



# Students learning styles strategies: A validation process

## *Estrategias de estilos de aprendizaje de estudiantes: proceso de validación*

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### Abstract

On the basis the dissemination of the use of learning styles, several recommendations have been published on the use of certain strategies, which could be used in teaching-learning process without a way of measuring instrument that allows their study. Thus, the objective of the research was to validate an instrument of learning strategies based on theoretical, reflexive, pragmatic and active styles, through criterion and construct validations, as well as its psychometric correction. The criterion validations process was carried out by judges who were researchers that recommended the use of specific learning strategies for each style. The construct validation process was performed by analyzing the concepts of learning styles by Alonso, Gallego & Honey (2007) in order to identify their congruence with the suggested strategies. The instrument was answered by 116 college students. The overall reliability obtained was 0.95. The reliability for the active style was 0.79, for the theoretical 0.85, for the reflexive 0.87 and for the pragmatic of 0.88. The measuring capacity for research on learning styles and strategies, as well as their diffusion, are discussed. The results are also discussed on the topic of educational practice, due

the recommendations about learning strategies should be based on verifiable knowledge and on evidence that explain how are linked the strategies and the learning processes.

**Keywords:** Learning strategies, measuring instrument, learning styles, university students, learning process, research applicability.

### Resumen

A partir de los estilos de aprendizaje se han publicado recomendaciones sobre el uso de ciertas estrategias para los procesos de enseñanza aprendizaje, sin que su funcionamiento haya sido puesto a prueba, en tanto no existe un instrumento que permita su estudio. El objetivo de la investigación fue validar un instrumento de estrategias de aprendizaje basado en los estilos teórico, reflexivo, pragmático y activo, mediante procedimientos de validación de criterio, de constructo, y su corrección psicométrica. La validación por jueces la realizaron investigadores que recomiendan el uso de estrategias de aprendizaje específicas para cada estilo. La validación de constructo se realizó mediante el análisis de los conceptos de estilos de aprendizaje de Alonso, Gallego y Honey

(2007), para identificar su congruencia con las estrategias sugeridas. Para identificar el nivel de confiabilidad del instrumento, se hizo su aplicación a 116 estudiantes universitarios. Se obtuvo una confiabilidad general de 0.95. La confiabilidad por factor fue para el estilo activo 0.79, para el teórico 0.85, para el reflexivo 0.87 y para el pragmático de 0.88. Se discute la capacidad de medida para la investigación sobre estrategias asociadas a los estilos de aprendizaje, ya que las recomendaciones deberían

## 1. Introduction

Educational research has distinctive characteristics that give it the particular responsibility of generating knowledge and providing practical recommendations. To generate knowledge in the educational field implies to recognize a high degree of complexity and explanatory diversity, susceptible to be used pragmatically, for that reason the information that is published on its findings must be especially careful. Moreles (2009) identifies three types of publications on the educational field potentially usable for pragmatic purposes: strategic documents, essays and research reports.

The usefulness of research reports has the particularity of focusing on scientific bases that, as Kerlinger and Lee (2008) express, allow the development of knowledge that, in addition to being verifiable, can be improved in its practical application. This is possible because their explanations come from systematically constructed theoretical structures, are internally evaluated and susceptible to be tested. The tests that are made are ordered, in order to look for empirical evidence through relationships observed in the field or in the laboratory; are controlled to the maximum, with the purpose of distinguishing them consciously and systematically, to discard metaphysical explanations. Thanks to the care of this process, the derived explanations have the particular characteristic of self-correcting. Otherwise, any form of knowledge would apply indiscriminately, its understanding could not

basarse en la generación de conocimiento, que favorezca la explicación del funcionamiento de estrategias sobre los procesos de aprendizaje, para tener fundamentación susceptible a verificación.

**Descriptores:** Estrategias de aprendizaje, instrumento de medida, estilos de aprendizaje, estudiante universitario, proceso de aprendizaje, aplicabilidad de la investigación.

be developed and its self-correction would be difficult.

Considering that scientific production is evaluated on the basis of publications, which are validated through consultation and subpoena, and which consequently lead to scientific recognition (Cortés, 2007), it is necessary to take care of the findings that are published, therefore, in agreement with Moreles (2009), there will be others who find it useful and lead them to reproduce and employ knowledge or fallacies.

Learning is, in agreement with Cornejo and Redondo (2007), one of the topics most prolifically addressed in publications of the educational field, either because it allows to identify optimizing aspects, or to intervene as a guide and remedy. With respect to optimization, for example, these studies contribute to understanding the academic performance that, in the case of higher education, represents the possibility of empowering human capital.

Regarding intervention in counseling and remedial processes, the issue has focused on problems of socio-educational relevance, such as educational lag, which is a persistent problem because students in this condition are usually economically located among the disadvantaged and because the assignment of the educational service, is generally provided by teachers without the required care (Muñoz, 2009). Another problem of this nature is that the mere access to the educational system, does not guarantee that the student stays and achieves his academic training (Organization of Ibero-American States, 2010).



Understanding what and how the factors that, in addition to influencing the educational lag, maintain and favor the culmination of academic formation, will allow explanations both to optimize learning and to intervene in it, through processes of orientation and remedy. In both cases there is an impact on academic performance.

Research on academic performance through learning has allowed the recognition of multiple variables and different dimensions. This is so because of the theoretical diversity and areas of study from which it is addressed (Cornejo and Redondo, 2007), and given the complexity of the educational reality (Albert, 2007).

The present research is part of the tradition that Cornejo and Redondo (2007) categorize as “studies of school teaching and learning processes based on learning theories by” restructuring “(p.156). This tradition is characterized by focusing on learning processes in the classroom, considered as heterogeneous, located in constructivism, in which there is no intention to compare or hierarchize the factors involved.

It is desired to understand with precision how the student does to learn considering processes derived from his mental activity; this topic is treated in the exposed tradition, and can be understood through certain characteristics of the students. These, in turn, are considered by Cerquera (2014) as factors that determine academic performance. We will not discuss other aspects involved here, because the interest is to find explanations on how the characteristics of the student, in this case described by the learning styles, allow to understand how he/she does to learn. So that the practical recommendations are oriented to do so under different conditions, because in agreement with Alonso, Gallego and Honey (2007), the learning styles are located in pedagogical approaches that indicate the need to learn to learn, implying with it “effectiveness in any situation,” p. 54.

The study of learning styles has generated explanatory and therefore pragmatic diversity. Its recurrence has resulted in the creation

of a magazine considered by Soler (2014), as one of the more outstanding fifteen publications in Spanish (also published in English). It has two international events: Ibero-American Congress of Learning Styles and World Congress of Learning Styles (D.J. Gallego, 2015, personal communication, April 14, 2015). It has also been disseminated through web 2.0 resources such as: pages, “blogs, wikis, social networks, online courses and discussion forums” (García, Sánchez, Jiménez and Gutiérrez, 2012, p.68). They are also the object of institutional collaborations in Spain and Mexico. This gives it diffusion power making it susceptible to practical or investigative use; such is the case of publications that expose recommendations of use, through learning strategies for each style. The problem is that the research variety developed from its origins, according to Ortiz and Aguilera (2008) make it difficult to understand and institutionally apply.

## 2. Learning styles

Ortiz and Aguilera (2008) identified two moments of development on the subject; the former showed that learning styles were characterized by a primarily cognitive component; the second, which detonated current variations, was defined by recognizing the existence of motivational components that affect learning.

### 2.1. Honey and Mumford’s perspective

Honey and Mumford (as cited in Alonso, Gallego and Honey, 2007) observed that, in the face of common learning conditions, students show different ways of response. This leads to Alonso, et.al. (Ibid) to develop their proposal by emphasizing the role of students in their learning, as they are the ones who must respond to those situations, with the resources at their disposal. For these authors, the knowledge of learning styles, allows to guide the design of the pedagogical proposal of the teacher, from a scheme of learning to the actual learning.

Alonso, et.al. (Ibid) define learning styles as “cognitive, affective and physiological traits, which serve as relatively stable indicators of how learners perceive, interact and respond to their learning environments” (ibid, p. 48).

Regarding them, Gallego and Alonso (2008, as cited in Arenas, Jiménez and Avila, 2014), propose that they contain two main aspects: 1) cognitive, associated with physiology and therefore does not show variations over time and; 2) another in which the learning strategies are found, which, unlike the previous one, is susceptible to vary depending on how the individual develops them, to integrate what is learned in the predominant style. Thus, the learning style is relatively stable; where “stable” derives from its physiological basis and “relative” is the product of learning and exercising strategies. From this point of view, one would expect to empirically see variable responses.

In their proposal also they identify psychological components or traits of the styles: 1) affective, that refers to the feeling; 2) cognitive, relative to knowing and 3) behavioral, which is manifested in action. The functions of these components are: a) structured based on the style of learning, b) reflect the way the person builds their learning and c) show strategies, the responses designed by the individual, when the environment demands it (2008, as quoted in Arenas, et.al, 2014).

In the paper by Gallego and Alonso (2008, as cited in Arenas, et.al, 2014), the distinction between aspects and the psychological components or traits is not clear, nor the relation between them to explain the functioning of the learning styles, being that the strategies play a special role, because their relative nature apparently impacts on the predominant style. For example, from a cultural historical point of view, Ortiz and Aguilera found that the trend of styles only remains stable, if individual and social conditions remain constant, but if conditions change, the person will need to consider another scheme to follow (2010). These results could indicate that the strategies perform a kind of “adjustment” in

the predominant style in the of face the learning situations, possibly showing that the manifestation of the styles is as dynamic as the learning conditions. Strategies based on styles are the main interest of this study because practical recommendations have been developed, both by the authors of this perspective and other researchers, without having the basis to understand their role.

## 2.2. Characteristics of the learning styles

Alonso, Gallego and Honey (2007) affirm that one has all the styles, but one tends more towards some. They suggest that the mastery over the four is ideal, so that it can respond to the different situations of learning. The general and specific characteristics for each style according to them are:

### *Theoretical*

Methodical, logical, objective, critical and structured. It is disciplined, planned, systematic, ordered, synthetic, reasoner, thinker, relational, perfectionist, generalize, hypothesis finder, search for theories, models, questions, underlying assumptions, concepts, clear purpose, rationality, causes, systems, values, criteria, inventor of procedures, explorer (pp. 73 and 74).

### *Reflexive*

Weighted, conscientious, receptive, analytical, exhaustive, observer, compiler, patient, careful, detailing, elaborate arguments, forecaster of alternatives, behavioral student, data logger, investigator, assimilator, Inquisitor, sounder (pages 72 and 73).

### *Pragmatic*

Experimenter, practical, direct, effective, realistic, technical, useful, fast, decided, planner, positive, concrete, objective, clear, confident, organizer, present, problem solver, applicator of learned, action planner (p .74).



*Active*

Animator, improviser, discoverer, risky, spontaneous, creative, novel, adventurer, renovator, inventor, vital, live experiences, brainstorm, thrown, protagonist, shocking, innovative, talkative, leader, willful, funny, participatory, competitive, eager to learn, problem solver, moody (p.72).

Although the characteristics are clearly defined, it is unknown what leads the student to define its strategy. This is important because its relative nature seems to suggest that it is contingent on how they perceive learning experiences, and will probably lead them to adjust their style. Then it is not known if it is the mastery of all styles that empowers the student to attend to any learning situation or is the management that he makes about their strategies. The problem with this ignorance is that there have been published works with recommendations of strategies to strengthen all styles, without having evidence to explain why it is so.

### 3. Learning strategies

#### Learning

Learning is understood here as an internal, self-structuring constructive process, which in turn depends on the level of cognitive development; part of previous knowledge and involves an internal reorganization, produced when the student conflicts with what he already knows (Díaz-Barriga and Hernández, 2010).

#### Strategies

On the other hand, the strategies of learning are a:

Conscious and intentional decision-making process, in which the student chooses and recovers, in a coordinated way, the conceptual, procedural and attitudinal knowledge necessary to fulfill a certain objective, according to the conditions of the educational situation in which

produces the action (Juárez, Rodríguez and Luna, 2012, page 4).

From the point of view of cognitive psychology, the main aspect of the strategy is the objective, because it allows the identification of where learning is going, leads to the design of action plans (strategies) and evaluation, to determine the degree to which it reaches its scope. Objectives and feedback are then the main variables that favor learning, because they pose what will be learned and how it will be done (using strategies).

The functions of the strategies are: cognitive facilitation of learning, acquisition of knowledge in general and promotion of significant learning achievement. The assumptions also consider that each person is unique, so that their ways of learning are different (Lago, Colvin, and Cacheiro, 2008). In this sense it is suggested that each person can employ strategies in a particular way, without being clear on the basis of what happens.

### 4. Learning strategies and styles

Alonso, Gallego and Honey (ibid) consider that the styles show characteristics that the students use to respond to learning situations, affirming that it is desirable to have high levels in all to respond to different learning conditions. In their book *Learning Styles* they even dedicate spaces to describe ways to improve each style and recommend guidelines for tutorial action, but again there is no data on how it works or how it is explained. This promoted publications with practical recommendations in this sense, even though it is not clear whether the styles per se define the way of learning or some kind of adjustment among its components, for example, depending on how the strategies operate. The consequence of this is that it is not possible to demonstrate the impact of its implementation (Aragón and Jiménez, 2009), even for users of styles may not be relevant (Castro and Guzmán, 2005).<sup>4</sup>

Examples of this productivity are the publications that show proposals for learning strategies derived from the identification of student styles. Reinicke, Chiang, Montecinos, Del Solar, Madrid and Acevedo (2008) did so for Biological Science students; Ortega (2008) of Dentistry; Medina and Medina (2012) and Giménez-Bertomeu, by Alfonseti Hartmann, Lillo, Lorenzo, Mira-Perceval, Rico and Asensi (2008) for Social Work; Jiménez (2004) conducted an intercultural study with foreign students. These authors recommend integrating learning styles into educational processes, but do not show the results of their implementation.

In this spirit of looking for mechanisms to achieve learning, in a previous study, a case profile of learning styles and strategies was used in students of food genomics and educational innovation (Arenas, Reyes and Ávila, 2014). Although qualitatively it was found that their behavior for strategies of activation, information processing, metacognition, organization and application, was in accordance with the characteristics of its style, the learning achieved with respect to the proposed material was poor. They recognized the importance of strategies in their learning, but did not use them. In this particular study it is not possible to verify the impact of styles on learning. If it is thought that strategies play an essential role in the manifestation of styles and that these students did not use them, it may be part of the explanation, but it cannot be verified as long as there is no theorized or empirical evidence is found, regarding this matter.

In spite of this, some authors have developed concrete strategies without obtaining conclusive results that lead them to insist on recommending their use as part of the teaching strategies (Del Valle de Moya, Hernández, Hernández and Cózar, 2009; Farfán, Gallardo, Terán and Alonso, 2010). Others assert that their use favors educational quality (Ventura, 2011). Strategies associated with identified styles have been exposed in (Cózar, Bravo and Fernández, 2012); It is affirmed that they promote learning and that their identi-

fication allows to locate groups of risk of low performance students, as well as level of accessibility of the content of the subjects (Del Valle de Moya, et.al., 2009). But none of these works prove, and therefore does not explain the incidence of styles on learning.

The interest in the learning styles has favored the production of proposals of strategies associated to them, to seek improvements in the educational practice. But how prolific productivity can be in a field or subject does not account for its explanatory capacity. Although clearly characterized in this case by Alonso, et.al. (2007), its conceptualization is diverse, its components confusing and do not explain what defines the responses to learning situations.

In order to know if the strategies disseminated can be based on the learning styles, it was proposed to develop an instrument that allowed studying them. It was hoped that this instrument would specify the possibility of identifying learning strategies associated with each style. It is also intended that the instrument will allow exploring the operation of these strategies, to know if it is possible to establish a framework that base proposals on their use.

In making practical recommendations on strategies that can be systematically examined and tested, replicability and self-correction are encouraged; thus promoting the development of knowledge about strategies of learning styles, through the investigative action, so that their practical use offers explanatory basis. In this way, the objective of the research was to validate an instrument of learning strategies based on theoretical, reflexive, pragmatic and active styles.

## 5. Method

Initially, based on the works of Farfán, et.al. (2010), Del Valle de Moya, et.al. (2009) and Cózar, et.al. (2012) it was possible to observe proposed strategies to strengthen learning styles. The former were aimed at stimulating the development of low styles; the second and third were custom



tasks for each style. With these strategies 90 reagents were designed that were used for the first application.

Subsequently, according to the construct validity, the characteristics and ways of learning generated by Alonso, et.al. (2007), 91 reagents remained for the second application.

## 6. Procedure

### Phase 1. Validity of criterion

Eight of the authors of strategies and learning styles were invited via e-mail as judges. Seven agreed to participate in this phase of the process. They were provided with a review format, a manual and the instrument. Their task consisted in comparing each reagent with the aspects and characteristics of each style. In order to compare, they had to consider: the identification of the congruence of each reagent with each style, the agreement or disagreement in which the reagent used to evaluate strategies, the determination of whether each reagent, in its formulation, adequately expressed a learning strategy based on his style; If the content of each reagent was consistent with the principles of learning styles, their appreciation of which learning style each reagent corresponded to, whether the wording of the reagent was understandable, the final opinion to establish whether the reagent was preserved, deleted or modified. The academics reviewed each of the reactants, responding to each task.

### Phase 2. Construct validity

For this phase the participation of an eighth judge was essential, which suggested that the instrument be contrasted with the publication on the learning styles of Alonso, et.al. (2007) in which he has co-authored. Based on this suggestion, two scholars collaborate from different cities to develop psychopedagogical proposals in their respective faculties, and those who have a shared interest in learning styles (one pertaining to one psychology program and another to one

of psychology and another one of architecture), they contrasted the reagents, doing the content analysis of the proposal of learning styles. With this base were selected and double-blind grouped the reagents that agreed with the aspects and characteristics of each style of learning, as well as with the section that deals with the topic of ways to improve each style. After a comparison of the obtained observations, the final classification of the reagents was discussed and agreed, and their wording was adjusted to be characterized as strategies, that is, including the objective to be followed and the action that would be taken to achieve it, for the purpose distinguishing them from learning styles.

With the instrument recognized in its conceptual structure, it was applied to a non-probabilistic sample for the convenience of 116 university volunteers, of which 59% were women and 41% were men with an average age of 21 years of age (SD = 4.5). The majority (n = 90) were students of the psychology programs and the rest of architecture (n = 26) who belonged to the academics who did the final revision. This supply allowed the psychometric correction of the instrument. Although a comparative study between majors was not sought, the courses of psychology and architecture could be equivalent to the experimental careers and sciences of health, as well as humanities classified by Alonso (1992, as cited in Alonso, et.al, *ibid.*) to interpret their own data.

The instrument was again applied to a sample of 263 psychology students, age 21 (SD = 3.1), of whom the majority were women (71%), 29% of whom were men.



## 7. Results

### Validity of criterion

In the validity of criteria in general, the observations were made on the writing of the

instructions and some reagents. Only one of the researchers pointed out that it was necessary to review Alonso's book, et.al. (Ibid.). None suggested changes that would significantly modify the instrument. As a result of the concordances, three reagents were removed from the scale (41, 48, 71), leaving 87 reagents (see Chart 1).

**Table 1. Grouping of reagents according to strategies**

Strategies for each style	Reagents
<b>Pragmatic</b>	1, 4, 13, 17, 18, 19, 22, 24, 27, 37, 45, 49, 57, 69, 72, 82, 84, 85, 86, 88, 89
<b>Active</b>	7, 8, 10, 15, 16, 21, 23, 42, 51, 52, 55, 58, 59, 60, 79, 81, 87, 90
<b>Theoretical</b>	2, 3, 12, 14, 26, 30, 31, 35, 39, 43, 54, 61, 62, 64, 66, 70, 73, 74, 76, 77, 78, 80, 83
<b>Reflexive</b>	5, 6, 9, 11, 20, 25, 28, 29, 32, 33, 34, 36, 38, 40, 44, 46, 47, 50, 53, 56, 63, 65, 67, 68, 75

### Construct validity

Concerning construct validity, we found concordances between the learning strategies explored by the instrument, with the characteristics of learning styles and ways to learn from Alonso, et.al. (2007). this allowed the removed reagents to be reintegrated and another one was divided that investigated two aspects at the same time. In this way 91 reagents remained in total. The comparative for each style is presented below.

The characteristics of students with pragmatic style are: organizer, activity planner, uses what is learned, problem solver, concrete, actual, practical, technical, experimenter, direct, effec-

tive, clear, realistic, useful, decisive, positive. Their ways of learning are: to be exposed to a model that can be emulated, to have immediate possibility to apply what has been learned, to develop action plans with obvious results, to give indications to suggest shortcuts, to experiment or to practice with expert advice, to see a link between subject and problem, Opportunity to apply it, to see demonstrations with experts, to see examples or anecdotes, to concentrate on practical aspects, to verify that the activity has immediate validity, to experience simulations, to verify that experts dominate the subject and know how to do things. Table 2 shows the general characteristics of the strategies associated with this style.



**Table 2. Comparison of pragmatic style with learning strategies**

Dimension	General Characteristics Learning Strategies
Pragmatic	<ul style="list-style-type: none"> <li>• Set objectives on the identification of real situations to define the steps that allow its attention</li> <li>• Find the practical utility of what you review in class</li> <li>• Update what you know and how to do things with experts</li> <li>• Explain procedures and detect ways to evaluate them to recognize their usefulness</li> <li>• Guide others to develop tasks</li> </ul>

Students with active style are: innovative, participatory, extroverts, protagonist, conversational, funny, leaders, innovative, creative, novel, inventor, eager to learn, problem solvers, vital, brainstorming, competitive, willful, Shocking, adventurous, refreshing, spontaneous. Their ways of learning contemplate: to do new things, to generate new ideas, to solve problems, to live situations

of interest or crisis, to make presentations, to participate actively, to risk, to solve as part of teams, to solve something that did not know or could not, having someone to talk to, not sitting for a long time, trying something different. The characteristics of the strategies for this style are observed in Table 3.

**Table 3. Comparison between active style and learning strategies**

Dimensio n	General Characteristics Learning Strategies
Active	<ul style="list-style-type: none"> <li>• Use diverse and dynamic ways of learning to maintain its participation</li> <li>• Participate actively in different initiatives that involve the mobilization of others and their protagonism</li> <li>• Use social skills to achieve what is proposed</li> <li>• Simplify ways of doing things</li> <li>• To follow the own schemes without intervention of others</li> </ul>

The student with a theoretical style is described with the following characteristics: critical, relating ideas, synthetic, structured, orderly, disciplined, planned, systematic, perfectionist, methodical, organized. Their ways of learning consider: being in structured situations with clear purpose, inscribing information in systems mod-

els and theories, analyzing the whole situation, finding complex ideas that can interest it. The characteristics of the strategies associated with this style are illustrated in Table 4.



**Table 4. Comparison between theoretical style and learning strategies**

Dimension	General Characteristics Learning Strategies
<b>Theoretical</b>	<ul style="list-style-type: none"> <li>• Have clear and concise representations of organized information</li> <li>• Have information available with support from different mechanisms</li> <li>• Relate information by forming panoramic explanatory schemes</li> <li>• Have elements to keep a critical view on things</li> <li>• Maintain order, discipline and neatness both in the information and in the instruments in which it is stored</li> </ul>

Students with reflexive style are characterized by being analytical, observers, compilers, data loggers, exhaustive, report writers, argument makers, prover of alternatives, probers, conscientious, careful, detailed, slow, assimilators, receptive, prudent. Their ways of learning are: to reflect on activities, to exchange opinions, to work

without pressure of time, to carefully investigate, to gather information, to think before acting, to assimilate before commenting, to make detailed analyzes of carefully weighted reports. In comparison, the characteristics of the reflective strategies are shown in Table 5.

**Table 5. Comparison of reflexive style with learning strategies**

Dimension	General Characteristics Learning Strategies
<b>Reflexive</b>	<ul style="list-style-type: none"> <li>• Generate own ideas after the exhaustive analysis of their thoughts in contrast to those of others.</li> <li>• Having all the resources available before safely proceeding</li> <li>• Argue based on aspects derived from different angles and from the own appreciations, to explain things</li> <li>• Spreading the knowledge acquired after laborious and extensive research on novel subjects</li> </ul>

Tables 2 to 5 contain a synthesis of the characteristics of the set of strategies for each style of learning contained in the instrument. Their concordance was identified by analyzing the content of the reagents in contrast to the characteristics of learning styles and ways of learning by Alonso, et. al.(Ibid).

**Reliability analysis**

Initially, reliability analysis of the reagents was performed using the Cronbach alpha coefficient. The total Alpha of the 87 reagents was 0.95, showing internal consistency. Subsequently, the same analysis was performed for each set of strategies. Reliability results and examples of some reagents can be seen in Table 6.



**Table 6. Reliability analysis by indicator exemplified with some reagents**

Strategies per each style	$\alpha$	Amount of reagents	Reagents
<b>Pragmatic</b>	0.88	21	<ul style="list-style-type: none"> <li>Identified activities where I can put into practice what I learn in classes</li> <li>Identified socially relevant problems related to the topics of class</li> <li>I listen, on my own, conferences with career professionals of my interest</li> </ul>
<b>Active</b>	0.79	18	<ul style="list-style-type: none"> <li>I make sentences and/or acrostics to study concepts that are difficult for me</li> <li>I participate in class with my own ideas even without the teacher's request</li> <li>I search information on the internet more than in the library</li> </ul>
<b>Theoretical</b>	0.85	23	<ul style="list-style-type: none"> <li>Develop conceptual maps as a study activity</li> <li>I take care of the structure, order and cleaning in the documents that I elaborate for the school</li> <li>I tend to get good grades so that the work is not loaded at the end of the courses</li> </ul>
<b>Reflexive</b>	0.87	25	<ul style="list-style-type: none"> <li>include my own reflections and conclusions when I do school work</li> <li>I express my doubts in class to the teacher</li> <li>I take personal notes of my readings</li> </ul>

After the second application, a total reliability of 0.94 was obtained for the 91 reagents, with the internal consistency for each set remaining for the pragmatic style strategies of 0.86; for the active, 0.79; for the theoretical ones, 0.86 and for the reflexives, 0.83.

## 8. Discussion and conclusions

In general the instrument has capacity of being used. The criterion validity made it easier to specify instructions and to write the items legibly to be understood as strategies and not as activities indicated by the teachers, while each reactant reflected as clearly as possible that contained a goal and an action aimed at achieving it. The instrument showed stability after verification in the second application.

Strategies recommended in the publications of Farfán, et.al. (2010), Del Valle de

Moya, et.al. (2009) and Cózar, et.al. (2012), were inspired by their moment in the proposals of Alonso, et.al. (2007), but it was not established whether such strategies could be based on learning styles. For this reason in the present work it was expected to know if with an instrument it was propitious to study strategies associated to each style, to be able to base them and to explain them. The results showed that the instrument identifies strategies associated with styles, so it is possible to have learning strategies that can be explained through them.

This allows the student to recognize their own strategies, to complement them with others that correspond to their style and also allows them to identify other strategies to strengthen styles in which they are lacking. For the time being, the study was limited to checking the correspondence between practical recommendations inspired by the proposal of learning styles. The verification

was obtained after its application in students of two undergraduate programs and the results were verified in a second application. It is considered that the instrument is potentially usable because, even though the participants were from different cities, its consistency remained stable.

It was observed that the published strategies left out some specific characteristics and ways of learning from the four learning styles of Alonso (et.al). This demonstrates the point being made here about the care that is needed when practical recommendations are disseminated.

In general the characteristics and ways of learning of Alonso, et.al. (2007) are consistent with the reagents of the instrument and with each other, which was observed with total reliability and by indicator in the two applications. The criterion and construct validity process was developed with systematicity, control and verification, while clear steps were followed for each part. The work was followed and verified by ten academics and tested with two applications. It was favored the advance of the knowledge on strategies associated to learning styles recommended in publications because there is evidence that shows theoretical-practical agreement through the revision of inputs in these two dimensions, thus enabling self-correction (Kerlinger and Lee, 2008).

Direct contact with the authors of the proposals fully recognizes their work, and their effort provides the possibility of advancing knowledge. This is part of recognition and validation to which Moreles (ibid) alluded; Its accessibility and availability to perform the work made it possible to autocorrect the missing gap, since according to Kerlinger and Lee (2008), in seeking a systematic, conscientious and orderly management of information in a field, we are able to obtain explanations that provide a basis in the investigative action for the advancement of knowledge and its practical recommendation.

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