Adaptation to the Spanish university context and psychometric properties of the MSLQ: Contributions to the measurement and analysis of gender differences of self-regulated learning

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Título: Adaptación al contexto universitario español y propiedades psicométricas del MSLQ: Contribución a la medida y análisis de las diferencias de género del aprendizaje autorregulado.
Resumen: Una dificultad para el avance en la investigación del aprendizaje autorregulado en general, y las diferencias de género en particular, está relacionada con la medida de los diferentes componentes y procesos autorregulatorios. Por ello, el presente estudio tiene como objetivo adaptar y analizar 1) la estructura interna, fiabilidad e invarianza en función del género del Motivated Strategies for Learning Questionnaire (MSLQ) en español y 2) las diferencias entre hombres y mujeres en las dimensiones y subdimensiones del MSLQ. Han participado 428 estudiantes universitarios (73,7% mujeres). Los resultados han evidenciado que esta adaptación es más breve que la versión original y presenta mejores propiedades métricas que otras versiones. La herramienta posee una estructura y pesos factoriales comunes (invariancia métrica) para varones y mujeres que garantiza la validez de las comparaciones por género. Se han hallado diferencias de moderadas a altas a favor de las mujeres en el valor concedido a la tarea, distintas estrategias de aprendizaje y ansiedad ante los exámenes. Este estudio da respuesta a la necesidad de contar en España con un instrumento adaptado culturalmente a nuestro contexto, válido y fiable y ahonda en las diferencias de género en el aprendizaje autorregulado, constructo clave para desarrollar con éxito la formación académica en la actualidad.
Palabras clave: Aprendizaje autorregulado. Motivated Strategies for Learning Questionnaire (MSLQ). Adaptación cultural. Propiedades Psicométricas. Diferencias de género. Educación superior.

Abstract: A challenge in advancing research into self-regulated learning in general, and gender differences in particular, is related to the measurement of various components and self-regulatory processes of it. Therefore, this study aims to adapt into Spanish and analyzes 1) the internal structure, reliability, and gender invariance of the Motivated Strategies for Learning Questionnaire (MSLQ) and 2) the differences between males and females in the MSLQ dimensions and subdimensions. Participants consisted of 428 university students (73.7% women). Results showed that this adaptation is shorter than the original and has better metric properties than other versions. Also, invariance analysis showed that for men and women, the instrument possesses a common structure and loads (metric invariance) that guarantees valid score comparisons by gender. Moderate to high differences were found in women's favor in the value given to homework, different learning strategies, and anxiety before examinations. This study responds to the need for a culturally adapted, valid, and reliable instrument in Spain and delves into gender differences in self-regulated learning, a key building block to successfully develop academic training at the present times.
Keywords: Self-regulated learning. Motivated Strategies for Learning Questionnaire (MSLQ). Cultural adaptation. Psychometric properties Gender differences. Higher education.

Introduction

All of us are *knowmads* (Moravec, 2008) in continuous reinvention. We live in a very unpredictable and changing society that demands incessant learning processes, as it has been evidenced in this context derived from the COVID-19 pandemic. Thee fluctuating situations require personal skills to understand ourselves and to regulate learning processes both in our daily lives and in the academic world, now more than ever. For this reason, "self-regulated learning (SRL)" has become a sharp focus of psychoeducational research and practice (Rienties et al., 2019).

Although several theoretical models have attempted to describe SRL (for a recent literature review, see Panadero, 2017), our study focuses on Pintrich's model (2000) due to its relevance and high degree of acceptance and use in the scientific-educational community (Panadero, 2017).

In Pintrich's model, SRL is defined as a process through which people activate and maintain cognitions, behaviors,

and affects directed systematically toward an achievement of their goals, considering their possibilities and limitations (Zimmerman, 1989; Zimmerman & Schunk, 2011). This multidimensional process facilitates academic success (Curione & Huertas, 2016), and acquisition of skills for problem solving and motivation (Credé & Phillips, 2011; Musso et al., 2019).

Measuring SRL: The MSLQ

A major challenge in advancing research into SRL emerges from the measurement of its various components and self-regulatory processes (Curione & Huertas, 2016; Rovers et al., 2019). Although other tools exist for the same purpose, the most commonly used questionnaire for SRL assessment is the MSLQ (Pintrich et al., 1991) and it consists of two main dimensions: one focuses on motivation and the other one on learning strategies. Indeed, several Latin American studies have adapted the MSLQ into the Spanish language (Donolo et al., 2008; Inzunza et al., 2018; Muñoz, 2012; Ramírez et al., 2013; Ramírez-Echeverry et al., 2016), but various formulations, derived from the Spanish language's cultural nuances, make these adaptations differ between territories and generate difficulties in understanding items' content.

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The only adaptation for Spain is the "Cuestionario de Estrategias de Aprendizaje y Motivación II", created and validated by Roces et al. (1995) and later by Martínez and Galán (2000). Although CEAM II is considered a highly valuable tool (Credé & Phillips, 2011), it is not exempt from some psychometric problems, the most noteworthy being: 1) ambiguity in some of its items' formulation; 2) possible lack of discrimination between some dimensions, for example, *time and study environment* and *effort regulation* or *peer learning* and *help seeking*; 3) differences in reliability indices in some subdimensions of the original version; and 4) lack of consensus on the instrument's internal structure or dimensionality between studies.

Gender differences in the MSLQ

Together with the issues derived from the assessment of SRL, increasingly more attention is paid to factors that differentiate successful students from the unsuccessful ones, among the more and more diversified student body in modern educational contexts (Li, 2019). In fact, one of the individual factors that was already urged to be investigated by Pintrich and de Groot (1990), and increased attention over the years is related to gender (Torrano & Soria, 2017). Despite studies that found no significant gender differences (Bruso & Stefaniak, 2016; Syam et al., 2016) and even some which postulated that men had higher scores in critical thinking (Rodarte-Luna & Sherry, 2008) and deep processing, most found differences favoring women, both in motivational components and learning strategies (Bozpolat, 2016; Torrano et al., 2017; Torrano & Soria, 2017; Tseng et al., 2017). Specifically for motivation, studies found that women had higher intrinsic goal orientation, more test anxiety (Albert, 2017), more beliefs of self-efficacy (Rianudo et al., 2006) and control (Navea, 2015), and lower levels of extrinsic goal orientation (Rusillo & Casanova, 2004). As for learning strategies, women scored higher in planning, goal setting, organization (Valenzuela & Suarez, 2017), metacognitive self-regulation (Albert, 2017; Suarez et al., 2004), personal regulation, and control of the context (Navea, 2015; Velasco & Cardeñoso, 2020; Zimmerman & Martinez-Pons, 1990).

In sum, given the MSLQ's great usefulness and its widespread use in national and international educational contexts, we recognize the need to adapt it to the current variable and uncertain circumstances along with the analysis of gender differences so as to contribute to the understanding of self-regulated learning. Therefore, the aims of this study are: (1) to adapt the MSLQ into Spanish for Spain and validate its scoring for its use with university students; and (2) to assess the appropriateness of the Spanish MSLQ's use for both men and women in order to analyze the possible differences between genders in the SRL.

Method

Participants

Through incidental sampling, researchers recruited 456 Spanish university students who completed the MSLQ, only 428 answered all the items, 28 left some unanswered, with 24 different and random patterns: 18 had only 1 blank item, 4 had 2, 1 had 3, and 1 had 4. Questionnaires with missing values were omitted from subsequent analyses. 314 (73.7%) of the students enrolled in the study were women and 112 (26.3%) were men, whose socio-demographic characteristics can be seen in the following table (Table 1).

Table 1
Characteristics of participants.

	Women	Men	Total
	n (%)	*n* (%)	*n* (%)
Age groups			
18–19 years	183 (58.3%)	57 (50.9%)	240 (56.1%)
20–21 years	75 (23.6%)	37 (33.0%)	112 (25.9%)
22–23 years	25 (8.0%)	7 (6.3%)	32 (7.9%)
24–26 years	11 (3.5%)	5 (4.5%)	17 (4.0%)
26–30 years	11 (3.5%)	3 (2.7%)	14 (3.3%)
over 30 years	8 (2.5%)	2 (1.8%)	10 (2.3%)
No information	2 (0.6%)	2 (0.8%)	4 (0.9%)
School year			
First year	164 (52.2%)	58 (51.8%)	222 (52.1%)
Second year	138 (43.9%)	50 (44.6%)	188 (44.2%)
No information	12 (3.8%)	4 (3.6%)	16 (3.7%)
Access to a degree			
High school	245 (78.0%)	98 (83.0%)	339 (79.2%)
Higher degree	48 (15.3%)	15 (12.5%)	63 (14.7%)
Another degree	16 (5.1%)	3 (2.7%)	19 (4.4%)
Other means	5 (1.6%)	2 (1.8%)	7 (1.7%)
Studies and Work			
No	153 (48.7%)	68 (60.7%)	221 (51.9%)
Yes	138 (44.0%)	35 (31.3%)	173 (40.6%)
No information	23 (7.3%)	9 (8.0%)	32 (7.5%)
Attended class regularly	287 (91.4%)	93 (83.0%)	380 (89.3%)

n = frequency, % = percentage

Differences between men and women did not achieve statistical relevance in Pearson chi-square tests and were not associated with moderate to high values in Cramer's V-test.

Instruments of measurement

In its original version, the MSLQ (Pintrich et al., 1991) is a self-report measure of 81 items divided into 15 subdimensions. It is grouped into two components: one dedicated to *motivation* and the other to *learning strategies*. The motivational component contains 31 items in six subdimensions divided into three sections: value components (*intrinsic goal orientation, extrinsic goal orientation,* and *task value*), expectation components (*control beliefs* and *self-efficacy for learning and performance*), and affective components (*test anxiety*). The learning strategies component contains 50 items. It has

nine sub-dimensions, distributed in two sections: cognitive and metacognitive strategies (*rehearsal, elaboration, organization, critical thinking,* and *metacognitive self-regulation*) and resource control strategies (*time and study environment, effort regulation, peer learning,* and *help seeking*). All items use Likert-type responses, with seven options. These options ranged from 1– "Does not describe me" to 7– "Describes me very well." The MSLQ takes about 30 minutes to complete.

For this study, additional information was requested on gender, age, academic performance, access to the degree, the degree's perceived difficulty, weekly dedication time, and work not related to studies.

Adaptation process

Following International Test Commission (ITC, 2017) guidelines, the questionnaire's intellectual property rights were checked, and the process of linguistic, conceptual, and cultural adaptation was conducted. To this end, a multidisciplinary team of four bilingual English–Spanish educational experts was formed. First, two team members translated the original English version into Spanish. Next, the other two, blind to the original English version, back-translated the first Spanish version into English. The team evaluated similarities and discrepancies, considering Hambleton and Zenisky's list for quality control of the items' translation–adaptation (2011). To assess the adapted questionnaire's understandability, legibility, and duration, researchers modeled the instrument and conducted a pilot test with university master's degree students in psychodidactics.

Collection of information

After obtaining informed consent from all participants and according to current regulations, researchers administered the test.

Data analysis

The initial analysis evaluated the presence and patterns of missing and atypical values and whether basic assumptions underlying the general linear model were met.

Subsequently, to study the relations between MSLQ items and their concordance with the theoretical model of its construction, descriptive statistics were calculated for each item (e.g., % cases chosen by each option, mean standard deviation, asymmetry, kurtosis, and corrected homogeneity indices), and confirmatory factor analyses (CFAs) were conducted to evaluate the relationship pattern between items and their sub-dimensions. In addition, a formal description of the resulting sub-dimensions was developed, including average variance extracted (AVE) and composite reliability (CR). Given that the scores' distribution distances with respect to the normal curve were small, the estimation method used in CFAs was of maximum likelihood. Evaluation of the model fit to data was based on the χ^2 test, χ^2/df ratio's value,

together with information provided by the incremental goodness-of-fit index (CFI), the root mean square error of approximation (RMSEA), and its standardization (SRMS). Acceptable models met the following criteria: χ^2/df = >5; CFI=0.90+; and RMSEA and SRMS=0.08 or less (Hu & Bentler, 1999; Kenny et al., 2015).

Several models were then piloted to test relationships between dimensions derived from previous analyses.

Next, once the model with the best fit was selected, possible gender differences were analyzed, specifically, an analysis of progressive invariance of associations between men and women in the MSLQ's components was carried out. Equivalence levels were defined according to parameters conditioned as equal in the study's groups. The simplest model was configural invariance (factorial loads pattern); which was evaluated by adding constraints, metric invariance (factorial loads magnitude), scalar (intercepts or covariances), and strict (residual variances). To accept configural, metric, scalar and strict invariance, a triple criterion was used: differences in chi-square values (should be non-significant), Akaike's information criterion (AIC) (the smaller - the better), and in CFI (must be equal to or less than 0.01) between two immediate models.

Finally, comparisons of mean differences between male and female participants were developed using the student's T test. Associated effect sizes were calculated by Hedges' g (g'), with reference values 0.20, 0.5, and 0.8 as small, medium, and high effect sizes; respectively.

Analyses were conducted using SPSS and AMOS, version 24.0.

Results

As a result of the reverse retro-translation process, translators and researchers reached agreement on the obtained Spanish version, in which no item was completely reformulated as culturally inappropriate. 71 items remained unchanged, and 10 items had to be modified during translation to maintain semantic and conceptual equivalence. For example, in item 28 the expression "I feel my heart beating strongly" was modified by "I feel nervous", item 77 "I find that I do not dedicate much time to it" by "I realize that I do not dedicate much time to it" and in item 48 "heavy work" by "hard work", more familiar in our context. In other cases, the term "class" instead of "course" (items 1 and 7) was used, or, the order of the sentence was changed for a better understanding of the item (items 4 and 9).

Most participants in the pilot test reported that the test was interesting, easy to understand and not excessively long. An average duration of 26 minutes was calculated. In addition, some suggestions of small changes were taken into consideration in order to reformulate some terms into context. As a result, the initial version was obtained and it was administered to the sample described above.

Preliminary analysis, evaluation of measurement models, dimensions and components' metric properties in the MSLQ's Spanish version

First, the properties of each of the items that make up the test were analyzed to know the number of missing, outliers, the distribution of scores and individual psychometric indices. Then, factor analyses were conducted to evaluate each sub-dimension's unidimensionality. Results led to 19 items' suppression due to their low relationship with their underlying factors [3 *motivational* (9.7% of component items); 16 *learning strategies* (32%)].

The Table in Appendix 1 summarizes the formal description of the final, validated Spanish MSLQ, consisting of 66 items. Few items had a high floor or ceiling effect, but that would be expected in those that did, due to their content. On all items, averages were slightly above the theoretical average of four points; in statistics of asymmetry and kurtosis, they were from −1 to 1 on most items, thus reporting a score distribution similar to a normal curve. Factor weights were greater than .40 in all cases and .50 in most cases. Corrected homogeneity indices were good, higher than 040 in most cases. These results endorsed the individual suitability of each element on the questionnaire.

Second, the joint measurement model was tested for all sub-dimensions in each component, resulting in the creation of two additional components, extraction of *extrinsic objective* and *anxiety* dimensions of the motivation component, along with restructuring of the sub-dimensions in the learning strategies component.

For the motivation component, four sub-dimensions were extracted. The first, called *intrinsic goal orientation*, was composed of items that formed that sub-dimension in the original version (1, 16, 22, and 24). The same occurred in the

second sub-dimension, *task value*, formed by items 4, 10, 17, 23, 26, and 27. The third sub-dimension, *control beliefs*, was formed only by items 2 and 18. The fourth, *self-efficacy for learning and performance*, replicated the sub-dimension's original version (items 5, 6, 12, 15, 20, 21, 29, and 31).

In the learning component, a solution of five sub-dimensions was obtained. First, *organization of study material* was constituted by items belonging to organization (32, 42, 49, and 63) and rehearsal scales (46, 59, and 72) and focused on the material's self-organizing aspects. The second, *deep learning*, contained questions about relating, developing, questioning, or establishing connections between ideas, concepts, or conclusions (items 53, 62, 64, 69, 81, 38, 47, 51, 66, and 71) and combined the original scales of elaboration and critical thinking. The third sub-dimension, *metacognitive self-regulation*, matched the original and was formed by items 36, 41, 44, 54, 55, 56, 76, 78, and 79. The fourth, *time and effort management*, was composed of items from the original sub-scales of time and study environment (43, 52, 70, and 77) and effort regulation (37, 48, 60, and 74). The sub-dimension in relation to *peers* was composed of items 34, 45, and 50 of the peer learning scale and of item 68 of the help seeking scale.

Items belonging to the sub-dimensions of *anxiety* and *extrinsic goal orientation*, originally in the motivation component, were grouped into 2 one-dimensional components. Thus, the *extrinsic goal orientation* component overlaps the original version (items 7, 11, 13, and 30). Similarly, items in the *anxiety* component were also associated in an independent one-dimensional factor (3, 14, 19, and 28) in accordance with the original version—except for item 8, which was eliminated.

For each of these four measurement models, Table 2 displays adjustment indices that guarantee their adequacy to the data.

Table 2
Component Adjustment Indexes of the MSLQ (n = 428).

Component	χ^2	df	p	χ^2/df	CFI	RMSEA (IC90%)	SRMR
1. Motivation	590.36	165	<.001	3.57	.89	.07 (.07-.09)	.06
2. Learning Strategies	1951.39	660	<.001	2.96	.89	.06 (.06-.07)	.07
3. Anxiety	3.74	2	.154	1.87	.99	.04 (.01-.11)	.02
4. Extrinsic objectives	1.17	2	.558	0.58	.99	.01 (.00-.08)	.01

χ^2 =chi-square test, df= degrees of freedom, p=significance level χ^2/df = chi-square test/ degrees of freedom ratio's value, CFI= incremental goodness-of-fit index, RMSEA= root mean square error of approximation, SRMR =standardized root mean square error

Table 3 displays descriptive statistics for the nine sub-dimensions and the four components. It also includes information on their scores' reliability. In brief, results showed that all components and sub-dimensions were distributed

similarly to the normal curve, presenting only slight negative asymmetry. For reliability, both Cronbach's alpha and CR showed moderate and high internal consistency levels. Some AVE indices were lower than desirable.

Table 3
*Descriptive Statistics and Internal Consistency of Components and Sub-dimensions.*

Components and Sub-dimensions	M	M_{lL}	M_{uL}	SD	A.	K.	α	CR	AVE
Motivation	5.37	5.30	5.44	0.71	-0.42	0.00	.90	.97	.80
Intrinsic goal orientation	5.22	5.13	5.30	0.89	-0.48	0.45	.71	.69	.36
Task value	5.12	5.03	5.22	0.96	-0.56	0.63	.84	.83	.44
Control beliefs	5.84	5.76	5.93	0.91	-0.55	-0.37	.64	.65	.48
Self-efficacy	5.28	5.21	5.36	0.78	-0.36	-0.05	.83	.84	.40
Learning Strategies	4.82	4.75	4.89	0.77	-0.34	0.40	.92	.98	.81
Organization of the material	5.15	5.06	5.25	1.04	-0.63	0.40	.79	.79	.36
Deep learning	4.74	4.65	4.83	0.96	-0.27	0.32	.87	.87	.42
Metacognitive self-regulation	4.97	4.89	5.05	0.87	-0.40	0.09	.80	.81	.32
Time and resource management	4.54	4.44	4.65	1.12	-0.08	-0.49	.83	.83	.38
Relationship with peers	4.69	4.58	4.80	1.15	-0.54	0.20	.71	.72	.39
Extrinsic goal orientation	4.28	4.17	4.40	1.20	-0.10	-0.43	.70	.71	.40
Test Anxiety	4.43	4.30	4.56	1.38	-0.12	-0.59	.75	.77	.79

Mean (*M*), 95% Mean Lower Limit (M_{lL}), 95% Mean Upper Limit (M_{uL}), Standard Deviation (*SD*), Asymmetry index (A), Kurtosis index (K), Cronbach Alpha (*a*), Composite Reliability (FC), Average Variance Extracted (AVE).

As for relationships between components, model fit, in which all components showed correlation, obtained satisfactory test results. However, modification indices revealed that adjustment increases significantly if we allow the motivation component to explain deep learning. The final model is the following, due to its good theoretical sense (Figure 1): (χ^2 = 194.2; p < .001; χ^2/df = 3.18; CFI = .92; RMSEA (IC90%) = .09 (.08-.12), SRMR = .05).

Figure 1
Model of relations between the components of the Spanish version of the MSLQ in men and women.

A) Males   **B) Females**
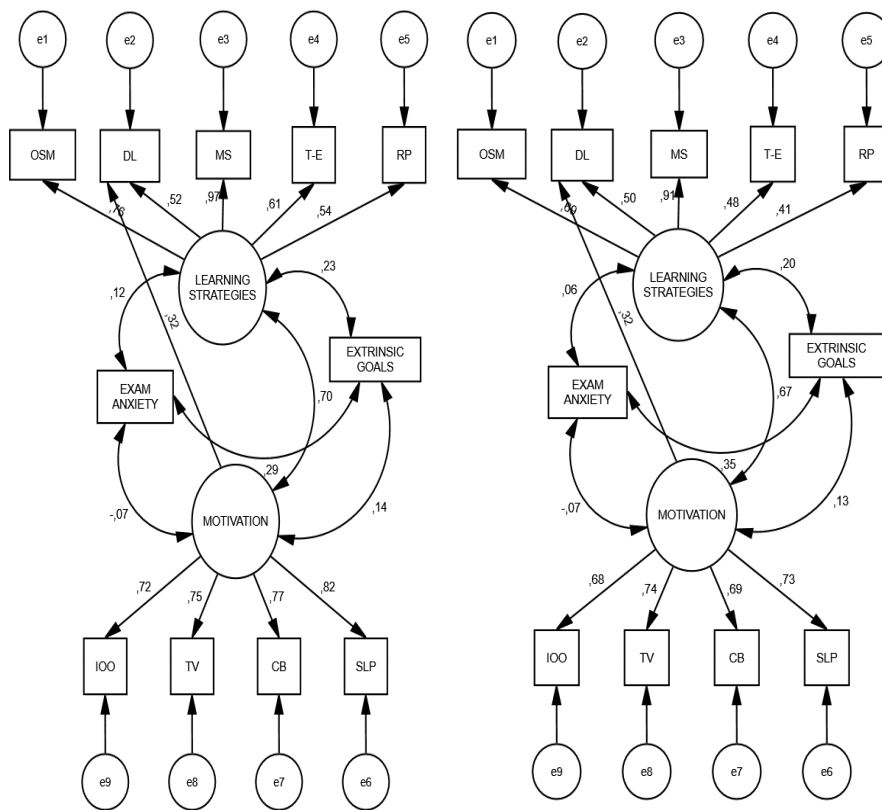
Note: SMO= Organization of the Study Material; DL= Deep Learning; MS=Metacognitive Self-regulation; T-E=Time and Effort Management; PH= Relation to Peers; IO=Intrinsic Objectives Orientation; TV=Task Valor; C=Control Beliefs; SLP=self-efficacy for learning and performance.

Regarding subgroup analysis, progressive estimation of invariance began with the configural invariance model. The adjustment indexes obtained (Table 4) allowed to accept the equivalence of the model between genders. Adding restrictions on the regressing coefficients, the values that are listed in the table, and the differences between χ^2 ($\Delta\chi^2$ =11.33; p = .183), AIC (ΔAIC = 4.66), CFI (ΔCFI = .001) and RMSEA (ΔRMSEA = -.003) led us to accept the metric invariance model, which allows us to assess the equivalence

between interceptal values. The values obtained permits us to reject this model, both by independently evaluating it and by analyzing it with respect to its nesting with the metric invariance model ($\Delta\chi^2$ = -93.88; p < .001; ΔAIC = -76,48; ΔCFI = -.050, ΔRMSEA = -.011). Comparing the estimated intercepts for both groups, an attempt was made to achieve partial scalar invariance by freeing up parameter constraints for subdimensions that showed more differences. Since it was unsuccessful, we decided to stop the analysis.

Table 4
Adjustment indices for factor invariance of the Spanish MSLQ model by gender.

Model	χ^2	df	$\chi^{2/df}$	p	AIC	CFI	RMSEA (IC90%)
Unconstrained model	265.72	78	3.40	< .001	417.72	.891	.07 (.06-.08)
Weights constrained	277.66	86	3.22	< .001	413.06	.890	.07 (.06-.08)
Intercepts constrained	371.54	95	4.22	< .001	489.54	.840	.08 (.07-.09)
Residuals constrained	416.33	111	3.75	< .001	502.33	.823	.08 (.07-.09)

χ^2 =chi-square test, df= degrees of freedom, χ^2/df = chi-square test/ degrees of freedom ratio's value, p=significance level, AIC=, Akaike's information criterion, CFI= incremental goodness-of-fit index, RMSEA= the root mean square error of approximation

In summary, factor invariance analyses indicated feasible comparisons between men and women, given that the minimum requirement of metric invariance in the tool's gender structure and loads was met.

Gender differences

In relation to gender comparisons, as can be seen in Table 5, out of a total 13, 10 comparisons showed statistically

significant differences between men and women. In the motivation component, however, the associated effect size was moderate only in terms of *task value*, whereas in learning strategies, the effect size was moderate or high in all subdimensions except *deep learning*. The greatest differences occurred in *organization of study material* and *management of time and resources*. Similarly, for *test anxiety*, women presented significantly higher scores than men, with moderate effect size.

Table 5
Gender differences

	Men		Women				
Components and Sub-dimensions	M	SD	M	SD	t	p	g´
Motivation	5.18	0.79	5.43	0.67	-2.91	.004	-0.35
Intrinsic goal orientation	5.04	0.95	5.28	0.86	-2.45	.014	-0.27
Task value	4.83	1.09	5.23	0.89	-3.44	.001	-0.42
Control beliefs	5.71	0.95	5.89	0.89	-1.74	.082	-0.20
Self-efficacy	5.16	0.85	5.33	0.75	-1.89	.060	-0.22
Learning Strategies	4.36	0.82	4.98	0.68	-7.79	<.001	-0.86
Organization of the material	4.50	1.14	5.39	0.90	-7.42	<.001	-0.92
Deep learning	4.57	1.02	4.81	0.93	-2.26	.024	-0.25
Metacognitive self-regulation	4.61	0.98	5.10	0.80	-4.70	<.001	-0.57
Time and resource management	3.96	1.08	4.75	1.06	-6.73	<.001	-0.74
Relationship with peers	4.17	1.09	4.88	1.12	-5.78	<.001	-0.64
Extrinsic goal orientation	4.09	1.21	4.34	1.18	-1.92	.055	-0.21
Test Anxiety	3.99	1.33	4.60	1.37	-4.06	<.001	-0.45

g´ = g of Hedges effect size

Discussion

Adaptation and psychometric properties of the MSLQ

First, the systematic and rigorous translation procedure led to a MSLQ version adapted to the sociolinguistic reality of the Spanish territory. This version is semantically equivalent to the original version, thus overcoming possible comprehension problems in the use of Latin American versions.

Specifically, as we described before, in some cases certain terms have been changed. Also, modifications have been made with regard to specific expressions or grammatical aspects, such as verb tenses or the order of the sentence

Analysis of the Spanish version's internal structure allowed us to conclude: 1) the final MSLQ Spanish version is shorter (66 items) than the original (81 items); 2) considered individually, each of the 66 items has adequate metric properties; and 3) the four-dimensional structure obtained better fit indices than alternative models (i.e., original structure,

one-dimensional model, two-dimensional, five-dimensional oblique and orthogonal and nine-dimensional oblique and orthogonal for each component) even though it does not correspond to the original instrument's structure.

The new Spanish version is structured of four components, two multidimensional and mutually related: *motivation* (intrinsic goal orientation, value given to the task, control beliefs, perceived self-efficacy) and *learning strategies* (organization of study material, deep learning, metacognitive self-regulation, time and effort management, help seeking and relationships with peers). The other two structures are one-dimensional, mutually related, and independent of the others—*test anxiety* and *extrinsic goal orientation*.

Specifically for motivation, four sub-dimensions were extracted. The first, *intrinsic goal orientation*, was composed of items forming the original version's subscale (Pintrich et al., 1991); this is in partial agreement with Roces et al. (1995) because item 24 was part of the subscale *task value*, but in opposition to what Cardozo (2008) obtained, since this subscale had no factor. In the adaptation by Martínez and Galán (2000), the factor's items were dissolved into subscales of *self-efficacy for learning and performance* and *task value*.

Similarly, the second sub-dimension, *task value*, also corresponded to the original version. Other adaptations found that this factor's items were grouped with others belonging to the scales of *test anxiety*, *intrinsic goal orientation*, and *control beliefs* (Martínez & Galán, 2000) or *self-efficacy for learning and performance* (Cardozo, 2008).

The third sub-dimension, *control beliefs*, was formed by two of the four items belonging to that subscale in the original version. Martínez and Galán (2000) also found this factor to be composed of two items, while Roces et al. (1995) reproduced the original subscale.

The fourth sub-dimension, *self-efficacy for learning and performance*, replicated the original version's subscale, coinciding with Roces et al. (1995) but differing from Inzunza et al. (2018) because it was fragmented into two subscales.

Items belonging to sub-dimensions of *test anxiety* and *extrinsic goal orientation* were grouped into two independent components, although they were congruent with the original. However, this excludes item 8 in *anxiety*, which was eliminated in accordance with Inzunza et al. (2018).

Regarding *learning strategies*, a solution of five sub-dimensions was obtained. Some were congruent with the structure of Pintrich et al. (1991), but others were clustered around common topics that did not follow this structure, such as in CEAM II's adaptation to diverse contexts (Cardozo, 2008; Martínez & Galán, 2000; Roces et al., 1995) and in other Latin American adaptations (Ramírez-Echeverry et al., 2016). The first sub-dimension was *organization of study material*, items of which belonged to scales of organization and rehearsal in Pintrich et al.'s model (1991), thus coinciding with previous studies' findings (Martínez & Galán, 2000; Roces et al., 1995).

The second sub-dimension, *deep learning*, included items about relating, developing, questioning, or establishing connections between ideas, concepts, or conclusions; it contained the original scales of elaboration and critical thinking. This sub-dimension coincided, to a large extent, with CEAM II's elaboration scale (Roces et al., 1995) and with other studies' findings (Cardozo, 2008; Ramírez-Echeverry et al., 2016).

The third sub-dimension, *metacognitive self-regulation*, referred to the degree of awareness, knowledge, and control of cognitive aspects when planning, monitoring, and regulating study; it used Pintrich et al.'s (1991) original items. Our adaptation included two more items (78, 79) than Roces et al.'s (1995) and had a more solid structure than Martínez and Galán's (2000).

The fourth sub-dimension, *time and effort management*, focused on contextual and behavioral aspects that represent an obstacle or difficulty in achieving academic goals. Its items belong to the original subscales of time and study environment. This sub-dimension completes Roces et al.'s (1995) adaptation since it adds more items.

The last sub-dimension was *relationship with peers* which concerns learning with peers and resorting to them if needed. Thus, its items belong to peer learning and help seeking, coinciding with previous research (Cardozo, 2008; Inzunza et al., 2018; Ramírez-Echeverry et al., 2016; Roces et al., 1995).

In line with previous studies, some items were eliminated due to inadequate psychometric properties. Specifically, on the motivation scale, items 8, 9, and 25 in the *test anxiety* and *control beliefs* scales, respectively, were deleted. On the learning strategies scale, several items assessing behavioral and contextual regulation were eliminated. They belonged to the subscales of *time and study environment* (35, 65, 73, and 80) and *help seeking* (40, 58, 75), in accordance with Roces et al. (1995) and Ramírez-Echeverry et al. (2016). Likewise, items related to *metacognitive self-regulation* (33, 57, 61), *rehearsal* (39) and *elaboration* (67) were removed.

In spite of these dimensions' restructuring and certain items' elimination, we believe that our new structure does not affect the base model's theoretical coherence. Similar to our findings, Credé and Phillips (2011) suggested a four-component solution in their university meta-analytic MSLQ study. Their first and second components were composed by learning strategies, the third by motivational aspects, and the fourth by test anxiety. For our version's reliability, all components and sub-dimensions have adequate internal consistency, with values estimated for Cronbach's alpha and for CR higher than those in other studies. However, indices of AVE were lower than desirable in some sub-dimensions.

Gender differences

This study's second objective was to analyze the Spanish MSLQ's adequacy between men and women in order to analyze the possible differences between genders in SRL. Thus, factor invariance was evaluated by adding restriction on loads in the factor, intercepts, and error variances so that

they were equal between groups. Results supported metric invariance in the instrument's structure according to gender; therefore, gender differences were analyzed.

As expected, results showed gender differences in 10 of the 13 comparisons: moderate and high associated effect size in sub-dimensions of intrinsic goal orientation, task value, test anxiety, material organization, deep learning, metacognitive self-regulation, time and effort management, and relationship with peers. These findings coincide with previous research (Albert, 2017; Navea, 2015; Suárez et al., 2004; Valenzuela & Suárez, 2017). No statistically significant differences were found in control beliefs, self-efficacy for learning and performance, and extrinsic goal orientation. This endorses the need for more study of gender differences in self-regulation in learning, as Torrano and Soria (2017) stated.

Conclusions

The MSLQ Spanish version responds to a current need in psychoeducational research, especially because of CEAM II's low internal consistency in the validations of Roces et al. (1995) and Martínez and Galán (2000) together with students' difficulties in comprehending expressions in Latin American versions.

The MSLQ Spanish version is a useful, updated, shorter, and metric-guaranteed alternative for assessing student motivation and learning strategies.

Remarkably, although this updated MSLQ version has fewer subscales than the original, they are still easily recognizable. Therefore, this version permits future research with a robust instrument, so we can continue to compare new SRL studies with valuable past studies that, to a great extent, used the MSLQ.

Besides that, invariance analysis showed that it possesses a common structure for men and women (metric invariance),

thus increases validity of score comparisons according to gender, an especially relevant factor in current research.

Women showed higher scores in motivation, different learning strategies, and anxiety before examinations.

Limitations, practical implications, and future lines of study

This study's results are somewhat conditional. First, the incidental sample's size was not very large, which led us to perform the AFE and AFC on the total data. In addition, all participants belonged to a faculty of education, so given the importance of university students' motivation and learning strategies, the number of students, faculties, and disciplines should be increased. To understand more about SRL processes, this quantitative research could be enriched with qualitative study, thus adding specific information about global cultural idiosyncrasies among university learners.

With a view to future research, as pointed out in the revision of the MSLQ of Curione and Huertas (2016), it is worth highlighting the need to adjust the questionnaire to the) suggested in their recent MSLQ revision, adjusting measurement instruments to align with contemporary social and technological changes that have occurred in recent years, adding sub-dimensions that includes an ongoing need. Future psychometric studies might add situations that students perceive as emotionally and academically significant, such as group work, organization of tasks, and anxiety before oral presentations (Larruzea-Urkixo et al., 2020, 2021).

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Appendix 1

		%os	%ot	M	LiM	LsM	DT	Asi.	Cur.	PF	IHc
	1.MOTIVACION										
Objetivos Intrínsecos	En un curso como este, prefiero material que realmente me rete para así poder aprender cosas nuevas.	0.7	11.7	5.00	4.88	5.12	1.22	-0.38	0.13	0.50	0.45
	En este curso prefiero material que despierte mi curiosidad aunque sea difícil de aprender.	0.7	27.8	5.67	5.55	5.79	1.22	-1.03	1.04	0.60	0.54
	Lo más satisfactorio de este curso para mí es intentar entender el contenido lo mejor posible	0.0	17.3	5.44	5.33	5.54	1.11	-0.51	-0.02	0.72	0.52
	Cuando tengo la oportunidad, elijo actividades que me ayuden aunque no garanticen obtener una buena calificación.	1.4	9.1	4.76	4.63	4.89	1.33	-0.35	-0.14	0.57	0.47
Valor concedido a la Tarea	Creo que seré capaz de aplicar lo que he aprendido este curso a otros cursos.	0.0	18.0	5.37	5.26	5.48	1.19	-0.51	-0.24	0.66	0.52
	Es importante para mí aprenderme el material de este curso.	0.5	15.9	5.24	5.12	5.36	1.27	-0.62	0.12	0.64	0.53
	Estoy muy interesado/a en el contenido de las asignaturas de este curso.	2.1	11.9	4.80	4.66	4.93	1.41	-0.46	0.00	0.64	0.68
	Creo que el material del curso me ayuda a aprender.	1.4	13.6	5.20	5.08	5.32	1.26	-0.81	0.81	0.74	0.67
	Me gustan los temas de este curso.	3.5	8.9	4.63	4.50	4.77	1.43	-0.44	-0.01	0.58	0.64
	Entender los temas de las asignaturas es importante para mí.	0.7	20.1	5.52	5.41	5.63	1.15	-0.89	1.35	0.74	0.66
Creencias de Control	Si estudio de manera adecuada, seré capaz de aprender el material de este curso.	0.2	32.2	5.83	5.72	5.93	1.12	-0.87	0.16	0.63	0.48
	Si me esfuerzo, seré capaz de entender el material de este curso.	0.0	29.7	5.86	5.77	5.96	1.00	-0.77	0.58	0.75	0.48
Autoeficacia para el Aprendizaje y el Rendimiento	Creo que obtendré una excelente calificación en este curso.	1.9	3.5	4.66	4.55	4.77	1.17	-0.65	0.90	0.63	0.54
	Estoy seguro/a que puedo entender incluso el material de lectura más difícil de este curso.	3.0	9.3	4.48	4.34	4.62	1.47	-0.19	-0.41	0.51	0.48
	Estoy seguro/a de que puedo aprender los conceptos básicos enseñados en este curso.	0.2	40.9	6.04	5.94	6.13	1.02	-0.95	0.45	0.56	0.60
	Estoy seguro/a de que podré entender al profesorado de este curso.	0.2	14.0	5.13	5.01	5.25	1.24	-0.41	-0.19	0.60	0.53
	Confío en que puedo hacer un excelente trabajo en las actividades y exámenes de este curso.	0.5	11.0	5.25	5.14	5.35	1.08	-0.54	0.67	0.74	0.68
	Espero que me vaya bien el curso.	0.5	50.0	6.24	6.15	6.33	0.98	-1.73	4.47	0.43	0.35
	Estoy seguro/a de que puedo dominar a la perfección las habilidades que se enseñan este curso.	0.2	10.7	5.10	4.99	5.21	1.16	-0.37	-0.01	0.67	0.60
	Teniendo en cuenta la dificultad del curso, el profesorado y mis habilidades, creo que me irá bien.	0.5	13.1	5.39	5.28	5.49	1.09	-0.79	1.09	0.77	0.70
	2. ESTRATEGIAS DE APRENDIZAJE										
Organización del Material	Cuando estudio, leo mis apuntes y lecturas una y otra vez.	2.6	24.1	5.35	5.21	5.49	1.47	-1.01	0.76	0.43	0.37
	Memorizo palabras clave para acordarme de los conceptos vistos en clase.	2.8	24.3	5.36	5.22	5.50	1.70	-0.48	-0.60	0.58	0.52
	Hago listas de los conceptos importantes y los memorizo.	7.2	11.2	4.53	4.36	4.69	1.60	-1.29	0.90	0.54	0.52
	Cuando estudio las lecturas del curso, subrayo el material para organizar mis ideas.	2.6	43.9	5.70	5.55	5.86	1.19	-1.26	1.83	0.61	0.51
	Cuando estudio, reviso las lecturas y apuntes para intentar encontrar las ideas más importantes.	0.5	31.5	5.80	5.69	5.91	1.89	-0.23	-1.10	0.63	0.59
	Hago tablas, diagramas o cuadros que me ayuden a organizar la información.	10.7	12.4	4.23	4.05	4.41	1.57	-0.74	-0.09	0.55	0.50
	Cuando estudio, reviso las notas de clase y hago un resumen con los conceptos importantes.	2.6	21.0	5.11	4.96	5.26	1.47	-1.01	0.76	0.71	0.63
Aprendizaje Profundo	Cuando estudio, reúno información de diferentes fuentes como las clases, lecturas los debates.	3.3	10.5	4.61	4.47	4.76	1.55	-0.39	-0.51	0.57	0.49
	Trato de relacionar las ideas que aparecen en diferentes asignaturas siempre que puedo.	1.4	10.5	4.70	4.56	4.83	1.43	-0.30	-0.45	0.70	0.65
	Cuando leo, trato de relacionar la información nueva con la que ya conozco.	2.6	21.0	5.33	5.20	5.45	1.30	-0.52	-0.35	0.73	0.63
	Trato de entender el material de las clases estableciendo conexiones entre las lecturas y los conceptos de las clases.	0.7	11.9	5.05	4.92	5.17	1.28	-0.57	0.17	0.78	0.69
	Intento aplicar las ideas del curso en otras actividades como discursos o debates.	6.1	11.9	4.50	4.34	4.66	1.66	-0.37	-0.60	0.52	0.52

	%os	%ot	M	LiM	LsM	DT	Asi.	Cur.	PF	IHc
A menudo, me cuestiono cosas que oigo o leo para decidir si son convincentes.	2.3	8.2	4.64	4.51	4.78	1.41	-0.36	-0.29	0.49	0.50
Cuando nos presentan en clase una teoría, una interpretación o una conclusión intento decidir si hay evidencias que las apoyen.	4.9	3.3	4.14	4.01	4.28	1.43	-0.26	-0.37	0.45	0.47
Uso la información del curso como punto de partida para intentar desarrollar mis propias ideas.	2.1	8.9	4.71	4.58	4.84	1.36	-0.41	-0.01	0.70	0.65
Trato de jugar con mis propias ideas, relacionándolas con lo que estoy aprendiendo en este curso.	1.2	13.8	5.02	4.89	5.15	1.37	-0.51	-0.17	0.76	0.70
Cuando leo u oigo una conclusión o comentario pienso en posibles alternativas.	0.7	7.0	4.73	4.60	4.85	1.31	-0.31	-0.45	0.65	0.63

Autorregulación Metacognitiva

	%os	%ot	M	LiM	LsM	DT	Asi.	Cur.	PF	IHc
Cuando leo para el curso, me hago preguntas para que me ayuden a enfocar mi lectura.	4.9	9.3	4.47	4.32	4.62	1.60	-0.35	-0.56	0.46	0.43
Cuando no entiendo bien algo que estoy leyendo, vuelvo hacia atrás e intento aclararme.	0.2	39.5	6.00	5.89	6.10	1.09	-1.20	1.41	0.49	0.39
Si las lecturas del curso son difíciles de comprender, cambio la manera de leerlas.	2.6	7.7	4.58	4.44	4.71	1.44	-0.40	-0.31	0.57	0.51
Antes de estudiar un tema a fondo, lo reviso para ver cómo está organizado.	1.9	25.7	5.36	5.22	5.50	1.48	-0.96	0.48	0.65	0.56
Me hago preguntas para asegurarme de que entiendo lo que hemos estado viendo en clase.	2.6	11.4	4.68	4.53	4.82	1.50	-0.35	-0.41	0.61	0.61
Trato de cambiar mi forma de estudio para ajustarme a los requerimientos del curso y el método de enseñanza del profesorado.	5.1	4.9	4.18	4.04	4.33	1.51	-0.25	-0.52	0.51	0.47
Cuando estudio trato de identificar los conceptos que no entiendo muy bien.	0.2	17.8	5.43	5.32	5.54	1.17	-0.72	0.36	0.63	0.53
Cuando estudio me marco metas para planificar mis actividades en cada periodo de estudio.	2.8	15.4	5.03	4.89	5.17	1.45	-0.72	0.28	0.52	0.44
Si no entiendo las notas de clase, me aseguro de solucionarlo después.	0.9	11.7	5.01	4.88	5.14	1.34	-0.57	-0.07	0.61	0.53

Gestión Tiempo-Esfuerzo

	%os	%ot	M	LiM	LsM	DT	Asi.	Cur.	PF	IHc
Hago un buen uso de mi tiempo de estudio.	6.5	10.5	4.28	4.12	4.44	1.68	-0.19	-0.73	0.77	0.67
Me resulta difícil seguir un plan de estudio.	4.0	14.7	4.57	4.41	4.74	1.70	-0.28	-0.87	0.59	0.54
Me aseguro de llevar al día las lecturas y tareas del curso.	7.7	8.6	4.23	4.07	4.39	1.72	-0.25	-0.88	0.73	0.64
A menudo me doy cuenta de que no dedico mucho tiempo al curso por hacer otras actividades.	11.0	6.8	3.75	3.58	3.92	1.78	0.15	-1.04	0.52	0.51
Normalmente me siento tan perezoso/a y aburrido/a cuando estudio, que no termino lo que tenía planeado.	11.0	9.8	4.09	3.91	4.26	1.86	-0.11	-1.13	0.64	0.62
Trabajo duro para que el curso me vaya bien, aunque no me guste lo que estamos haciendo.	4.0	12.4	4.73	4.58	4.88	1.58	-0.52	-0.40	0.47	0.38
Cuando el trabajo del curso es difícil, me doy por vencido/a o estudio solo las partes fáciles.	0.9	31.8	5.52	5.38	5.66	1.47	-0.96	0.25	0.48	0.46
Incluso cuando los materiales del curso son aburridos y poco interesantes me las arreglo para seguir trabajando hasta que acabo.	1.6	18.7	5.16	5.02	5.30	1.48	-0.77	0.03	0.68	0.59

Relación Iguales

	%os	%ot	M	LiM	LsM	DT	Asi.	Cur.	PF	IHc
Cuando estudio, trato de explicar el tema a un compañero/a o amigo/a.	6.3	13.6	4.58	4.42	4.75	1.73	-0.46	-0.68	0.51	0.44
Intento trabajar con otros/as estudiantes para llevar a cabo las tareas.	4.4	11.9	4.75	4.60	4.90	1.56	-0.62	-0.19	0.67	0.54
Cuando estudio, me tomo un tiempo para discutir los temas del curso con los compañeros/as de clase.	8.2	4.0	3.95	3.81	4.10	1.55	-0.19	-0.61	0.63	0.51
Cuando no entiendo algún tema del curso, le pido ayuda a algún/a compañero/a.	1.9	26.9	5.48	5.34	5.61	1.41	-1.03	0.78	0.68	0.52

3. OBJETIVOS EXTRÍNSECOS

Objetivos Extrínsecos

	%os	%ot	M	LiM	LsM	DT	Asi.	Cur.	PF	IHc
Obtener una buena calificación es lo más satisfactorio que puedo lograr en este curso.	6.1	10.0	4.30	4.14	4.46	1.69	-0.21	-0.84	0.74	0.57
Lo más importante para mí ahora es mejorar mi nota media, por lo que mi principal preocupación es obtener una buena calificación.	9.1	5.1	3.85	3.69	4.01	1.67	-0.01	-0.91	0.80	0.60
Si puedo, quiero sacar mejores notas que el resto de estudiantes de mi clase.	7.7	9.3	4.41	4.25	4.57	1.67	-0.46	-0.56	0.40	0.33

		%s	*%t*	*M*	*LiM*	*LsM*	*DT*	*Asi.*	*Cur.*	*PF*	*IHc*
	Quiero hacerlo bien porque es importante para mí demostrar mi habilidad a mi familia, amigos/as y otras personas.	3.7	12.1	4.57	4.42	4.72	1.58	-0.31	-0.55	0.50	0.43
	4. ANSIEDAD										
Ansiedad	Cuando hago un examen, pienso que lo estoy haciendo peor que el resto de los/as estudiantes.	18.2	8.6	3.37	3.19	3.55	1.88	0.45	-0.91	0.46	0.43
	Cuando hago un examen, pienso en las consecuencias de suspender.	6.5	17.3	4.67	4.49	4.84	1.82	-0.47	-0.83	0.45	0.42
	Tengo un sentimiento de intranquilidad y agobio cuando hago un examen.	6.3	16.6	4.46	4.28	4.63	1.82	-0.22	-1.04	0.97	0.73
	Me siento nervioso/a cuando hago un examen.	4.7	34.1	5.24	5.07	5.41	1.79	-0.81	-0.38	0.77	0.62