Journal of Psychological and
Educational Research
JPER - 2016, 24 (2), November, 17-36

PENTAVALENT INVENTORY TO MEASURE LEARNING STYLES

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Abstract
This article presents the theoretical support and empirical validation of an instrument designed to measure learning styles. The instrument considers five dimensions (hence the term pentavalent): chronobiological, sociological, level of dependence on others, sensory preferences in general and sensory preferences in the use of technology. The instrument had 108 items measurable with the Likert scale, grouped into 18 scales. The results show descriptive statistics data of the sample that was taken as a frame of reference for the establishment of norms. It also includes an analysis of the reliability (internal consistency), validity, and item analysis to determine the psychometric characteristics of the instrument. The Pentavalent inventory for measuring learning styles is proposed as a useful tool to adapt the design of learning environments based on students' individual preferences.

Keywords: learning styles; measure instruments; psychometric analysis; design of learning environments

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Introduction

A great variety of instruments to measure learning styles can be found in the literature (García Cué & Santizo Rincón, 2011). Many of them cater to different preferences and trends in learning from several points of view: environmental, sensory, sociological and cognitive, among others.

The present study deals with the development of an assessment instrument of learning styles on the basis of five kinds of preferences that people use to learn: chronobiological (if the person feels that learning is more productive in the morning, afternoon or evening), sociological (learning individually or in a group), level of dependence on others (independence vs. dependence), sensory preferences in general and sensory preferences in the use of technology.

Rodríguez Carracedo and Vazquez Carro (2013) point out that there is a variety of approaches to develop and validate instruments that allow diagnosing learning styles. These include different traits that are evaluated and different levels of depth, which can range from the preferences under the context to those relating to personality traits that are more difficult to discover.

While it is true that there are other instruments that estimate the magnitude of different preferences, none of them offers the set presented in this proposal. The design was requested by a Mexican company which is in the process of construction of their own corporate university and wanted to know the learning styles of its employees and collaborators. In a period of eight months, several processes were carried out: the collection of information about learning styles' state of the art, the self-report test design, the application of the test (including several pilot studies), and the psychometric analysis of the collected data.

The instrument includes a list of 108 items that deliver 18 scores, each of them associated with the possibilities offered by each preference.

Since its creation, the corporate university had considered the need for an instrument that would allow it to identify the preferences of their employees and partners so that, starting from there, they could design courses, seminars, and workshops intended to be imparted in their training and development.

Teachers, instructors, and facilitators that will support the corporate university need to focus on setting and supplying the conditions of learning, as well as on the teaching strategies, which should connect, mobilize and activate

schemes of the students' prior knowledge, properly reinforcing their processing based on their preferences. Several authors (e.g., Dunn & Dunn, 1984) have determined that, in so far as the preferences of the participants in educational environments are taken into account, the academic achievement will be higher.

This is why each person's preferences allow the conception of what is called a style, and based on this idea, it can be said that human beings are different from each other. However, it is possible to observe certain similar patterns between them (Lozano, 2005).

Styles of learning are defined as a set of different preferences that individuals have to learn or to assimilate knowledge. The genuine equality of educational opportunities for students does not mean that they have the same book, the same schedule, the same activities, the same exams or even the same professors, but the variety of factors that intervine in teaching (Alonso, Gallego, & Honey, 1995). Table 1 presents some definitions of learning styles from various authors.

Table 1. Learning styles definitions

Definitions	*Authors*
Personal set of behaviors and attitudes related to the learning context.	Riechmann & Grasha (1974)
Favorite mode by each individual to concentrate and learn new information. It implies multiple interactions between environmental, sociological, emotional and physical elements.	Dunn & Dunn (1984)
Distinctive behaviors that indicate how a person learns and adapts to their environment.	Schmeck, Geisler-Brenstein, & Cercy (1991)
Favorite method by each one to gain and process information.	Kolb (1984)

Learning style is formed by two sets of elements: on one hand, the cognitive style, which is very close to the physiology and varies very little over the years; and on the other, the strategies and mechanisms of learning that individuals develop to adjust learning material to their cognitive style (Alonso & Gallego, 2008).

This way, we can point out that learning style refers to all those tastes, preferences, trends, or provisions that in some ways the individual has, in order

to develop their skills and transform them into meaningful actions (*see* table 2). Therefore, it is necessary to understand how learning styles affect the learning processes in general, so that students can perform in a more optimal way and achieve better academic performance (Lozano, 2005).

Table 2. Learning style's elements

Elements	*Definitions*
Disposition	Physical or psychological state to perform (or not) a determined action
Preferences	Conscious attitude in choosing preferences between several options.
Tendency	Bent, sometimes unconscious from a person who makes an action in a certain way.
Behavior patterns	Typical manifestations that a person has in a determined situation.
Ability	Outstanding physical or intellectual capacity of a person in relation to other capacities.

Learning styles are based on certain principles according to Sternberg (1997):

1. The styles are preferences in the use of skills, but not skills themselves.
2. A relationship between styles and skills creates a synergy that is more important than the simple sum of its parts.
3. Livelihood options need to fit both styles and skills.
4. People have profiles (or patterns) of styles, not a single style.
5. Styles vary according to the tasks and situations.
6. People differ on the strength of their preferences.
7. People differ in their stylistic flexibility.
8. The styles are socialized.
9. The styles may vary throughout life.
10. The styles can be measured.
11. The styles can be taught.
12. The valued styles at one specific time or place may not be in others.
13. The styles are neutral; there are no good or bad styles.
14. The stylistic patterns are not synonymous of skill levels.

For this research, we reviewed different models and theories concerning learning styles (Garcia Cue, Santizo Rincón, & Alonso, 2009) and selected five

that match the same number of preferences the instrument evaluates: chronobiological, sociological, level of dependence on others, sensory preferences in general and sensory preferences in the use of technology. The following are five relevant models in the literature.

Dunn and Dunn model

This model is associated with the types of chronobiological and sociological preferences of this current study and it is composed by 24 elements grouped in five stimulus.

1. Environmental: it includes the sound, light, temperature and the furniture organization inside the classroom. (Nelson, Dunn, Griggs, & Primavera, 1993).
2. Emotional: it includes the motivation, persistence, responsibility, and structure (this last one refers to the compliance with norms and regulations) (Dunn, Griggs, Olson, Beasley, & Gorman, 1995).
3. Sociological: it refers to the learner's preference to work alone, in pairs, in small groups, under adult supervision or even a bit of all the elements.
4. Physiological: these preferences relate to the favorite way of receiving information (sensory preferences), the food intake moments, the chronobiology, and the need of physical movement.
5. Psychological: it involves perception processes, cerebral laterality, and response time in an external event (Dunn, Sklar, Beaudry, & Bruno, 1990).

Grasha-Riechman Model

This model is associated with the type of instructional preferences linked to the students' dependence or independence level from each other, as well as each student's involvement t in a class session (Grasha, 1996). Six styles are identified within this scheme: participative, elusive, competitive, collaborative, dependent and independent. In this model, three dimensions are considered:

- Dimension 1: Students and their attitude towards learning.
- Dimension 2: Classmates and the perspectives about their interaction.
- Dimension 3: Didactical procedures and their relation within an educational environment.

According to this theoretical proposal, learners can combine styles taking an element of each dimension; this way, twelve possible combinations can be formed (Grasha & Yangarber-Hicks, 2000).

Felder and Silverman Model

This model is associated with the sensory preference during the learning process and it uses an instrument that diagnoses learning styles through four dichotomous categories (Felder, 2012; Felder & Silverman, 1998):

1. Perception: Sensorial and intuitive.
2. Stimulus: Visual and verbal.
3. Processing: Active and reflexive.
4. Understanding: Sequential and global.

VARK Model

This model is associated with the type of sensory preferences (Fleming & Mills, 1992; Fleming, 2006) and has four modalities that represent the forms in which information is perceived and make the pattern for the VARK acronym: (V) visual, (A) auditory, (R) reading and (K) kinesthetic.

Each individual uses different items of representation, some more than others; the more this different preferences are put into practice it will be more developed. However, if the perceptive channels aren't used, it will be impossible to learn through them (Hawk & Shah, 2007).

Palloff and Pratt proposal

This proposal (2003) considers the type of sensory preference associated with technology. It involves certifying that the new technologies help to strengthen and enrich distance education models, because during the teaching-learning process they foster interactivity mediated by technology. This context refers to an online student that is not hampered by the absence of visual and auditory objects during the communication process.

With the development of mobile devices and the use of internet, online education emerges as a solution to problems that traditional education cannot solve; however, by itself it does not guarantee an education of better quality or a better learning performance (Gallego & Martínez, 2003).

However, a unique format for all the approaches and participants will not work. "It is a mistake to assume that each online student sees and feels the

same way" (Palloff & Pratt, 2003, p. 37). The technological component is important because previously it was not taken into consideration as a vital element in the learner's preferences. Now more than ever, with the rise of the new technologies and their development and expansion, it is necessary to know the preferences of the people that interact with different types of technology that help and strengthen the learning (Melaré Vieiria, Alonso, & Ferreira do Amaral, 2008).

In conclusion, there are different models and theories about learning styles; however, it is important to remember that all of them are focused in knowing and strengthening the participants' learning, ensuring a significant learning in all of them. As time goes on, the idea that each individual is different and learns in a certain particular way has been generalized within the educational process. Several researches show that students learn more effectively when they are taught based on their predominant learning styles (Gallego & Martínez, 2003).

Method

The *Pentavalent inventory to measure learning styles* is a self-reported test with five dimensions. The instrument presents a set of items regarding the characteristics and preferences in the learning process. The self-report term means that it is the user who applies the instrument, calculates, and then interprets the results. Obviously, the instrument assumes that only the honest answers from the users (that is, those answers that represent how the users *are*, and not how they think they *should be*) help to obtain a more precise self-diagnosis.

This instrument was tested through the classical true score model (Crocker & Algina, 1986). We now describe how the instrument was tested.

Participants

The instrument was applied to a sample of 1,564 workers from a company in the energy sector in Mexico. These workers are trusted employees assigned to maintenance and marketing processes, there were also unionized

employees, and operators assigned to maintenance and permanent operation processes.

The non-random sampling was intentional, as the total number of employees that make up the four different contractual regimes were considered: trusted employees, trusted permanent employees, transients unionized and permanent unionized. In the academic range of the workers, there were people with studies from elementary to graduate school. The bachelor level was the most common one in the sample (592 participants have engineering studies and 503 have other completed degrees).

As demographic data, is important to point out that from 1,564 participants, 1,291 are men (85%) and 273 are women (15%). The age of the participants is between 17 and 77 years old, with an average of 44.84 years of age and a standard deviation of 9.01 years.

Instrument

We designed a test with 108 items, grouped into 18 scales (six items per scale) linked with five dimension of learning styles: chronobiological, sociological, dependence level of others, sensory preferences in general and sensory preferences applied to use of technology. These dimensions are based on the previously discussed theoretical models of Dunn and Dunn (2012); Grasha-Richmann (Grasha, 1996); Felder and Silverman (Felder, 2012; Felder & Silverman, 1998), VARK (Fleming & Mills, 1992; Fleming, 2006) and Palloff and Pratt (2003).

Each item was designed to be answered with a Likert scale of six levels: totally disagree, strongly disagree, disagree, agree, strongly agree, and totally agree. The "translation" of these six levels to numeric values (from one to six, respectively) was made according to the practice of assuming that the Likert scale, which is of ordinal nature, can be considered as an intervals scale.

Five judges reviewed a preliminary version of the instrument: two Doctors in Education, two Doctors in Psychology (one of them with psychometric formation) and a Doctor in Anthropology. There was also feedback from the people in charge of the project in the corporative university, regarding the relevance of the scales and the number of items for each of them. After the review, the original sample of 120 items was reduced to 108 in its final version. Table 3 shows the different scales that evaluate each dimension of learning styles.

Table 3. Detail of the five dimension and the 18 scales with their abbreviations

Dimension	*Scale*	*Acronym*
Chronobiological	Morning	MOR
	Afternoon	AFT
	Evening	EVE
Sociological	Alone	ALO
	Pairs	PAI
	Little groups	LGP
Sensory	Visual	VIS
	Auditory	AUD
	Kinesthetic	KIN
	Reading-writing	REA
Dependence level	Dependent	DEP
	Independent	IND
	Interdependent	INT
Technological	Visual/Verbal	VIV
	Visual/Spatial	VSP
	Auditory/Verbal	AUV
	Tactile/ Kinesthetic	TAK
	Logical/ Mathematical	LOM

Procedure

After developing the instrument, its final version was placed in the platform "Sum Total", so participants could answer the test from wherever they were. The instrument application started with the trusted employees group assigned to maintenance and marketing processes, and afterwards, the unionized personnel assigned to maintenance and permanent operation processes.

The data was statistically analyzed to describe the sample's characteristics regarding learning styles and to determine psychometric indicators about the instrument's characteristics.

Results

The results of this study are divided into two sections: (1) one with descriptive statistical data of the sample that answered the self-report

instrument; and (2) other with psychometric information about the instrument's characteristics.

Descriptive information of the sample

Table 4 shows descriptive statistical data about the learning styles of the participants' sample associated with each of the 18 scales that form the instrument. The scores presented should be interpreted in a scale from one (1) to six (6), where 1 means "totally disagree" and 6 means "totally agree" in the Likert scale.

Table 4. Descriptive statistical information about the styles of the participant sample

Acronym	*Average*	*Median*	*Lower value*	*Higher value*	*Standard deviation*	*Bias coefficient*
MOR	4.55	4.67	1.50	6.00	0.73	-0.36
AFT	3.43	3.50	1.00	6.00	0.71	-0.07
EVE	3.50	3.50	1.00	6.00	0.87	-0.12
ALO	3.57	3.50	1.00	6.00	0.73	0.17
PAI	4.46	4.50	1.67	6.00	0.69	-0.15
LGP	4.54	4.50	1.00	6.00	0.74	-0.15
VIS	4.52	4.50	1.50	6.00	0.65	-0.08
AUD	4.36	4.33	1.33	6.00	0.61	0.00
KIN	4.53	4.50	1.50	6.00	0.69	-0.13
REA	4.67	4.67	1.00	6.00	0.67	-0.23
DEP	4.31	4.33	1.17	6.00	0.57	-0.17
IND	4.60	4.67	1.33	6.00	0.60	-0.07
INT	5.09	5.17	1.33	6.00	0.65	-0.59
VIV	4.10	4.00	1.33	6.00	0.75	-0.04
VSP	4.43	4.33	1.00	6.00	0.73	-0.33
AUV	3.94	4.00	1.00	6.00	0.80	-0.20
TAK	4.02	4.00	1.00	6.00	0.76	-0.22
LOM	4.32	4.33	1.33	6.00	0.64	-0.07

Table 4 shows a global vision of the sample, however, one of the contributions that emerges from this study is the creation of a reference norm that allows each person in particular to evaluate their learning style by contrasting it with all others in the reference sample. This way, each person can

generate a profile that points their position in percentiles, relative to other people in the reference sample. This is shown as an example in figure 1.

	ALO	AFT	EVE	ALO	PAI	GRU	VIS	AUD	KIN	REA	DEP	IND	INT	VIV	VSP	AUV	TAK	LOM
Percentile 10	22	16	14	16	22	22	23	22	22	23	22	23	25	19	21	18	19	21
Percentile 20	24	18	17	18	23	23	24	23	24	24	23	24	27	21	23	20	21	23
Percentile 30	25	19	19	19	24	25	25	24	25	26	24	25	29	22	24	21	22	24
Percentile 40	26	20	20	20	26	26	26	25	26	27	25	27	30	23	25	22	23	25
Percentile 50	28	21	21	21	27	27	27	26	27	28	26	28	31	24	26	24	24	26
Percentile 60	29	21	22	22	28	28	28	27	28	29	27	29	32	26	28	25	25	27
Percentile 70	30	22	24	23	29	30	29	28	29	30	28	30	33	27	29	26	26	28
Percentile 80	31	24	25	25	30	31	30	29	31	32	29	31	34	28	30	28	28	29
Percentile 90	33	26	27	27	32	33	32	31	33	33	30	32	36	30	32	30	30	31

Figure 1. Profile example of the learning styles of a person, according to a reference norm

Evidently, the generated norms for the corporative university's personnel won´t be the same that for other organizations. If they choose to use the *Pentavalent inventory to measure learning styles* they should create their own reference norms.

Unlike other instruments, the scales in this inventory show results about the learning styles that are not mutually excluding. The obtained values for each participant, in the component scale of each dimension, should be interpreted independently and do not require other scales to assign a label to a certain style of learning. This contrasts with theories by Kolb (1984), Gregorac (1984) and McCarthy and McCarthy (2005), which present results tagging the instrument's user within a certain style. In the case of the *Pentavalent inventory of learning styles*, results show a profile of styles and not a style *per se*.

Psychometric information about the instrument's characteristics

The psychometric analysis of the instrument included three aspects: reliability, validity and the item analysis.

The reliability of the instrument's scores refers to the degree to which they present an error of measurement. In the case of the *Pentavalent inventory*

to measure learning styles, the reliability was determined by the Cronbach's alpha internal consistency coefficient. Table 5 shows the coefficients of each scale.

Table 5. Cronbach Alpha Coefficient of the 18 scales of learning styles

Scale	*Acronym*	*Cronbach's Alpha*
Morning	MOR	0.66
Afternoon	AFT	0.66
Evening	EVE	0.74
Alone	ALO	0.67
Pairs	PAI	0.74
Little groups	LGP	0.74
Visual	VIS	0.68
Auditory	AUD	0.57
Kinesthetic	KIN	0.74
Reading-writing	REA	0.70
Dependent	DEP	0.47
Independent	IND	0.66
Interdependent	INT	0.80
Visual/Verbal	VIV	0.69
Visual/Spatial	VSP	0.70
Auditory/Verbal	AUV	0.73
Tactile/Kinesthetic	TAK	0.73
Logical/Mathematical	LOM	0.63

The validity of the instrument refers to how well it measures what it intends to measure. When we talk about validity, we usually refer to the three C's: content validity, criterion validity, and construct validity. In the case of the *Pentavalent inventory to measure learning styles*, the content validity is supported in the different models that have been discussed in this article, as well as by the consulted experts' judgment at the time of evaluating the pertinence and design of each of the items in the instrument's 18 scales. The intrinsic value of this instrument lies exactly in the theme of the content validity. Unlike other instruments in the educational market, the value of the *Pentavalent inventory to measure learning styles* is that it is a comprehensive instrument that contains several dimensions of learning styles that other instruments just partially consider.

Although in this study there was not a criterion or construct validity analysis, there are results linked to the last topic. Traditionally, construct validity in a test is determined through procedures of factorial confirmatory or exploratory analysis. Intuitively, a test like the one presented here, with 18 scale measuring the learning styles of a person, would hardly show 18 factors in a factorial confirmatory analysis. On the other hand, an exploratory analysis neither would make sense because of the juxtaposition of the scales for each dimension. A way to understand this is to think of the different dimensions as layers stacked one on top of other. Since each dimension includes its own scales, it is logic to see that one scale intersects with the other scales and, for sure, to the one that belongs in theory. That intersection can be represented using Diagrams of Venn as seen in the figure 2.

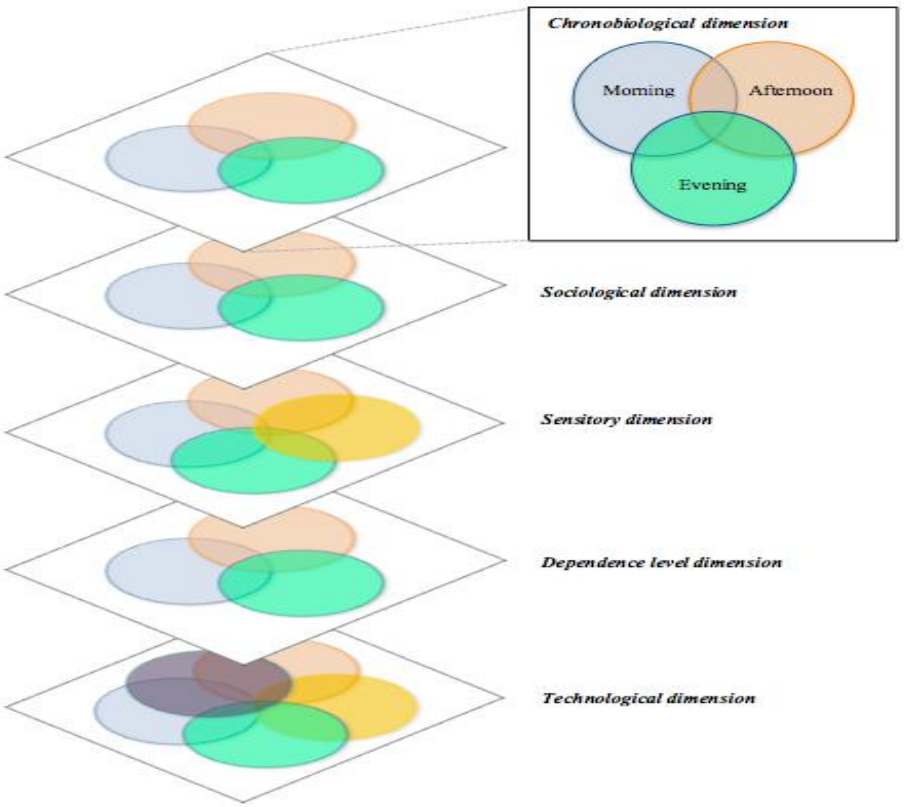

Figure 2. Graphic representation of the scales and dimensions of the *Pentavalent inventory to measure learning styles*

The third type of analysis was the item analysis. To identify problematic items, due to wording or their inclusion in certain scale, that could affect the test's structure, we carried out two types of analysis.

1. The first one established a correlation coefficient between the values of a particular item and the instrument's different scales. In theory, the items correlate higher with the belonging scale, and lower with the other scales. This type of analysis was done correlating the 108 items with the 18 scales of the instrument.
2. The second analysis consisted in determining the degree to which an item contributes to the increment or reduction of the scores' reliability in each scale. If a scale is composed by six items, one of them is erased to determine the Cronbach's alpha coefficient of the five remaining items. In principle, the value of the Cronbach's alpha should decrease when an item is eliminated from the studied scale. If the Alpha value increases, this would indicate that the item creates certain "noise" in the reliability of the results.

As a result of these two analysis we identified 5 of 108 items that correlated higher with other scale different from the one they belonged to in theory; also 12 items contributed negatively to the improvement of the reliability of the scores in the belonging scales. Thus, there is a low percentage of items that needs to be reviewed before a second edition of this inventory is made.

Discussion

The results discussion is in the same order in which they were presented: (1) discussion of the descriptive information of the sample that answered the self-report instrument; and (2) discussion of the psychometric information about the characteristics of the instrument.

Discussion of the descriptive information of the sample

In the results section, several descriptive statistical data was provided regarding the sample that completed the test. What use can we give to this information? Its relevance can be seen in the extent the instructor uses this information to improve the teaching processes. Accordingly, the information that emerges from the instrument makes more sense when it is referring to the

particular learning styles of a person or group. Making the study with a big sample results in the establishment of norms that help as a reference framework to interpret the scores of a person or the averages of a group.

Discussion of the psychometric information about the characteristics of the instrument

A Cronbach alpha coefficient can take values between zero (0.00) and one (1.00). When closer to one, the coefficient will show more reliability (internal consistency) of the scores in the scale. In general, dividing this range of values in three equal parts, e.g. an alpha value in the range [0.00, 0.33) implies a low reliability; in the range [0.33, 0.66) implies a moderate reliability; and in the range [0.66, 1.00] implies a high reliability. Table 5 shows there are 12 of 18 scales with high reliability; and the remaining 6 scales show moderate reliability. From all the calculated Cronbach alpha coefficients, the "dependent" scale of the dimension "level of dependence" stands out with the lowest value of Cronbach alpha (0.47) which implies a higher measuring error.

In relation to the instrument validity, in the results sections we pointed out that the main strenght of the test is in the content validity. Differing from some other instruments of similar nature, the *Pentavalent inventory to measure learning styles* has a comprehensive nature evaluating five different dimensions linked with the learning styles. The construction of this instrument is inspired in Sternberg's proposal (1997) where his measured thinking styles based on his theory of mental self-government.

Although the constructs behind every scale can seem independent, this does not make them exclusive when a person defines the learning preferences. To understand this better, take the example of the chronobiological dimension. Due to the form in which the test was made, a person can show preferences to study and learn in the morning, afternoon and evening (see the "and" inclusion). This contrasts with other instruments (e.g., Felder & Silverman, 1998; Alonso, Gallego, & Honey, 1995) that compel to whom answers it to choose one and leave others out. A different situation is observed in certain scales in that the person cannot distinguish between two relatively similar options. For example, in the sociological dimension, there are two scales ("pairs" and "little groups") with a high correlation (0.70), this situation allows us to infer that the items from one and other scale tend to measure the same construct.

Many learned lessons emerge from this proposal; they are a guideline for future work in this theme. On one side, we suggest the application of the instrument in groups of different nature (for example, in educational institutions of different levels and geographic zones) to make sure if the information in this study is consistent with other contexts. Future research should consider the review of the items that are contradictory to the expected, so they can be modified or substituted for others. The determination of other reliability coefficients (for example the test-retest) is necessary to consider external factors that contribute to measure errors beyond the internal consistence measures. It is also advisable to correlate the results of this inventory with others that similar instruments present, to help determine their criterion validity.

The *Pentavalent inventory to measure learning styles* is a proposal from the interest of a Mexican company, to measure the learning styles in its personnel, looking to optimize the instructional designs of its corporative university. Regardless of the context in which the development occured, this instrument aims to be a way to make decisions about formative processes in diverse educational settings.

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Appendix

Example of items of the *Pentavalent inventory to measure learning styles*

Item example	*Scale*
I feel more productive early in the morning.	MOR
I like to start my activities at sunrise.	MOR
I like to organize work meetings during lunch break.	AFT
The best time of my day is in the afternoon.	AFT
I focus more to study when everyone else is asleep.	EVE
I like to work when the evening comes.	EVE
I check my e-mail daily.	ALO
I like to establish my own learning objectives.	ALO
I enjoy my work more when I share my ideas with someone.	PAI
I have always thought that two heads are better than one.	PAI
I like to get involved in projects where large amounts of people are participating.	LGP
I prefer sports that play in teams.	LGP
I am good at visualizing faces in my mind.	VIS
I like to use pens in different colors.	VIS
It is easy for me to remember the names of people.	AUD
I like to listen to audiobooks whenever it is possible.	AUD
I like outdoors activities.	KIN
I like to participate in activities that require physical skills.	KIN
I like to keep a written record of the activities I must achieve.	REA
I enjoy reading books and/or magazines.	REA
When I don't know how to do something, I prefer to ask.	DEP
I consider that the teacher is responsible of my learning.	DEP
I like to lead the projects on which I participate.	IND
I think that each one is responsible of their own learning.	IND
I consider that when we work in teams, everyone is responsible of the success or failure of the activity.	INT
I think that to solve problems, two heads are better than one.	INT
I consider that social networks help strengthen our development.	VIV
I like to use electronic tools to elaborate visual aids.	VIV
I like to do mind maps or diagrams through mobile devices such as tablets, iPad or smartphones.	VSP
I consider that an efficient person is one who checks their messages instantly.	VSP
I like to register my activities in electronic devices such as iPad, smartphones or tablets.	AUV
I like to use tools such as audio or video conferences.	AUV
I like to have mobile devices such as tablets or smartphones because I consider them as tools that make my work easier.	TAK

Example of items of the *Pentavalent inventory to measure learning styles - continued*

Item example	*Scale*
I consider that laboratories must have virtual simulators.	TAK
I like to participate in discussion groups and I generally explain my ideas with real life cases.	LOM
I like to work with abstract concepts.	LOM

Received January 26, 2016
Revision May 12, 2016
Accepted September 27, 2016