Assessment of learning strategies in college students: a brief version of the MSLQ

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Abstract

Introduction: The Motivated Strategies for Learning Questionnaire (MSLQ) is one of the most worldwide employed scales to assess self-regulated learning and its factor structure is a topic of debate nowadays. In this paper the internal structure of the instrument is analyzed on university students of Argentina and Uruguay. The aim was to extract a short version of the MSLQ.

Method: 918 Argentinian and Uruguayan university students participated. An exploratory factor analysis as well as confirmatory factor analysis was applied using SPSS 21, SIMLOAD and LISREL 8.8 respectively. The factor invariance of the model was tested through the segmentation of each sample according to country, age and gender. The internal consistency was calculated for each sample using the Omega coefficient, these coefficients were compared using the *AlphaTest* program and the coefficient *q*.

Results: The exploratory factor analysis yielded a hexafactorial solution that kept 18 items. This structure was tested in the sample of each country through a confirmatory factor analysis, which verified adequate fit indices ($CFI > .90$, $RMSEA < .06$). The factorial invariance of the model was tested, verifying the metric equivalence ($\Delta CFI < .009$, $\Delta RMSEA < .002$). For each dimension and country, internal consistency was estimated, obtaining values between .55 y .79.

Discussion and Conclusion: The abbreviated version of the MSLQ will allow to have further understanding of the way in which Argentinian and Uruguayan students self-regulate their learning. This information could prove useful for the design of interventions that promote self-regulated learning processes at a college level. Future research will test the structure hereby obtained, aiming to verify whether its results persist in different academic orientations and countries.

Keywords: Self-regulated learning, College Students, Learning Strategies, MSLQ.

Resumen

Introducción. El Motivated Strategies for Learning Questionnaire (MSLQ) es uno de los instrumentos más utilizado para evaluar el aprendizaje autorregulado y su estructura factorial es tema de debate en la actualidad. En este trabajo se analiza la estructura interna del instrumento en estudiantes universitarios de Argentina y Uruguay. Se buscó extraer una versión abreviada del MSLQ.

Método. Participaron 918 estudiantes universitarios argentinos y uruguayos, se aplicaron tanto un análisis factorial exploratorio como confirmatorio, utilizando el SPSS 21, SIMLOAD y LISREL 8.8 respectivamente. Se examinó la invarianza factorial del modelo segmentando la base según país, sexo y edad. Se estimó para cada dimensión la consistencia interna para ambas muestras mediante el coeficiente Omega, se compararon estos coeficientes mediante el programa *AlphaTest* y el coeficiente *q*.

Resultados.: El análisis factorial exploratorio arrojó una solución hexafactorial que conservó 18 ítems. Se testeó esta estructura en la muestra de cada país mediante un análisis factorial confirmatorio que verificó un ajuste adecuado (*CFI* > .90, *RMSEA* < .06). Se testeó la invarianza factorial del modelo verificándose la equivalencia métrica (*ΔCFI* < .009, *ΔRMSEA* < .002). Para cada dimensión y país se estimó la consistencia interna; obteniendo valores entre .55 y .79.

Discusión y conclusiones. La versión abreviada del MSLQ permitirá conocer el modo en que estudiantes argentinos y uruguayos autorregulan su aprendizaje. Esta información podría resultar útil para el diseño de intervenciones que promuevan los procesos de autorregulación del aprendizaje a nivel universitario. Futuras investigaciones pondrán a prueba la estructura aquí obtenida a fin de verificar si la misma se replica en distintas orientaciones académicas y en diferentes países.

Palabras Clave: Aprendizaje Autorregulado, Estudiantes Universitarios, Estrategias de Aprendizaje, MSLQ.

Introduction

Thirty years have passed from the first publication of the *Motivated Strategies for Learning Questionnaire* (MSLQ), and this instrument continues arousing the interest of researchers worldwide. It has been used in hundreds of studies with thousands of students, being the most administered one to assess self-regulated learning (SRL) (Dunn et al., 2012; Roth et al., 2016).

Self-regulated learning is an active and constructive process through which students set goals for their learning and try to monitor, regulate, and control their cognition, motivation, and behavior as well as some contextual aspects (Pintrich, 2000). Thus, even though self-regulated processes are not limited to the use of learning strategies, in order to self-regulate learning, the selection and use of different cognitive strategies, which students use to memorize, learn, reason, solve problems and think (Pintrich, 2004), are central.

At the college level, learning requires increasing amounts of autonomy, and many students are faced with problems to self-regulate it (Zusho, 2017). Previous findings have shown that learners start university/college using learning strategies that are not consistent with such educational level (Pintrich et al., 1987; Tuckman & Kennedy, 2011; Uriel et al., 2011). This is problematic, especially if we consider that self-regulated learning strategies are related/linked to academic performance (Credé & Phillips, 2011; Dent & Koenka, 2016; Kitsantas et al., 2008, Lodewyk et al., 2009; Pintrich et al., 1993). And also, that academic performance has been identified as one of the factors that influences on the learners' stay/permanence in college (Baars & Arnold, 2014; Esteban et. al., 2017).

The MSLQ contains 81 items grouped in two sections: *Motivation (M)* that consists of six subscales, and *Learning Strategies (LS)*, which is composed of nine subscales. MSLQ sections and subscales can be independently administered and its use can be adapted to the needs of instructors and researchers (Pintrich et al., 1993).

The LS section comprises 50 items that are organized in the following subscales: *Rehearsal* (α=.69), *Elaboration* (α=.75), *Organization* (α=.64), *Critical thinking* (α=.80), *Metacognitive self-regulation* (α=.79), *Time and study environment management* (α=.76), *Effort regulation* (α=.69), *Peer learning* (α=.76), and *Help seeking* (α=.52). The first four

correspond to cognitive strategies, the next one assesses metacognitive strategies, and the last ones refer to the resources management component (Pintrich et al, 1991; Pintrich et al., 1993). Even though, four out of nine subscales showed values that are lower than .70, its consistency cannot be taken as low if we consider the small number of items that comprise it (Anselmi et al., 2019). On the other hand, as it is well-known, the Cronbach's alpha coefficient used for the /applied to the ordinal variables' analysis tends to underrate the internal consistency values, thus, a cautious interpretation must be done (Contreras-Espinoza & Novoa-Muñoz, 2018).

Cognitive strategies include the use of simple and complex ones for information processing that comes from the reading materials, and the classes themselves. Rehearsal is the most superficial processing strategy; it implies the repetition of words to help remember them. Among the deep processing strategies, we find Elaboration (e.g. paraphrasing and summary writing), and Organization of the study material that entails a transformation of the information (e.g. underlying, selection of the main ideas, elaboration of charts and tables where the study material is reorganized by the student). Critical thinking, the fourth cognitive strategy, involves applying previous knowledge to a new situation, and a deep and reflective evaluation of the ideas presented in the study materials or by the teacher (Pintrich et al., 1993; Pintrich, 2004).

On the other hand, Metacognitive self-regulation includes processes of planning, monitoring, and cognitive regulation. Then four subscales are comprised in the Resources management dimension. The first one assesses the ability of the student to program, plan, and efficiently manage his or her Time and study environment. Effort regulation values persistence in the activity (e.g. to control one's attention in presence of distractors and persist in doing activities difficult to solve or that are boring). Lastly, two dimensions of management highlight the social nature of learning. Peer learning refers to studying in groups, and Help seeking involves asking for help either to classmates or to teachers (Pintrich et al., 1993; Pintrich, 2004).

MSLQ has been translated into several languages and validated in different countries (Bonanomi et al., 2018; Cazán, 2017; Chow & Chapman, 2017; Curione et al., 2019; Erturan-Ilker et al., 2014; Inzunza et al., 2018; Jakešová & Hrbáčková, 2014; Ortega et al., 2019; Ramirez-Dorantes et al., 2013).

Some studies have focused on a critical analysis of the instrument. Hilpert et al. (2013) analyzed the latent structure of the MSLQ and they considered that it still lacks satisfactory evidence to confirm the theoretical structure of the 81-item version. They found it difficult to replicate the original theoretical model, and deleted more than half of the subscales, thus arriving at a re-specified model with three latent factors (expectancy, value, and self-regulation). The LS section reported most of the psychometric problems. This was previously identified in other studies (Credé & Phillips, 2011; Dunn et al., 2012).

Credé and Phillips (2011) conducted a meta-analytic revision, that among its objectives were to research on the predictive capacity of the MSLQ on academic performance. A group of problematic items were identified, among which ten were of *conditional content*. Statements of these kind of items take on the occurrence of an event and the response to it. For example, *item 68* states: *When I can´t understand the material in this course* (event), *I ask another student in this class for help* (response to the event). However, it is not clear if the one who expresses disagreement does so with respect to the event (due to not understanding the material is something that doesn't happen to him/her), to the response to the event (he/she does not ask his/her classmates for help when he/she does not understand the material), or to both things at the same time (Credé & Phillips, 2011).

In this respect, they also found eight *ideal-point items*. They are those to which students, either high or low academic performance, respond the same way. While average students give different responses. An example is *item 58*: *I ask the instructor to clarify concepts I don't understand well*. According to, Credé and Phillips (2011), this item leads to disagreement among high, as well as low academic performance students, but for different reasons. While the first ones do not ask for help because they do not need it, the latter could not be motivated enough to do so, or may not be able to identify misunderstandings. Conversely, average students, who occasionally face academic problems and ask for help could agree with this item.

According to the authors, this kind of item could explain some of the validity problems of the instrument. Another identified psychometric problem referred to the high amount of redundancy at the measure level. Some pairs of subscales are strongly related, which could suggest they assess the same construct. This is observed between Time and study

environment management - Effort regulation (p= .92) and between Peer learning - Help seeking (p= .95). They suggest rewriting items or the combination of such subscales.

Jackson (2018) explored the validity and reliability of the MSLQ to assess college STEM (Science, Technology, Engineering, and Mathematics) students, who belong to an ethnic and racial minority (African-American students). The author pointed out the importance that the studies carried out using the MSLQ include samples with higher levels of diversity. Likewise, he faced difficulties in replicating the theoretical structure of the MSLQ, since the Confirmatory Factor Analysis (CFA) lead into re-specifying the model by removing several subscales. The revised version kept 48 items out of 81, and it included a cognitive strategy section, as well as a resources management one. The author concluded that the MSLQ could present psychometric problems if participants' diversity is increased.

Inzunza et al. (2018) examined the structure and reliability of the MSLQ with Chilean college students. They found difficulties in replicating the original structure, especially the LS section. Metacognitive self-regulation is not comprised as an independent subscale but Organization, Critical thinking, Help seeking, and Peer learning, were. Time and study environment management together with Effort regulation were partially replicated. The authors suggested that the participants' characteristics could explain the differences found in the original factorial structure.

Other studies analyzed some of the subscales and Dunn et al. (2012) studied Metacognitive self-regulation and Effort regulation. The authors carried out an Exploratory Factor Analysis (EFA) excluding the reversed items; they deleted low factory load items and carried it out again. Thus, items were grouped in two dimensions called General strategies for learning and Clarification strategies for learning. From such dimensions they put the model to test through a CFA finding a good adjustment. Tock and Moxley (2017) studied Metacognitive self-regulation and stated that even though it is one of the most used measures to assess metacognition, validity evidence from the scale and its psychometric properties were not well established. The authors conducted an EFA and a CFA of such subscale and the one factor model presented poor adjustment. After eliminating the problematic items, they got a revised version of Metacognitive self-regulation subscale.

On the other hand, Kim et al. (2020) raised the issue of lacking evidence to maintain the theoretical differentiation among the four areas of regulation: cognition, motivation, behavior and context. The authors inquired about how such areas were related among themselves, if they are either completely distinguishable or a general aptitude expression of self-regulation. They took up something that Pintrich (2004) himself had pointed out, namely the MSLQ does not capture all the components of his SRL model. So, for example, it does not include a scale that assesses the regulation of motivation. The authors also stated that Time and study environment management combined two different areas of self-regulation (behavior and context). They grouped items from different measures (among which it's the MSLQ) to assess the four regulation areas and provided empirical evidence to the theoretical distinction of Pintrich SRL model.

Hernández and Camargo (2017) revised the Iberoamerican literature on self-regulated learning in college students and observed that only five Latin American countries have publications in this area. This is then an area of study on its early stage in such a context. As the MSLQ is the mostly used assessment measure to assess SRL, it is important to continue advancing on validation processes that allow having versions which capture the most relevant aspects of the self-regulation of learning in the regional educational setting.

In this context, Argentina and Uruguay share some characteristics at the Higher Education (HE) level. In both countries there are public management universities which concentrate most of the student enrollment. These are macro universities, which have an open and unrestricted access for students, with flexible admission. They are free and their objective is to improve inclusion. However, the percentage of students that finish HE is a limited one. Approximately half of the students abandon school (Gorostiaga, 2019; Otero, 2017; SITEAL, 2019). This makes it necessary to examine variables that are involved in these results.

Psychology has focused on the study of cognitive as well as non intellective factors related to academic performance in order to explain them, because they enable intervention alternatives (Stover et al., 2015). The difficulties students face when learning in massive conditions are peculiar specific therefore it is important to characterize self-regulated learning processes in such a context.

The present study approaches the psychometric analysis of the *Learning strategies* section of the MSLQ. In view of antecedents, it is considered important to identify the most robust dimensions and get an abbreviated version of the LS section, which keeps the most relevant strategies for Argentinian and Uruguayan college students. It is expected that this version is a measure that gives evidence of validity for both populations.

Finally, interest in reaching an abbreviated version is oriented by the need to reduce application timing since, in practice, instruments are not administered in isolation instead they are part of an extensive battery composed of numerous tools. Thus, to reach an abbreviated version would contribute to reduce application timing and fatigue effect caused in those who complete it (Barrios & Cosculluela, 2013).

Objectives

The following objectives guided the present study:

1) To analyze the internal structure of the LS section of the MSLQ so as to select the most robust items from conceptual and empirical points of view, which will comprise the abbreviated version of the instrument.

2) To test the model corresponding to the abbreviated version in the Argentinian and Uruguayan student populations separately.

3) To study the factorial invariance of the abbreviated version adopting country, sex and age as segmentation variables.

4) To examine and compare the internal consistency of each dimension for both samples in the concerned countries.

Method

Participants

Through convenience sampling, a sample of 918 college students (70.2% girls and 29.8% boys) was collected. Students belong to careers related to Human and Social Sciences (Law, Business Administration, Human Resources Management, Communication Studies,

Educational Sciences, Economic and Business Sciences, Political Science, Psychology, Psychopedagogy, Music therapy, Sociology, and Social Work), and they are between 17 and 62 years old (*M* = 24.55; *Mdn* = 22; SD = 7.70). 44.8% of the students were from Argentina (57.9% girls and 42.1% boys) aged between 18 and 54 (*M* = 24.78; *Mdn* = 23; SD = 5.62). 55.2% of the students were from Uruguay (80.1% girls and 19.9% boys) and they were between 17 and 62 years old (*M* = 24.35; *Mdn* = 20; SD= 9.07).

Measures

The Spanish version of the complete LS section of the *MSLQ* (Pintrich et al., 1993; Pintrich et al., 1991) was administered, it was validated by Curione et al. (2019). This instrument allows evaluating different dimensions: Rehearsal (α=.62), Elaboration (α=.76), Organization (α=.72), Critical thinking (α=.76), Metacognitive self-regulation (α=.74), Time and study environment management (α=.75), Effort regulation (α=.70), Peer learning (α=.71), and Help seeking (α=.62). The instrument is answered through a 7- alternative-Likert scale, where 1 corresponds to *Totally disagree* and 7 to *Totally agree*. A sociodemographic survey was administered ad hoc.

Procedure

Data was collected during time class. Students were told of the objectives of the research and they were invited to participate in a free and voluntary way by registering their agreement by signing an informed consent that established guarantees for anonymity and confidentiality in the treatment and dissemination of information. Then the MSLQ was administered together with a sociodemographic survey. In turn, endorsement by the ethics committee of the University of Buenos Aires and the Faculty of Psychology of the University of the Republic, as well as of the participating institutions, and teachers in charge of the courses was given.

Data analysis

The analysis of the psychometric properties of the instrument was carried out by an instrumental, cross sectional, ex post facto research (Ato et al., 2013).

Considering the number of possible answers of the MSLQ items, a quantitative methodology, based on Pearson correlation matrixes (Robitzsch, 2020) was applied. Such work began by applying an Exploratory Factor Analysis to the total sample of students from

Argentina and Uruguay through the use of the program SPSS 21 (IBM Corporation, 2012) and SIMLOAD (Fleming & Merino, 2005). The maximum likelihood method was used together with Kaiser normalization. Using Varimax rotation method since oblique methodology (direct oblimin) showed low interfactorial correlations (< .30) in almost all the cases, thus suggesting the possibility of considering the independence among factors (Lloret-Segura et al., 2014). At this point in the analysis a selection of three items per dimension was made, which would be part of the following abbreviated version of the questionnaire. Firstly, to do so, a statistical-empirical criteria was adopted, which kept those items with higher factorial loads and factorial indices of simplicity. In turn, they tried that the obtained factorial solution showed good indices of adjustment of the scale, higher than .70. Second, a rational criterion was adopted through which researchers revised the content of the selected items in the light of the theoretical model. Thus, looking for an adequate coverage of the construct that is intended to be measured. Information provided by antecedents that identified problematic items was also considered. The purpose of this procedure was to keep items containing a high level of explanation and which content is not redundant.

The solution obtained from the exploratory procedure was tested afterwards in the samples of each country through a Confirmatory Factor Analysis with LISREL 8.8 (Scientific Software International, 2006) software. The adjustment of the model was evaluated from the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA) indices where equal values, higher than .90 and lower than .08 respectively, are indicators of a good adjustment (Schumacker & Lomax, 2016).

The differences among the estimated parameters were observed for the samples of students in Argentina and Uruguay through q Cohen's coefficient. Values were interpreted following Cohen's (1988) criterion that classifies the effects in null (lower than .10), small (.10 and .30), medium (between .31 and .50), and large (higher than .51).

Subsequently the factorial invariance of the segmented model was examined according to country (Argentina or Uruguay), sex (girls or boys), and age (young or old). This last variable was segmented considering the median of the total sample (22 years old). For the invariance analysis three nested models were proposed (configural, metric, structural) progressively applying different levels of restriction. Results were analyzed from the CFI and

RMSEA indices being their values lower than .01 and .015, respectively (Davidov et al., 2018).

Finally, internal consistency was estimated for each dimension in the Argentinian and Uruguayan samples through Omega coefficient (Ventura-León & Caycho-Rodríguez, 2017). Then these coefficients were compared through the *AlphaTest* program (Merino & Lautenschlager, 2003) and *q* coefficient (Cohen, 1988).

Results

First of all, in the total sample of college students (Argentina and Uruguay) an exploratory factor analysis was applied. After trying several factorial solutions, an hexafactorial solution was obtained which explained an ordinary invariance of 46.916% (Table 1).

Table 1. *MSLQ. Exploratory factor analysis with Argentinian and Uruguayan students.*

Items	Factors						FSI
	E	PL	O	CT	TSEM	R	
62. I try to relate the ideas in this course to those of others, whenever it is possible.	**.813**	.122	.035	.033	.227	.019	.889
64. When I read for this course, I try to relate the material with what I already know about it.	**.608**	.019	.262	.086	.178	.028	.739
81. I try to apply the ideas on the materials for this course to other courses.	**.593**	.134	.024	.124	.312	-.003	.699
34. When I study for this course, I often try to explain the materials to a classmate or a friend.	.212	**.453**	.112	.147	.123	-.002	.634
45. I try to work with other students of this course to finish the tasks.	.039	**.707**	.062	-.014	.008	.075	.974
50. When I study for this course, I often save time to discuss the materials of the course with a group of classmates.	.035	**.801**	.103	.091	.155	.032	.922
32. When I study the materials of this course, I make a draft to help me organize my ideas.	.031	.057	**.651**	.180	.005	.167	.844
49. I make outlines, diagrams or tables to help me organize the material of the course.	.095	.190	**.457**	.152	.104	.166	.600
63. When I study for this course, I revise my notes and make a draft with important concepts.	.177	.084	**.746**	.148	-.079	.185	.817
38. I often question things I listen to or read about in this course to decide if they are convincing or not.	.191	.115	.118	**.700**	.089	.089	.834
47. When a theory, interpretation or conclusion are introduced in this course or its materials, I try to decide if there is solid evidence that supports them.	-.014	.005	.113	**.549**	-.040	-.006	.945
71. When I read or listen to an assertiveness or conculsion in this course I think about possible alternatives.	.071	.087	.172	**.612**	.110	.130	.810
43. I really take advantage of my study time for this course.	.122	.026	.030	-.052	**.549**	.023	.927
52. It is difficult for me to stick to a study routine. (R)	.201	.124	.009	.101	**.696**	.057	.852
70. I make sure to keep up with the course readings and activities.	.272	.120	-.014	.116	**.521**	.025	.694
39. When I study for this course, I review the materials by repeating them to myself.	-.020	.008	.218	.071	.021	**.409**	.738
59. I memorize words to remember important concepts of this course.	.074	-.010	.049	.014	-.037	**.810**	.983
72. I make lists of important words and memorize them.	-.020	.138	.229	.099	.136	**.477**	.647
FSI Total							.852
Variance %	9.164	8.314	8.037	7.434	7.426	6.541	
Scale Adjustment Indices	.838	.900	.822	.871	.791	.892	

Note. E = Elaboration; PL = Peer Learning; O = Organization; CT = Critical Thinking; TSEM = Time and Study Environment Management; R = Rehearsal; FSI= Factorial Simplicity Index.

The obtained solution from the exploratory analysis was separately tested afterwards in the Argentinian and Uruguayan samples through a CFA (Table 2).

Table 2. *MSLQ. Confirmatory factor analysis according to country.*

Items	Argentina						Uruguay						q
	E	PL	O	CT	TSEM	R	E	PL	O	CT	TSEM	R	
MS62	.80						.84						.130
MS64	.67						.62						.085
MS81	.65						.76						.221
MS34		.69						.45					.363
MS45		.52						.75					.396
MS50		.66						.92					.797
MS32			.73						.66				.136
MS49			.47						.62				.215
MS63			.75						.82				.184
MS38				.53						.49			.054
MS47				.73						.72			.021
MS71				.63						.65			.034
MS43					.68						.81		.298
MS52R					.49						.50		.013
MS70					.70						.66		.075
MS39						.52						.49	.04
MS59						.54						.66	.188
MS72						.57						.66	.145
CFI	.93						.94						
RMSEA	.060 [.051-.068]						.057 [.050-.065]						

Note. E = Elaboration; PL = Peer Learning; O = Organization; CT = Critical Thinking; TSEM = Time and Study Environment Management; R = Rehearsal; CFI= Comparative Fix Index; RMSEA= Root Mean Square Error of Approximation; Cohen *q* = size effect.

The tested model was examined in relation to its factorial invariance taking country, sex and age as segmentation variables. For that reason, three models with different levels of restriction (configural, metric, structural) were tested. The invariance of the model was tested in all the cases (Table 3).

Table 3. *MSLQ. Factorial invariance analysis according to country.*

		CFI	ΔCFI	RMSEA	ΔRMSEA
Country	Model 1	.938	-	.058 [.052-.063]	-
	Model 2	.934	.004	.058 [.053-.064]	.000
	Model 3	.929	.009	.058 [.053-.064]	.000
Sex	Model 1	.950	-	.068 [.062-.073]	-
	Model 2	.950	.000	.066 [.061-.072]	.002
	Model 3	.948	.002	.066 [.061-.072]	.002
Age	Model 1	.956	-	.065 [.059-.070]	-
	Model 2	.956	.000	.064 [.059-.069]	.001
	Model 3	.951	.005	.065 [.059-.070]	.000

Finally, internal consistency of all dimensions was estimated for each country and were compared among themselves. Except for the *Peer learning* dimension, the rest did not register meaningful differences (Table 4).

Table 4. *MSLQ. Factorial invariance analysis according to country.*

	Argentina ($n = 411$) [IC 95%]	Uruguay ($n = 507$) [IC 95%]	X^2	gl	p	q
Elaboration	.751 [.706-.790]	.787 [.753-.817]	1.383	1	.239	.088
Peer learning	.658 [.596-.712]	.764 [.726-.797]	7.827	1	.005	.216
Organization	.693 [.638-.741]	.745 [.704-.781]	1.955	1	.162	.108
Critical thinking	.666 [.606-.718]	.655 [.600-.704]	.059	1	.807	.019
Time and study environment management	.659 [.598-.712]	.701 [.653-.743]	.979	1	.322	.078
Rehearsal	.557 [.477-.626]	.634 [.575-.686]	2.07	1	.150	.120

Discussion and Conclusion

This study was intended to design an abbreviated version of the LS section of the MSLQ being potentially administered in the Argentinian and Uruguayan settings, which appropriately adjusts to school shifts and class time and also avoiding fatigue on the assessed ones. With such an objective in mind the most robust items were selected from the metric and conceptual points of view in both samples, so as to test the model in each country and compare the structure among them.

First, an EFA was done, which allowed to keep 18 items grouped in six factors (three items per factor). A structure that contains subscales related to the use of cognitive strategies, such as Rehearsal, Elaboration, Organization, and Critical thinking was obtained. So, all the dimensions, which theoretically refer to the use of specific cognitive strategies that students use to memorize, to learn, to reason, to solve problems, and to think (Pintrich, 2004) were kept.

Conversely, items from the strategies referring to the resources management, distributed in Time management and Peer learning, were kept. The first one was given that label because in it the items related to study time organization were grouped. Those items that referred to environment management were excluded. As it was previously stated, this structure has theoretical basis the Time and study environment management original subscale includes items that assess different areas of SRL. The first one refers to regulating behavior, while environment management relates to context regulation. Such elements are clearly differentiated in Pintrich SRL theoretical model though not sufficiently clarified in the MSLQ (Kim, et al., 2020). An abbreviated version of one of the MSLQ subscales with more predictive validity on academic performance (Credé & Phillips, 2011) was obtained. Furthermore, conceptual clarification was attained when focusing the assessment on behavioral regulation (Study time management).

Peer learning kept the three original items that comprise the subscale itself. Items include strategic interaction behaviors, among students which are relevant for learning (Donolo et al., 2008). Using this strategy, either inside or outside the classroom makes it easier to solve problems, and it invigorates knowledge building processes (Carrasco et al., 2019).

Help seeking was not kept, since its creation this subscale has evidenced reliability problems. Among all the revised studies, Credé and Phillips (2011) reported a .59 Cronbach's alpha for such subscale. They also pointed out the high redundancy between Peer learning and Help seeking, as well as between Time and study environment management and Effort regulation. This last one was not kept either in this study, the already mentioned meta-analytic study shows a .61 Cronbach's alpha for such subscale in all the revised studies.

Metacognitive self-regulation could not be established as an independent subscale and it was not represented in the solution that was found. This was also reported in the study that was carried out in Chile (Inzunza et al., 2018). Its psychometric difficulties were also previously identified (Dunn et al., 2012; Tock & Moxley, 2017).

The abbreviated version eliminates several items which are identified in the antecedents as problematic. It reduces the dimensions though keeping key aspects of self-regulated learning at the college level. Such aspects are the use of cognitive strategies and the management of resources related to study time and peer learning.

All factors show a similar variance percentage so it can be concluded that they evenly contribute to the explanation of the self-regulated learning strategies construct. Selected items show adequate factorial loads and factorial simplicity indices. Likewise, total and scale adjusting factorial simplicity indices showed optimal results higher than .80 (Fleming & Merino, 2005). All of this allows us to conclude that the obtained structure showed high theoretical and statistical robustness.

Subsequently, the model derived from the exploratory proceeding was independently tested in both samples getting acceptable adjustment indices, which indicate that the theoretical model is confirmed by the empirical data. In addition to that, estimated parameters were analyzed for the models of each country, thus registering only a large effect (item 50). This enables us to conclude that most of the items show similar values for both countries.

As it was intended to have a validated version for both countries, a factorial invariance test of the model was applied. First, the sample was segmented according to country, thus testing the equivalence of the model among students in Argentina and in Uruguay. This means that the instrument shows a similar functioning in both countries. And the registered differences among both samples, based on its administration, are explained due to differences in the

individuals and not due to a systematic mistake introduced by the instrument. On the other hand, provided the broad age rates of the samples and their disproportion in relation to sex, an invariance test was carried out. Its objective was to test that the model is not affected by such variables. In both cases the equivalence of the model was asserted. Accordingly, it should be noted that the analyses done here provide information in favor of generalizing this model (Davidov et al., 2018).

Finally, the internal consistency of the dimensions of the model was tested for both countries. Adequate coefficients are observed, when considering the number of items (3) which comprises each subscale, and the diversity/heterogeneity of its content (Anselmi et al., 2019; Panayides, 2013; Tang et al., 2014). On the other hand, when comparing coefficients between the two countries, significant differences were not verified, except for the Peer learning subscale which can be relativized because it shows a low effect size ($q < .30$).

In short, the psychometric quality for the abbreviated version of the LS section of the MSLQ was supported for both samples. The obtained version will enable to carry out studies that contribute to the analysis of the way in which local students self-regulate their learning. It will also enable the study of the relationships between self-regulated learning and academic performance at the college level, which, as it was indicated, it is related to students' continuity in such an educational institution. Another potential use of the version presented here is referred to the design and evaluation of the impact of interventions that promote self-regulated learning processes at the college level. Thus, it is intended to transfer technology to education in order to encourage Argentinian and Uruguayan students' continuity at the Higher Education level.

This study has some limitations, namely, the students in the samples were from the areas of Human and Social Sciences so results cannot be generalized to other areas of study. Data were collected in the cities of Montevideo (Uruguay) and Buenos Aires (Argentina), which could affect results' generalization nationwide in both countries. On the other hand, evidence of external validity of the instrument, that provides additional information related to the internal structure, was not analyzed. Considering such limitations, we are expected to continue working by increasing the sample size in relation to other areas of study, as well as other regions of both countries so as to test if the results presented here can be replicated or not. Furthermore, external measures, such as academic performance, as well as other instruments that assess similar constructs, which allow analyzing evidence of concurrent and

predictive validity, will be included. Finally, future studies could focus on the psychometric analysis and the reduction of the motivation section of the MSLQ, an aspect which also concerns self-regulated learning but that has not been addressed in this article.

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