related to the proper use of language and their rational management of information processes, they take the distinctive characteristics of quadrant B which are organizing, logical, planned practices and simultaneously integrate in the processing of information, particularly of their location in the kinesthetic-limbic-emotional quadrant. This sample has elements of other related intelligences, like musical intelligence, which favors the emotion management, serves as a way to capture feelings, knowledge about feelings and gives ways to communicate them to the listener. At the same time physical and kinesthetic intelligence provides elements related to the use of one's own body, to know and take actions upon the world. For this reason, these people have skills to express themselves through communication, the use of language, being empathetic, and having the ability to connect with other people. In other words, the different types of intelligences work together, interact, and although some dominate over others in an individual to provide a solution to the problems facing at a given time or to create products, different abilities are required of each one and therefore could not be developed in isolation. In addition, that relate directly to the values, culture and habits of the people.

It could be recognized that learning styles are the strategies that an individual has developed to address learning tasks in a manner more or less consistent over time, resulting from a triple influence, their heritage, the own experiences and demands of the context and that they should now it is part of all educational planning that seeks to promote the learning of students. According to this idea, it is suggested to incorporate in the pedagogical proposal, experiences that connect students with the context, and works that promote all types of intelligence and thought. In this sense, optimal

learning must be comprehensive, competencies to be developed should not only be related to the professional aspects, but it must also promote others that facilitate and adapt to changes, social skills, individual emotional management and teamwork.

Therefore, the intention is to integrate educational strategies that encourage the development of the different quadrants of the brain. In addition, to encourage less preferred thinking styles, as well as the preferred route. The contribution of different disciplines such as psychology, education, neuroscience, and information technologies, allows clear recognition and understanding of the processes required to enhance the pedagogical action centered on "student learning."

It is necessary to recognize and work the variables involved in this process, that is to say, those related to the student, teacher, pedagogy and didactics and the environmental variables, so that it refers to a process that promotes customized learning, to study every aspect in the planning of the educative act.

Thus, it is considered primordial learning focused on the student, which entails the need to explore alternatives to customize the virtual learning environments, based on the concept of adaptability (Mejía, 2013); as well as the reflection of the human being that is emerging in this new paradigm that is the virtuality and which is present in a new, forceful manner in all facets of human life, it is a new challenge to approach from the perspective of education and psychology.

Part of the reflections about elements that promote student-centered learning implies that to consider the processes of evaluation, regarding this research suggests those actions that can be done in the real-ecological context, which involve activities in context, addressing real problems, projects, looking for the student to benefit from the contribution of other people (Gargallo-Lopez, Pérez-Pérez, Green-Peleato & Garcia-Felix, 2017). In this context, it is sought that the educative act promotes the development of people with greater resources to deal with the real and everyday context.

Complementing this reflection, Costa & Kallick cited in Bisquerra, (2003) propose to integrate new skills into the learning process, required in the new labor context, which involves leaning on the intelligences that each individual has in order to cope with everyday life's complexity in a creative way and develop other skills of emotional intelligence like perseverance; learn skills for a proper management of the emotions, on the intrapersonal and interpersonal level. In the same way metacognitive skills; create, imagine and innovate; take risks, apply the sense of humor, think independently; be open to continuous learning. In this sense, Lucas & Claxton (2014) provide an open model, with four main components: research, experience, thought, and reason. Another avenue of development implies an intelligence that includes the ethical element, looking to make the individual and collective well-being compatible (Pfeiffer, 2015)

By way of conclusion, it is further enhanced that it is important, in education, to create pedagogical conditions that facilitate the care of diversity to promote inclusion, with proposed educational routes that enable expression options of the various learning styles, ways of thinking, and development of multiple intelligences. It is suggested that the teacher has the possibility of recognizing their learning style so that in addition to generate related proposals, they enrich their pedagogical and didactic proposals to improve the educative act, providing initiatives that favor other learning styles and thought to comprehensively promote the training processes in their students. It is noteworthy that Information Technologies combined with an educational model that includes all the variables that are present in the educative act, joined to constitute a fundamental variable for virtual and face-to-face training proposals, are essential tools that favor the development of the learning styles and enhance learning.

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