

Caracterización de la relación estilos de enseñanza- aprendizaje en la estadística, a propósito de un estudio en México

*Characterization of the Relationship Styles of the Teaching-Learning in
the Statistics, in Regards of a Study in Mexico*

*Caracterização da relação ensino-aprendizagem em estatística, em
relação a um estudo no México*

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Resumen

El siguiente estudio asume como punto de partida la necesidad de explorar el proceso enseñanza-aprendizaje en la asignatura estadística, la cual forma parte de la mayoría de los programas educativos en México. El estudio se posiciona en la teoría del autogobierno mental de Sternberg, con la intencionalidad de comprender la relación entre el estilo de aprendizaje y los estilos de enseñanza de 11 programas educativos del nivel superior en el Estado de Jalisco, México. La finalidad del estudio es identificar en términos de tendencia los estilos de enseñanza/aprendizaje que caracterizan el contexto educativo estudiado.

Para ello, se aplicó una encuesta expofeso a un total de ocho profesores y 159 estudiantes. Como hallazgos fundamentales, se declara que el estilo con mayor frecuencia registrado fue el ejecutivo y judicial para alumnos y profesores respectivamente, sin encontrar diferencias entre géneros ($p < 0.005$). Se encontraron diferencias en los promedios de calificación emitidos por profesores con estilo legislativo (evalúa con mayor calificación) que los profesores con estilos ejecutivos o judiciales. Contrario a lo señalado por diversos autores, las coincidencias de estilos entre alumnos y profesores (estilos Judicial) generaron los rendimientos (promedios de calificación) más bajos ($p < 0.005$).

Palabras clave: enseñanza de la estadística, estilos de aprendizaje, estilos de enseñanza.

Abstract

This study assumes as a starting point the need to explore the teaching-learning process in the statistics course, which is part of most educational programs in Mexico. The analysis is based on Sternberg 's theory of mental self-government, with the intention of understanding the relationship between learning style and teaching style of eleven higher education programs in the state of Jalisco, Mexico. The purpose of the study is to identify in terms of trends the teaching/learning styles that characterize the studied educational context.

For this, a survey was applied to a total of eight teachers and 159 students. As fundamental findings, it is stated that the style with the highest frequency registered was executive and judicial for students and teachers respectively, without finding differences between genders ($p < 0.005$). Differences were found in the grading averages issued by teachers with legislative style (evaluates with higher grades) than teachers with executive or judicial styles. Contrary to what was pointed out by several authors, the coincidences of styles between students and teachers (Judicial styles) generated the lowest yields (grades averages) ($p < 0.005$).

Keywords: teaching of statistics, learning styles, teaching styles.

Resumo

O seguinte estudo assume como ponto de partida a necessidade de explorar o processo de ensino-aprendizagem no sujeito estatístico, que faz parte da maioria dos programas educacionais no México. O estudo está posicionado na teoria do autogoverno mental de Sternberg, com a intenção de compreender a relação entre o estilo de aprendizagem e os estilos de ensino de 11 programas de ensino superior no estado de Jalisco, no México. O objetivo do estudo é identificar em termos de tendências os estilos de ensino / aprendizagem que caracterizam o contexto educacional estudado.

Para isso, uma pesquisa exprofeso foi aplicada a um total de oito professores e 159 estudantes. Como conclusões fundamentais, afirma-se que o estilo mais freqüentemente registrado foi o estilo executivo e judicial para estudantes e professores, respectivamente, sem encontrar diferenças entre os gêneros ($p < 0,005$). As diferenças foram encontradas nas médias de notas emitidas por professores com estilo legislativo (avalia com maior qualificação) do que professores com estilos executivos ou judiciais. Contrariamente ao que foi apontado por diferentes autores, a coincidência de estilos entre estudantes e professores (estilos judiciais) gerou os menores rendimentos (médias médias) ($p < 0,005$).

Palavras-chave: ensino de estatística, estilos de aprendizagem, estilos de ensino.

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Introduction

The number of researches on the didactics of statistics is still very scarce, in comparison with those existing in other branches of mathematics. The main difficulties of the students in many important concepts are not known for sure. It is necessary to know the specificity of educational contexts to experiment and evaluate teaching methods adapted to the specific nature of statistics, to which the general principles of mathematics teaching can not always be transferred. Existing research is not well known by teachers (Batanero, 2000), since there is still a lot of dissemination work and studies at a global level that support the importance of knowing how the teaching-learning processes of this important subject take place.

The interdisciplinary nature of the subject validates the importance of focusing approaches that deal with approaches that highlight what happens in educational contexts taking into account this particular. In the PISA Theoretical Frameworks (OECD, 2003), it is stated that: "Statistics provides something important and unique to mathematical training: reasoning from uncertain empirical data. This type of statistical thinking should be part of the mental equipment of every intelligent citizen." The statistical concepts today cross-section all areas of study such as social sciences, biology, geography, etc., demanding a high demand for both the teacher and the student

Interpretive competence in statistics should contribute, as Ottaviani (1999) points out, to the formation of critical thinking, based on the evaluation of objective evidence: "The critical approach to data must be counterbalanced by the awareness of the utility of the information required in relation to the reality under study, either for a purely cognitive purpose or to make a decision."

It is necessary, then, to explore from certain psychological constructs what happens in the space of development of teaching by the actors involved in the teaching-educational process. In this specific case it is decided to explore based on the so-called triadic theory or theory of mental self-government of intelligence (Stenberg, 1999) to the thought styles, which are the preferred ways to apply, use or explore one's own intelligence and knowledge about a problem or work that has to be done. According to Miranda (1999), thought styles are individual preferences for tasks and mental processes in the interaction with the environment (people or situations), in development and in socialization.

Using the metaphor of the powers of government - it can be considered that intelligence serves the individual, just as a government serves the community - Stenberg (1999) has proposed a model of thought styles called "mental self-government".

Given the lack of a single concept regarding the definition of "learning style", different authors (Schemck, 1988, Honey and Munford, 1989, Sternberg, 1990) agree that these reflect cognitive operations and elements of personality that each subject used in a certain context and in certain circumstances. According to Adán-León (2004), learning styles could be interpreted as "procedures, which are integrated by cognitive, affective and

behavioral elements", which in turn are used in a particular way to respond to certain problematic situations .

For the present work, three learning / teaching styles will be differentiated, according to Sternberg (1990).

Legislative style, which is made up of people who tend to create formulas and plan solutions to problems; they prefer to formulate laws rather than follow the established ones and question norms and assumptions rather than accept them. These people like to do things their own way and establish their own rules. In general, they prefer creative, constructive and planning activities, such as elaborating projects, founding new companies or institutions, among others. It is presented in those professions that choose to develop all their creative capacity, such as the scientist, the writer, the artist, the architect, the sculptor, etc.

Executive style, which includes those people who tend to follow the rules and handle problems structured and raised in advance; they prefer to complete the existing structures instead of creating them themselves. They tend to do activities that specify what they should do and how they should do it (Sternberg, 1977). The professions that choose this style are the lawyers, the police, the builders, the surgeons, the military, the managers (Miranda, 1996).

Judicial style, which includes those persons characterized by the tendency to analyze, compare, contrast, evaluate, correct and judge ideas, rules, procedures, structures, contents and existing problems; They prefer to criticize other people's way of doing things, give opinions, decide what is the right way to do something. The professions that are characterized by using this style of thinking are those of judges, critics, program evaluators, consultants, analysts, psychiatrists (Miranda, 1996).

Usually, talk about learning problems and not teaching problems, so in this work the authors have been good to question, How do learning styles contribute to the teaching of statistics in the context studied ? It is in relation to this question that the objective of the work is to describe the relationship between the style of learning and the style of teaching between teachers and students of 11 different educational programs at the top level, all of

them from the Department of Exact Sciences and Methodology (DCEyM), of the University Center of the South (CUSur), dependent on the University of Guadalajara (UDG).

Materials and methods

The department of Exact Sciences and Methodologies, (DCEyM) of the CUSur of the University of Guadalajara, treats in a transversal way to 11 programs of degree, two of masters and two of doctorate. In this study, a sample of 159 students enrolled in 11 different bachelor's degree programs of this center was considered, who had studied in the previous semester subjects directly related to the learning of statistics. At the same time, the teachers who taught these subjects (eight teachers) were considered. To determine the style of teaching / learning, each participant was administered the surveys prepared by Fuentes, López and Antiquino (s.f.). In addition to the above, in order to know the level of satisfaction, the student sample was given a survey related to satisfaction with the teaching received in the subjects of statistics studied in the previous cycle, in which elements were questioned on methodology, evaluation, teaching strategies and intensity of the workload.

In order to describe the relationship between the student's learning style and the teaching style of the teacher, other variables were taken into account, such as the use of the statistics subject, which was measured using the average obtained by the student in the course. corresponding subject. The information obtained after completing the questionnaire was coded and entered into a matrix for subsequent statistical analysis. Descriptive statistics, frequencies or averages where the variable required it were used to describe the data. To contrast differences in the averages in relation to learning styles, the chi2 distribution was used through the ANOVA test and post-hoc tests were obtained where statistically significant differences required it. The data was analyzed with the software SPSS version 19.

Results and discussion

A total of 159 students and eight teachers were surveyed. Of the total of the sample, the eight professors were identified a predominant teaching style and it was only possible to differentiate 139 students in a certain learning style.

The trend in terms of learning styles corresponds to the use of an executive learning style (Table 1). It is followed by the use of judicial learning style and, to a lesser extent as illustrated in Table 1, the legislative style; This could generate research questions referring both to the training that teachers receive for the exercise of their profession and the impact of this on the students.

Table1. Estilos de aprendizaje de alumnos.

		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válidos	Legislativo	14	10.7	12.4	12.4
	Ejecutivo	66	50.4	58.4	70.8
	Judicial	33	25.2	29.2	100.0
	Total	113	86.3	100.0	
	No aplica	18	13.7		
Total		131	100.0		

Source: elaboración propia.

With respect to the learning styles and their relation to the studied career (Table 2), statistically significant differences were found ($p > 0.05$) according to the study area, in such a way that it can be seen that the judicial style encompasses the psychology, job security and tourism; the legislative to the journalism; the executive to international business, agribusiness, nursing, telematics, medicine and veterinary. Which allows to infer that the professions, their objects of studies, curriculum and teaching methods, can determine one style or another. It would be interesting to ask the level of intentionality on the part of the professors in generating one style or the other in later investigations.

Table 2. Student learning styles by academic program completed.

	Legislativo	Ejecutivo	Judicial
Periodismo			
Agronegocios			
Enfermería Técnica			
Lic. Enfermería			
Turismo			
Negocios Internacionales			
Ing. en Telemática			
Medicina			
Veterinaria			
Psicología			
Seguridad Laboral			
Turismo			

Source: elaboración propia.

Academic performance

The averages obtained by the students in subjects related to statistics were related to their respective learning styles, although statistically they do not differ from each other ($p > 0.05$) they mark an important trend. Regardless of their studied career and their gender, students who show a legislative learning style obtained an average of 84.35, followed by students who present executive (82.25) and judicial (79.84) styles.

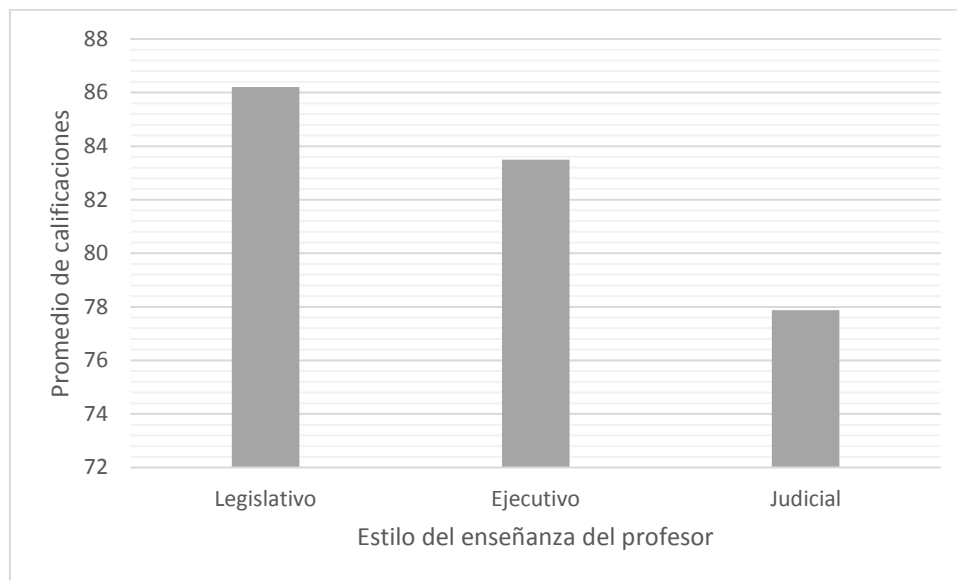
Teachers

Regarding the teaching staff, of the eight professors surveyed, three showed to identify themselves with a style of legislative education; three, judicial, and two, executive. The results coincide with the fact that the two legislative professors perform administrative functions and the three professors with judicial education style have engineering training. The only teacher surveyed as well as the only professor-researcher presented features of a legislative nature, the previous results are partially consistent with the profiles pointed out by Howard (1999), who points out that young teachers tend to be more of a legislative

style; however, in our work we found an important difference, given that the older teacher showed a legislative style, contrary to Howard (1999) who mentions that older teachers tend to be executives, locals and conservatives.

It should be noted that statistically significant differences were found with respect to the grades granted by professors who profess a certain style ($p < 0.005$). Which calls for more in-depth research in this context, validating the importance of this study for research that will serve as a pivot to long-term theoretical insights with the topic discussed here.

Figure 1. Promedios de calificación por estilo de enseñanza.



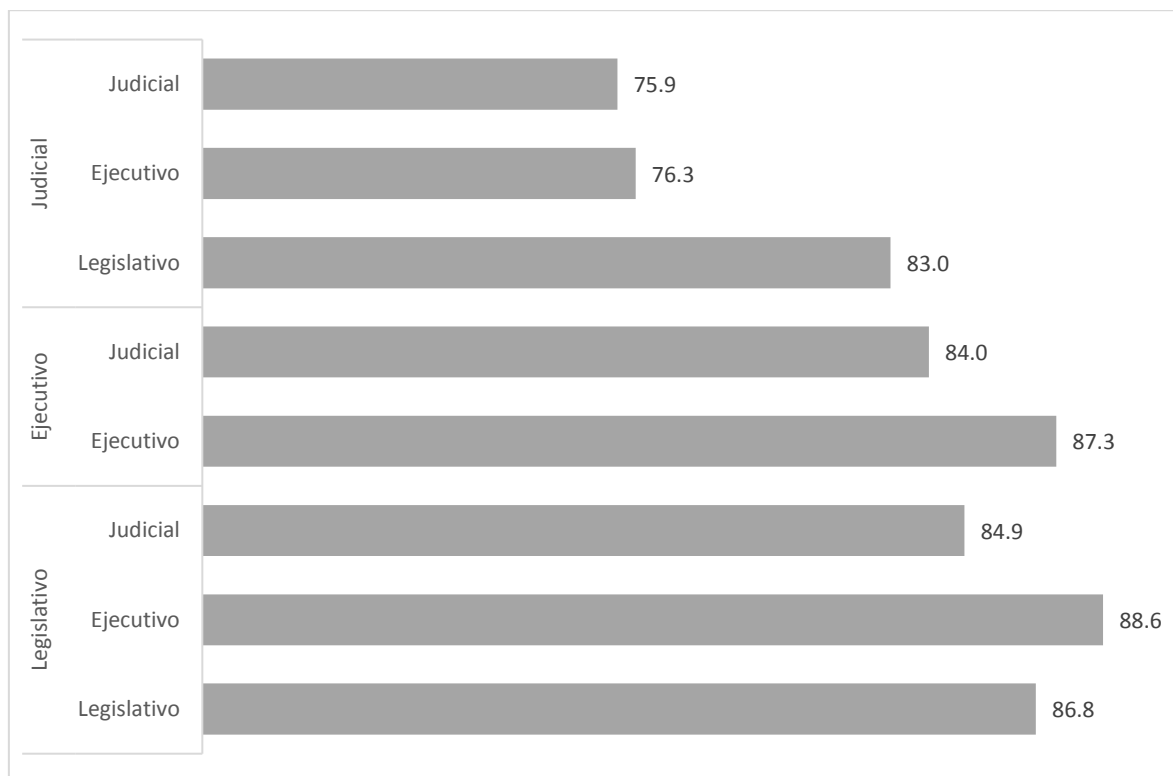
Source: elaboración propia.

Teachers with a legislative teaching style (Fig. 1) tend to evaluate more highly than teachers with executive or judicial styles.

Academic performance

The averages obtained by the sampled students, which correspond to the performance of the subject related to statistics and studied in the previous semester, were analyzed with respect to their learning style and the teaching style of the teacher who taught the subject (Fig. 2).

Figure 2. Promedio de calificación del alumno por coincidencia con los estilos de enseñanza vs. aprendizaje.



Source: elaboración propia.

In the previous diagram the teaching styles of the teachers are framed in the first axis (vertical) and the learning styles of the students in the second axis (horizontal). It must be emphasized that the worst results seem to be generated by teachers with guidance in judicial education. According to Aguilera (2012), there are multiple questions related to the criteria or variables to determine the ideal teaching styles in higher education that favor personalized learning styles and contextualized to the professional specialization. In the same tenor, González-Peiteado (2013) points out that a practical action to make the teaching-learning process more efficient begins with the reduction of disagreements between teaching styles and learning styles; however, for the present study, it is the interrelationships between the teacher's teaching and the student's learning styles that in some way generate the lowest yields (grade averages) (75.9), that difference is statistically significant ($p < 0.005$) compared to the most beneficial relationship, which occurs when a teacher of a legislative style is related to an executive-style student (88.6). This result is only an approximation to this reality investigated and it is assumed that

other educational influences that correspond to career and training also determine beyond the style that the professor of statistics says.

Level of satisfaction

With the intention of knowing the level of satisfaction that the student has in reference to the received education, an adapted *exprofeso* survey was completed.

According to Table 3, although there is a slightly higher trend in average student satisfaction with a legislative learning style, no statistically significant differences ($p > 0.05$) were found between levels of satisfaction and learning styles.

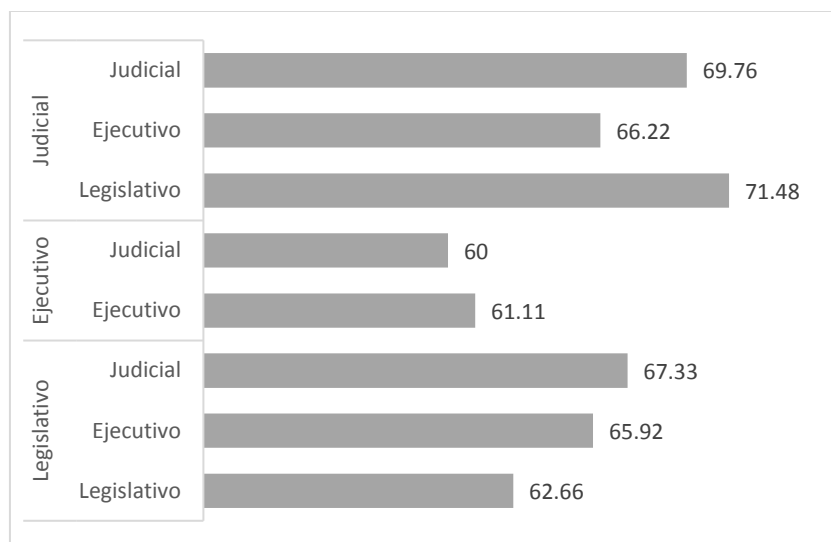
Table 3. Promedios de satisfacción.

Estilo de aprendizaje	N	Mínimo	Máximo	Media	Desv. típ.
Legislativo	14	46.67	100	68.33	16.15
Ejecutivo	66	33.33	100	65.50	11.74
Judicial	33	23.33	100	65.95	16.45

Source: elaboración propia.

Contrary to what was documented by Fuentes, López and Antiquino (2008), those who say they have found that students are more satisfied with teachers who teach according to the legislative and judicial style, while they are dissatisfied with those teachers who teach according to the executive style, in the present work when studying the effect of the interaction of teaching styles with learning styles in relation to the level of satisfaction (Fig. 3), no statistically significant relationship was found. These results seem to indicate that student satisfaction is not conditioned by the learning style that most teachers ponder.

Figure 3. Promedio de satisfacción del alumno por coincidencia con los estilos.



Source: elaboración propia.

From these results it is necessary to highlight, for example, that Rangel (2013) mentions that "a large number of professors, even at the university level, teach mathematics in an expository manner, without applying methods, techniques and strategies of learning and still privileging the traditionalist model ". Generating teaching / learning strategies centered on the student could contribute to increase academic performance. Pastor-Martínez (2010) mentions that on many occasions although teachers are aware of the differences in the way of learning of their students, they do not have the didactic resources that allow them to address this diversity and question how to meet cognitive objectives taking into account counts the procedural resources most related to each student. We are aware that it is more important to focus on the learning processes, on the "actions" tasks performed by the student, since there is their possibility of constructing knowledge, the teacher being a simple promoter of the subject-object-subject interaction (the object is mathematics). So, by way of closure, are considered independent of the style of teaching that ponder the teacher (legislative, executive or judicial), it would be possible for their classes to be successful if it adequately promotes the interaction of students with the objects of knowledge. In the words of García, Antonio and Gutiérrez (2015):

If the teacher knows his own Learning Style and that of all his students, he can adapt his course to actions or Didactic Strategies that favor the teaching-learning process. The idea is that teachers personalize, as far as possible, the education of their students and that the latter feel cared for and motivated to meet their educational goals.

As future lines of work it is proposed to investigate -given the findings of this research- that other educational influences determine these students beyond their teacher, career, curriculum, etc., and to what extent this is taken into account by the teacher for a better performance of their work, which transcends as here is appreciated the learning styles learned and those that you intend.

Conclusions

After analyzing a total of 159 students and eight professors from 11 different undergraduate programs. The style most frequently registered was the executive and judicial for students and teachers respectively, without finding significant differences between genres or careers studied. Although, if you look at the data inside the races, there is a valid differentiation to take into account for qualitative studies.

It is necessary to deepen between learning styles and teaching styles to understand their relationship and how they determine the teaching-learning process in the teaching of statistics.

The coincidence of styles between students and professors (judicial style) generated the lowest averages. The most favorable academic results were presented with the relation of professor with legislative style and student with executive style.

The teaching style is not related to student satisfaction. Therefore, strategies for diagnosis and change should be proposed in the educational context studied, which would guarantee to deepen the teaching of this subject in particular.

Bibliography

- Adán-león, M. I., (2004). *Estilos de aprendizaje y rendimiento académico en las modalidades de bachillerato*. (Tesis Doctoral, UNED, España). Recuperado de <http://www.estilosdeaprendizaje.es/IAdan.pdf>
- Aguilera, E. (2012). Los estilos de enseñanza, una necesidad para la atención de los estilos de aprendizaje en la educación universitaria. *Estilos de Aprendizaje*, 10 (10), 1-10. Recuperado de: http://www2.uned.es/revistaestilosdeaprendizaje/numero_10/articulos/Articulo07
- Arriaga, C. y Madariaga, J. M. (2004). Condiciones contextuales de la motivación para el aprendizaje de la música. *Revista de Psicodidáctica*, 17, 65-73.
- Cu, G. (2005). El impacto de la escuela de procedencia del nivel medio superior en el desempeño de los alumnos en el nivel universitario. *Revista Electrónica Iberoamericana sobre Calidad, Eficacia y Cambio en Educación*. 3 (1), 764-769. Recuperado de: <http://www.redalyc.org/pdf/551/55130171>
- Fuentes Claramonte, P., López Cruz, L., y Antiquino Porcar, L. (2008). Relación entre estilos de enseñanza, estilos de aprendizaje, satisfacción y rendimiento en una muestra de estudiantes de psicología. Repositorio Universidad Jaume I. Recuperado de http://repositori.uji.es/xmlui/bitstream/handle/10234/77989/forum_2008_8.pdf
- García, J.L., Antonio, P., y Gutiérrez, M. (2015). Estilos de aprendizaje y su relación con el instrumento EGEL-CENEVAL. *Journal of Learning Styles*, 8 (16), 211-250.
- Gómez, V. (1990). El rezago escolar en la educación superior: Un breve resumen. *Perfiles Educativos*. 49 (50), 14-26.
- González-Peiteado, M. (2013). Los estilos de enseñanza y aprendizaje como soporte de la actividad docente. *Revista estilos de aprendizaje*, 11 (11), 51-70.
- Howard, P.J. (1999). *The Owner's Manual for the Brain: Everyday Applications from Mind-Brain Research*, Atlanta. USA: Bard Press. 2a. ed. pp. 555-556.

- Honey, P. y Mumford, A. (ed.) (1989). *The Manual of Learning Opportunities*. Maidenhead. Berkshire, Reino Unido: Honey, Ardingly House
- Marchesi, A. (2007). *Sobre el bienestar de los docentes: Competencias, emociones y valores*, Madrid. España: Alianza.
- Martín-Cuadrado, A.M. (2011). Competencias del estudiante autorregulado y los estilos de aprendizaje. *Revista Estilos de Aprendizaje*, 8 (8), 136-148.
- Martínez, N. (04 abril 2014). Deserción escolar un lastre de 34 MMDP. *El universal*. Recuperado de <http://www.eluniversal.com.mx/nacion-mexico/2014/impreso/desercion-escolar-un-lastre-de-34-mmdp-212190.html>
- Miranda, M. (1999). *Estudios Portugueses sobre Estilos de Pensamiento*. Lisboa. Portugal: Universidad de Lisboa.
- Organización para la Cooperación del Desarrollo Económico (OCDE). (2011). Indicadores educativos. Recuperado de <http://www.oecd.org>
- Organisation for Economic Co-operation and Development (OECD) e Instituto Nacional de Evaluación y Calidad del Sistema Educativo (INECSE). (2004). Marcos teóricos de PISA 2003. Conocimientos y destrezas en Matemáticas, Lectura, Ciencias y Solución de problemas. En línea: <https://www.oecd.org/pisa/39732603.pdf> Ultima fecha de consulta 23 de febrero 2017.
- Ottaviani, M. G. (1999). A Note on Developments and Perspectives in Statistics Education. Invited paper at CLATSE4 (IV Congreso Latinoamericano De Sociedades de Estadística), Mendoza, Argentina. 26-30 July 1999. (Maria-Gabriella Ottaviani is a former President of IASE.). Consultado <http://iase-web.org/documents/history/ottargen.pdf>.
- Pastor-Martínez M. R. (2010). Estilos de aprendizaje y estilos de enseñanza: de alumna a maestra. *Encuentro*, 19 (1), 96-102.
- Perrenout, P. (2004). *Diez nuevas competencias para enseñar: Invitación al viaje*. Barcelona. España: Grao.

- Rangel, M.A. (2013). *Estrategia didáctica para el aprendizaje de medidas de tendencia central a través de las tecnologías de información y comunicación en el marco del modelo educativo por competencias* (tesis de maestría). Instituto Superior de Investigación y Docencia para el Magisterio, Guadalajara, México.
- Schmeck, R. (1988). *Learning strategies and learning styles*. New York. USA: Plenum Press.
- Sternberg, R.J., Bermejo, M.R. y Catejón, J.L. (1997). Factores intelectuales y personales en la cognición creativa definida por el insight. *Boletín de Psicología*, 57. Universidad de Valencia, España.
- Stemberg, R. (1999). *Estilos de Pensamiento*. Barcelona. España: Paidós.
- Talavera, R., Noreña, S., y Plazola, S. (2006). Factores que afectan la reprobación en estudiantes de la Facultad de Contaduría y Administración, UABC, Unidad Tijuana. VI. Congreso Internacional Retos y expectativas de la Universidad. Puebla. México.
- Zabalza Beraza, M. A. (2003). *Competencias docentes del profesorado universitario. Calidad y desarrollo profesional*. Madrid. España: Narcea.

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