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Psychometric properties analysis of the Motivational Self-Regulation Strategies Questionnaire

Análisis de las propiedades psicométricas del Cuestionario de Estrategias de Autorregulación Motivacional

Análise das propriedades psicométricas do Questionário de Estratégias de Autorregulação Motivacional

Agustín Freiberg-Hoffmann[1]
Florencia Anabel Motta[2]
Franco Tisocco[2]
Javier Sánchez-Rosas[3]

[1] Universidad de Buenos Aires; Consejo Nacional de Investigaciones Científicas y Técnicas
[2] Universidad de Buenos Aires
[3] Universidad Católica de Temuco

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Correspondence:
Agustin Freiberg-Hoffmann
agustinfreiberg@gmail.com

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Abstract: Motivational self-regulation allows students to sustain and/or improve their motivation to achieve their goals. This self-regulation variant is related to variables such as academic performance, classroom climate, and academic procrastination, among others. The Motivational Self-Regulation Strategies Questionnaire (MRSQ) operationalized the construct. The questionnaire was adapted in Córdoba (Argentina), dividing the dimensions of goal regulation according to the strategies employed ¬— whether by approximation or avoidance. The present research proposes to analyze new evidence of the validity and reliability of the MRSQ. A total of 412 university students from Buenos Aires (Argentina) participated in the study. The analysis of the internal structure of the instrument using confirmatory factor analysis (CFA) and exploratory structural equation modeling (ESEM) verified a better fit for the 8-factor model. Further, a measurement invariance analysis between samples of students from Buenos Aires and Córdoba verified the metric equivalence of the MRSQ. The internal consistency of the dimensions was adequate (> .70). Next, the concurrent validity test yielded positive and significant correlations with learning approaches and negative correlations with academic procrastination. Statistical norms were also computed. This work provides new evidence on the psychometric properties of the MRSQ and norms that enable its use and interpretation within applied settings.

Keywords: self-regulation; motivation; college students; psychometric properties; MRSQ

Resumen: La autorregulación motivacional permite a los estudiantes sostener o mejorar su motivación para alcanzar sus metas. Esta autorregulación se relaciona con variables relevantes como el rendimiento académico, el clima de clase y la procastinación académica, entre otras. El Cuestionario de Estrategias de Autorregulación Motivacional (CEAM) operacionaliza el constructo y fue adaptado en Córdoba (Argentina), dividiendo las dimensiones de regulación de metas según las estrategias empleadas sean por aproximación o evitación. Esta investigación propone analizar nuevas evidencias de validez y confiabilidad del CEAM. Participaron 412 estudiantes universitarios de Buenos Aires (Argentina). El análisis de la estructura interna del instrumento mediante análisis factorial confirmatorio (AFC) y el análisis de ecuaciones estructurales exploratorio (ESEM) verificaron el mejor ajuste para el modelo de ocho factores. Luego, un análisis de invarianza factorial entre muestras de estudiantes de Buenos Aires y Córdoba verificó la equivalencia métrica del CEAM. La consistencia interna de las dimensiones fue adecuada (> .70). Seguidamente, el examinen de validez concurrente arrojó correlaciones positivas y significativas con los enfoques de aprendizaje, y negativas con la procastinación académica. También se estimaron normas estadísticas.

Este trabajo proporciona nuevas evidencias sobre las propiedades psicométricas del CEAM y baremos que posibilitan su uso e interpretación dentro del campo de aplicación.
Palabras clave: autorregulación; motivación; estudiantes universitarios; propiedades psicométricas; CEAM

Resumo: A autorregulação motivacional permite aos estudantes manterem e/ou melhorarem sua motivação para alcançar suas metas. Essa autorregulação está relacionada com variáveis relevantes, como o desempenho acadêmico, o clima de sala de aula e a procrastinação acadêmica, entre outras. O Questionário de Estratégias de Autorregulação Motivacional (QEAM) operacionaliza o construto e foi adaptado em Córdoba (Argentina), dividindo as dimensões da regulação de metas de acordo com as estratégias empregadas, sejam elas por aproximação ou evitação. Esta pesquisa propõe analisar novas evidências de validade e confiabilidade do QEAM. Participaram 412 estudantes universitários de Buenos Aires (Argentina). A análise da estrutura interna do instrumento, por meio da análise fatorial confirmatória (AFC), e da análise exploratória de equações estruturais (ESEM) verificou o melhor ajuste para o modelo de oito fatores. Em seguida, uma análise de invariância fatorial entre amostras de estudantes de Buenos Aires e Córdoba verificou a equivalência métrica do QEAM. A consistência interna das dimensões foi adequada (> 0,70). Em seguida, o teste de validade concorrente revelou correlações positivas e significativas com as abordagens de aprendizagem e correlações negativas com a procrastinação acadêmica. As normas estatísticas também foram estimadas. Este trabalho fornece novas evidências sobre as propriedades psicométricas do QEAM e escalas que permitem seu uso e interpretação no campo de aplicação.
Palavras-chave: autorregulação; motivação; estudantes universitários; propriedades psicométricas; QEAM

Introduction

Students face challenges in staying motivated with their academic activities, as they may perceive assignments as irrelevant, monotonous, or overly challenging (Kim et al., 2018; Sánchez-Rosas, 2015). Although maintaining high motivation is fundamental, it is also key to self-regulate it in order to confront challenges and overcome uninteresting or adverse situations (Hendrie-Kupczyszyn & Bastacini, 2019). Within the university setting, motivational self-regulation has been extensively studied, showing a positive relationship with learning and academic performance (Dayupay et al., 2022; Kryshko et al., 2020; Suárez et al., 2018; Zoya & Saima, 2024), as well as with variables such as classroom climate, procrastination, and learning approaches (Arenas-Wong et al., 2022; Elizondo et al., 2023; Rojas-Ospina & Valencia-Serrano, 2021; Salgado et al., 2017).

The interest in evaluating motivational self-regulation has led to the development of various instruments, with self-report psychometric scales standing out due to their ease of application. Although alternative methods such as interviews, observations, think-aloud protocols, and tracking methods (Wolters et al., 2011) exist, these are usually more time- and resource-demanding, which is why scales remain the most widely used approach (Fong et al., 2024).

To delve deeper into its measurement and overcome the theoretical and methodological limitations of previous validations, the present study analyzes the psychometric properties of a widely used instrument in this field: the Motivational Self-Regulation Strategies Questionnaire (Wolters & Benzon, 2013), in its revised version adapted to the Argentine university-level context (Sánchez-Rosas et al., 2019). Specifically, the study evaluates its structure and measurement invariance across different university populations, examines evidence of concurrent validity, and computes statistical norms.

Motivational Self-Regulation Assessment Scales

Wolters (1998) designed one of the first instruments to measure motivational self-regulation through an open-ended questionnaire, in which students reported strategies to face challenges. Later, they formalized the measurement of five strategies: self-reinforcement, environmental control, self-affirmation of performance goals, self-affirmation of mastery goals, and interest enhancement (Wolters, 1998, 1999). Later still, Wolters and Benzon (2013) expanded this instrument by incorporating six strategies: value regulation, self-affirmation of performance and mastery goals, self-reinforcement, environmental structuring, and situational interest regulation.

Schwinger et al. (2007; 2009) adapted and extended this questionnaire into German, adding strategies such as increasing personal relevance, two types of performance goal regulation (approach and avoidance), and setting proximal goals. However, this instrument does not fully cover achievement goal regulation, as it does not incorporate Elliot and Murayama's (2008) 2×2 model, which distinguishes between approach and avoidance in both mastery and performance goals. Approach-mastery and avoidance-performance goals have been associated, respectively, with positive and negative effects on

learning, whereas avoidance-mastery and approach-performance goals show a more ambiguous role due to their focus on negative outcomes and norms (Sánchez-Rosas, 2015).

In the field of writing, Teng and Zhang (2016) designed the Writing Strategies for Motivational Regulation Questionnaire to assess motivational self-regulation in language students in China. This instrument includes five dimensions: performance goal regulation, mastery goal regulation, interest enhancement, emotional control, and environmental structuring.

Finally, some scales assess motivational self-regulation as a unidimensional construct. For example, Kim et al. (2018) developed the Brief Regulation of Motivation Scale (BRoMS) to globally measure beliefs about motivational self-regulation, rather than the use of specific strategies.

The Motivational Self-Regulation Strategies Questionnaire

The Motivational Self-Regulation Strategies Questionnaire (MRSQ), developed by Wolters and Benzon (2013), is one of the most widely used instruments to assess this construct. It consists of 30 items rated on a seven-point Likert scale to indicate the degree of agreement, organized into six dimensions: (1) Regulation of Value: the effort to find the interesting or useful aspects in academic content; (2) Regulation of Performance Goal: beliefs about one's ability and effort to achieve good results; (3) Self-consequence: a tendency to self-reward after completing a task; (4) Environmental Structuring: control over contextual and personal factors that may interfere with studying; (5) Regulation of Situational Interest: the ability to transform unappealing activities into more enjoyable experiences; (6) Regulation of Mastery Goals: efforts aimed at improving learning for the sake of acquiring knowledge.

The MRSQ has demonstrated adequate psychometric properties. An exploratory factor analysis confirmed its six-factor structure, explaining 69 % of the total variance. Additionally, Cronbach's alpha coefficients ranged between .77 and .91, and evidence of concurrent validity was reported with variables such as procrastination and self-efficacy (Wolters & Benzon, 2013).

Validations of the MRSQ

Research on motivational self-regulation strategies has led to the adaptation and validation of the MRSQ across different countries and educational levels.

Góes and Boruchovitch (2017) adapted the scale into Portuguese with a sample of Brazilian university students (n = 42), finding high reliability (Cronbach's alpha) for the overall scale and its six dimensions, although they did not assess its internal structure. No significant differences emerged in strategy use by field of study, but women reported greater use of self-reinforcement than men.

Guo and Tang (2022) administered the MRSQ to Chinese university students of English (n = 224) in an online learning context. Despite conducting a confirmatory factor analysis, they only reported factor loadings above .50 and did not provide fit indices. The full scale showed high reliability (Cronbach's alpha), but no dimension-specific values were reported. Women employed motivational regulation strategies more frequently than men, with no significant differences across academic levels.

Park (2021) validated the scale among primary, junior, and high school students in South Korea (n = 1,834). They evaluated the six-factor structure through exploratory and multi-group confirmatory factor analyses across different age groups, finding factor correlations between .14 and .63 and evidence of metric and scalar invariance, supporting its use at multiple educational levels. Reliability data were not reported. Differences in strategy use were observed by age and gender, with higher use among primary and junior school students compared to high school. Tutoring had a greater influence on motivational regulation than independent study time.

Rojas-Ospina and Valencia-Serrano (2019) validated the scale with Colombian university students (n = 315). Their exploratory and confirmatory factor analyses—allowing three pairs of correlated error terms—revealed a five-factor, 22-item structure, omitting the Mastery Goal Regulation factor, consistent with Paulino et al. (2015). Factor correlations ranged from .25 to .66, and internal consistency was adequate (Cronbach's alpha between .75 and .88). Motivational regulation also showed a positive relationship with motivational beliefs.

Lastly, Sánchez-Rosas et al. (2019) adapted the MRSQ for the Argentinian context by differentiating approach versus avoidance goal strategies. An exploratory factor analysis with 329 psychology and engineering students identified eight dimensions—including approach and avoidance for both performance and mastery goals. The final version comprised 37 items across eight dimensions

and demonstrated acceptable structural validity and internal consistency (Cronbach's alpha between .68 and .95), although evidence of associations with learning-related variables was not reported.

Limitations of the Priorly Conducted Validations

Previous research on the validation of the MRSQ (Wolters & Benzon, 2013) exhibits various methodological and conceptual shortcomings that compromise its applicability. In general, studies have neglected in-depth analysis of the factorial structure, used inappropriate reliability methods, and omitted examination of the relationship between strategies and key learning variables.

Góes and Boruchovitch (2017) assessed the scale's reliability in Brazilian university students (n = 42) but did not analyze its internal structure, preventing determination of whether it adequately measures the theoretical dimensions. Similarly, Guo and Tang (2022) performed a confirmatory factor analysis but reported only factor loadings, omitting fit indices and dimension-specific reliability coefficients, which hinders evaluation of internal consistency.

In the school context, Park (2021) explored the scale's structure across educational levels through exploratory and multi-group confirmatory factor analyses and tested factorial invariance; however, they did not report any reliability data nor examine its concurrent validity with learning variables. Meanwhile, Rojas-Ospina and Valencia-Serrano (2019) removed the Mastery Goal Regulation dimension without clear theoretical justification, which may affect construct interpretation. They also failed to assess the relationship between strategies and variables such as procrastination, limiting the scale's educational applicability.

One of the most noteworthy studies, by Sánchez-Rosas et al. (2019), addressed the instrument's theoretical dimensionality within Elliot and Murayama's (2008) achievement goal framework. Nonetheless, its methodological validation is constrained by a sample limited to Psychology and Engineering students, excluding other disciplines and educational levels. They did not conduct a confirmatory factor analysis to verify the eight-dimension structure, nor did they investigate relationships between strategies and outcomes like procrastination or other learning strategies. Regarding reliability, they relied on Cronbach's alpha—less appropriate for ordinal data—and the absence of normative data prevents interpretation of individual scores in applied settings.

Although these studies have advanced our understanding of motivational regulation, further research is needed to clarify how these strategies relate to learning (Fong et al., 2024; Villar et al., 2024) and to what extent discriminated performance- and mastery-goal regulation strategies (approach vs. avoidance; Sánchez-Rosas et al., 2019) influence different levels of information processing and academic behavior (Sánchez-Rosas, 2015; Tait et al., 1998; Tuckman, 1991). Whereas performance-goal regulation tends to focus on meeting academic demands, mastery-goal regulation fosters deeper, more meaningful learning (Elliot & Murayama, 2008). Differentiating approach and avoidance strategies offers a fuller picture of their impact on learning and achievement. It is also essential to determine whether motivational regulation operates as a global construct or comprises distinct, specific dynamics—an inquiry that justifies exploration of second-order, bifactor, or more flexible factor structures.

The Present Study

Previous research on motivational regulation in the university-level context has exhibited methodological and conceptual limitations that undermine its applicability. Some studies did not evaluate the instrument's internal structure (Góes & Boruchovitch, 2017), while others conducted confirmatory factor analyses without reporting fit indices or dimension-specific reliability coefficients (Guo & Tang, 2022; Park, 2021). Modifications to the instrument's structure have sometimes been made without clear theoretical justification (Rojas-Ospina & Valencia-Serrano, 2019), and samples have often been restricted to specific contexts, limiting the generalizability of findings (Sánchez-Rosas et al., 2019). Moreover, several validations have relied on Cronbach's alpha rather than more appropriate estimates for ordinal data (Sánchez-Rosas et al., 2019), and the absence of normative data has hindered the interpretation of individual scores in applied settings (Sánchez-Rosas et al., 2019).

To address these limitations, the present study has three primary objectives: (1) examine the instrument's internal structure through factor analysis, factorial invariance testing, and assessment of internal consistency; (2) analyze evidence of concurrent validity by exploring relationships with

procrastination and learning approaches (Tait et al., 1998; Tuckman, 1991); (3) develop normative data to facilitate the interpretation of individual scores in educational contexts.

Accordingly, confirmatory and structural factor analyses comparing multiple models (CFA, bifactor, ESEM, BESEM, and HESEM) were conducted to identify the best fit, thereby overcoming structural validation shortcomings in previous work (e.g., Rojas-Ospina & Valencia-Serrano, 2019; Sánchez-Rosas et al., 2019). Measurement invariance between university students in Buenos Aires and Córdoba was also tested to bolster the instrument's cross-cultural validity. Reliability was estimated using the Omega coefficient rather than Cronbach's alpha, yielding a more precise measure for ordinal data. Concurrent validity was examined via the instrument's associations with procrastination and learning approaches. Finally, normative data were produced to improve the practical interpretation of individual scores in higher education.

This study aims to advance the validation of the MRSQ (Sánchez-Rosas et al., 2019; Wolters & Benzon, 2013) by addressing prior methodological and conceptual gaps. Its contributions to the university setting include a deeper understanding of motivational regulation—which is vital for persistence, effort, and academic engagement (Fong et al., 2024; Villar et al., 2024)—and a more precise assessment tool with both research and educational applications. By examining links with procrastination and learning approaches, it provides evidence of the construct's impact on academic performance and informs strategies to strengthen student self-regulation. Finally, the development of normative data enhances score interpretation, thereby supporting improvements in learning and performance in higher education.

Methods

Participants

Data were collected via convenience sampling.

Internal structure analysis: A total of 412 university students from Buenos Aires participated (82.4 % women), aged 18 to 60 years (M = 27.46, SD = 8.19, Mdn = 24). They were enrolled in various faculties: Psychology (48.7 %), Medicine (10.0 %), Engineering (8.8 %), Economics (7.5 %), Social Sciences (5.6 %), Exact and Natural Sciences (5.1 %), Philosophy (4.6 %), Law (3.6 %), Design and Architecture (3.2 %), and Arts (2.9 %). Most attended public universities (78.3 %), with the remainder at private institutions (21.7 %).

Measurement invariance and internal consistency analysis: The same Buenos Aires sample (n = 412) and an additional sample of 529 university students from Córdoba (63.1 % women), aged 18 to 59 years (M = 23.61, SD = 4.70, Mdn = 23) were employed, drawn from two faculties: Exact, Physical, and Natural Sciences (50.9 %) and Psychology (49.1 %). This Cordoban data set was originally collected for the Argentine adaptation of the MRSQ (Sánchez-Rosas et al., 2019), and permission was granted by the authors to use their database.

Concurrent validity evidence analysis: A subsample of 249 Buenos Aires students (81.7 % women; age range 18–58, M = 28.14, SD = 8.67, Mdn = 25) completed, in addition to the MRSQ, the Tuckman Procrastination Scale and the Approaches and Study Skills Inventory for Students. These students represented a range of faculties: Psychology (30.2 %), Medicine (13.7 %), Engineering (10.9 %), Economics (10.5 %), Social Sciences (8.5 %), Exact and Natural Sciences (7.3 %), Design and Architecture (5.2 %), Law (5.2 %), Philosophy (4.4 %), and Arts (4.0 %).

Instruments

Motivational Self-Regulation Strategies Questionnaire (MRSQ; Wolters & Benzon, 2013): The Cordoban-adapted version validated by Sánchez-Rosas et al. (2019) was employed, which demonstrated satisfactory psychometric properties. This 37-item instrument measures eight motivational self-regulation dimensions, each rated on a five-point Likert scale from *Never* to *Always*: Regulation of Performance-Avoidance Goals (e.g., "I tell myself I must keep studying because my goal is to avoid doing worse than others in this course."), Regulation of Mastery-Avoidance Goals (e.g., "I think I should keep working because my aim is to avoid learning less than I could."), Self-consequence (e.g., "I promise myself I can do something I enjoy later if I finish the assigned work."), Regulation of Mastery-Approach Goals (e.g., "I challenge myself to complete the work because my goal is to understand most of the material."), Regulation of Performance-Approach Goals (e.g., "I remind myself that my objective is to perform better than other students."), Regulation of Situational Interest (e.g., "I make studying more

enjoyable by turning it into a game."), Environmental Structuring (e.g., "I ensure I have as few distractions as possible."), Regulation of Value (e.g., "I try to connect the material to something I like or find interesting.").

Tuckman Procrastination Scale (TPS; Tuckman, 1991): The TPS assesses academic procrastination with 15 items on a five-point Likert scale. The Argentine university adaptation by Tisocco and Fernández-Liporace (2021) was employed, which confirmed a unidimensional structure and excellent internal consistency (ordinal α = .90). In the present subsample (*n* = 249), the omega coefficient was ω = .923.

Approaches and Study Skills Inventory for Students (ASSIST; Tait et al., 1998): The locally adapted version was applied, measuring three learning approaches—Deep, Surface, and Strategic—across 17 statements on a five-point Likert scale. The instrument shows robust validity (factor structure and invariance) and high reliability for its dimensions (all α > .80; Freiberg-Hoffmann et al., 2023). In our subsample (*n* = 249), internal consistency was ω_Surface = .753, ω_Deep = .818, and ω_Strategic = .782.

Ad hoc sociodemographic and academic questionnaire: Developed to collect participants' background information.

Procedure

The study received approval from the Ethics Committee of the Faculty of Psychology at the University of Buenos Aires (CEI24012). Data were collected online via a Google Forms questionnaire. Students were invited to participate through Facebook groups of students from various disciplines and universities in Buenos Aires. Invitations were posted every fortnight over the course of one semester. Participants were informed of the study's purpose and of the voluntary and anonymous nature of their involvement. Only after reading and consenting to these terms did they proceed to complete the instruments. No financial compensation or academic credit was offered.

Data Analysis

Internal structure was examined using polychoric correlation matrices and the *Weighted Least Squares Mean- and Variance-adjusted* estimator (WLSMV; Freiberg-Hoffmann et al., 2013). Model fit was evaluated with the Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA). Values ≥ .90 for CFI and TLI and ≤ .08 for RMSEA indicate acceptable fit, while values ≥ .95 for CFI and TLI and ≤ .06 for RMSEA are considered optimal (Jordan-Muiños, 2021). Standardized residuals were also inspected: values near 0 indicate good fit, those > 1.96 suggest poor fit, and values > 2.58 denote lack of fit (Schermelleh-Engel et al., 2003; Xiong et al., 2025).

For measurement invariance, the Buenos Aires sample from this study was compared with the Córdoba sample used in the Argentine adaptation of the MRSQ (Sánchez-Rosas et al., 2019) to test metric equivalence. Six nested models were evaluated: Configural (no constraints), Weak invariance (factor loadings constrained), Strong invariance (loadings and intercepts constrained), Strict invariance (loadings, intercepts, and item residuals constrained), Latent variance–covariance invariance (loadings, intercepts, residuals, and latent variances/covariances constrained), Latent means invariance (all of the above plus latent means constrained) (Millsap, 2011).

Invariance was assessed by changes in CFI (ΔCFI < .01) and RMSEA (ΔRMSEA < .015) between nested models (Rojas et al., 2018).

Internal consistency for the Buenos Aires, Córdoba, and total samples was estimated using McDonald's omega, which is more appropriate for ordinal data than Cronbach's alpha (Doval et al., 2023). To test the stability of reliability across samples, omega coefficients for each dimension were compared against their confidence intervals in the other samples: overlapping intervals support the hypothesis of no difference in reliability across groups (Barrios & Cosculluela, 2013; Cumming & Finch, 2005). All analyses were conducted with Mplus 8.

Results

Internal Structure Analysis

To analyze the instrument's internal structure, several models were tested to determine which fit the empirical data best. First, using confirmatory factor analysis (CFA), a Model 1 of eight first-order factors (Figure 1) was evaluated, then a Model 2 of eight second-order factors (Figure 2), and a Model 3 bifactor model (Figure 3). Next, via exploratory structural equation models, a Model 4 ESEM with eight

first-order factors (Figure 4), followed by a Model 5 BESEM bifactor (Figure 5), and finally a Model 6 HESEM hierarchical model (Figure 6) were tested.

Of all the models tested, the one rendering the best fit was Model 1, corresponding to the first-order eight-factor CFA (Table 1). All estimated parameters in the first-order model were statistically significant. Of the 37 items, 34 obtained optimal regression coefficients, exceeding .70 (Table 2). All standardized residuals were below 1.

Table 1

Fit Indices

Models	CFI	TLI	RMSEA
Model 1 (CFA)	.987	.986	.048 [.044-.052]
Model 2 (Second Order CFA)	.952	.949	.091 [.087-.094]
Model 3 (Bifactor)	.954	.948	.091 [.088-.095]
Model 4 (ESEM)	.955	.925	.051 [.046-.056]
Model 5 (BESEM)	.968	.941	.045 [.039-.050]
Model 6 (HESEM)	.939	.904	.057 [.053-.062]

Table 2

Estimated Parameters

Item	λ	R^2	Item	λ	R^2
M1	.635	.403	M20	.892	.796
M2	.789	.622	M21	.928	.861
M3	.684	.468	M22	.914	.836
M4	.743	.551	M23	.947	.897
M5	.793	.630	M24	.965	.931
M6	.924	.853	M25	.943	.890
M7	.873	.761	M26	.949	.900
M8	.814	.662	M27	.944	.892
M9	.920	.846	M28	.813	.661
M10	.891	.794	M29	.888	.788
M11	.915	.838	M30	.846	.716
M12	.680	.463	M31	.911	.830
M13	.933	.870	M32	.832	.692
M14	.949	.900	M33	.898	.807
M15	.830	.689	M34	.912	.832
M16	.846	.715	M35	.889	.791
M17	.784	.614	M36	.932	.868
M18	.874	.765	M37	.901	.811
M19	.898	.807			

Figure 1

Model 1 first-order model

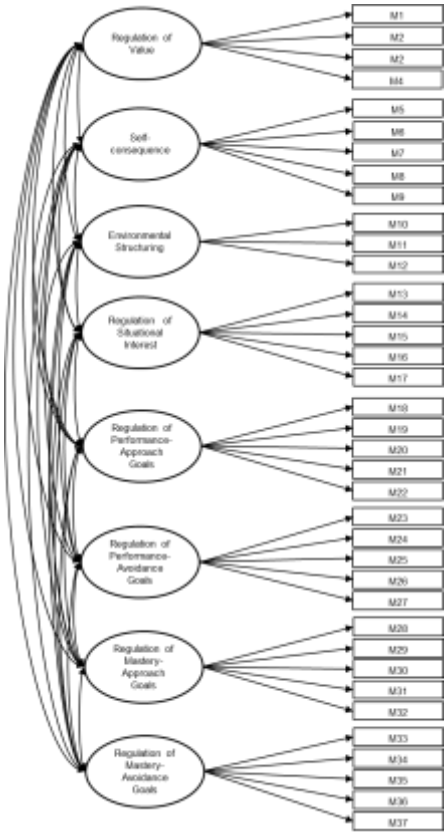


Figure 2

Model 2 second order model

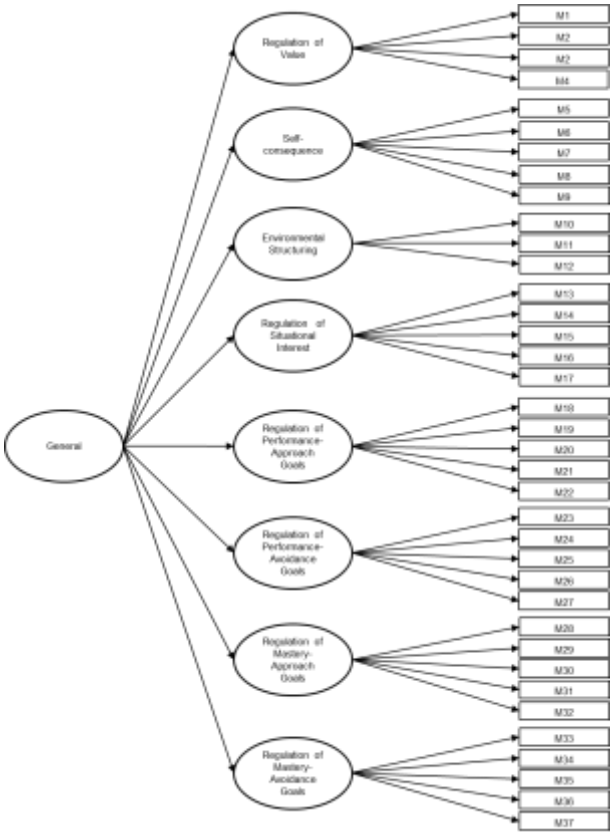


Figure 3

Model 3 bifactor

Figure 4

Model 4 ESEM

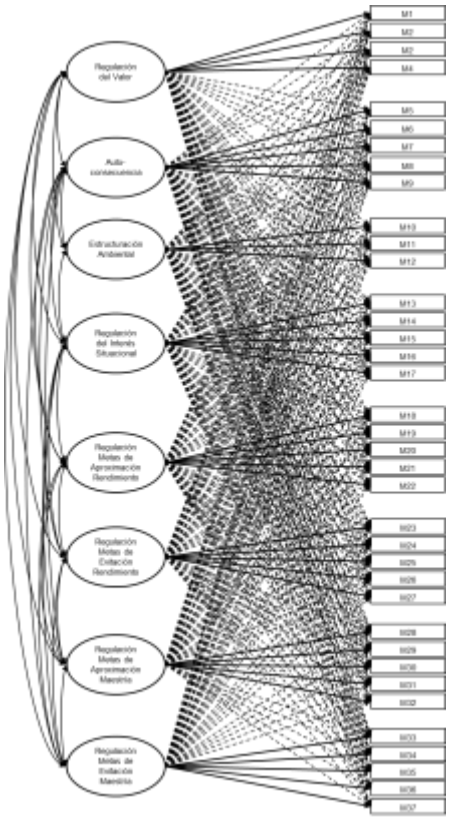


Figure 5

Model 5 BESEM

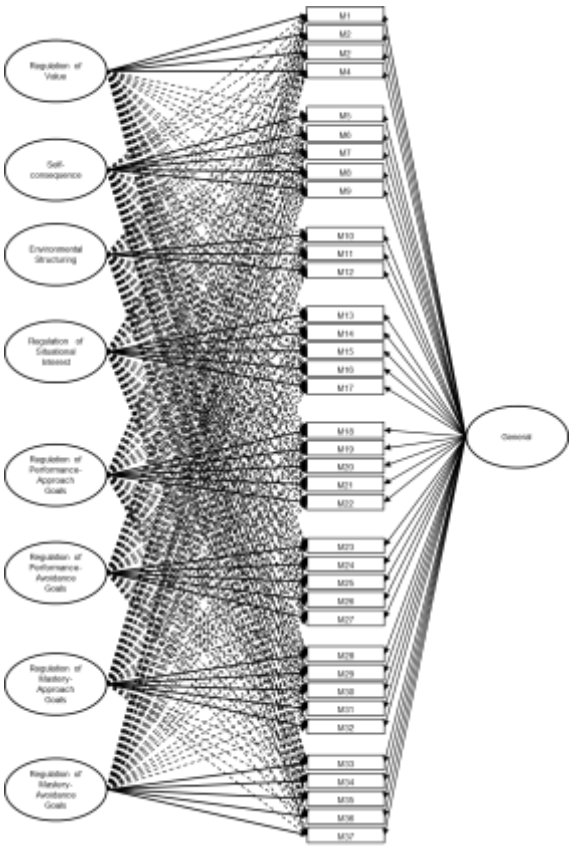
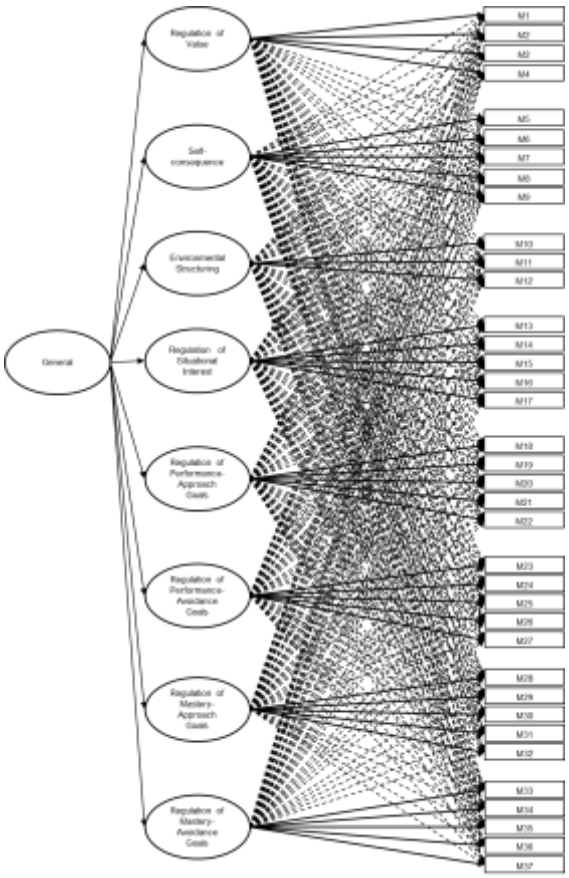


Figure 6

Model 6 HESEM



Factorial Invariance and Internal Consistency Analysis

The metric invariance of the instrument's structure was tested between university students from Buenos Aires and Córdoba. Six nested models were evaluated, progressively imposing different levels of constraint. Metric equivalence of the instrument's structure was confirmed across both samples (Table 3).

Table 3

Measurement invariance

Models	CFI	ΔCFI	TLI	ΔTLI	RMSEA [IC90%]	ΔRMSEA
M1	.985	-	.984	-	.048 [.046-.051]	-
M2	.987	-.002	.985	-.001	.046 [.043-.048]	.002
M3	.987	0	.987	-.002	.043 [.041-.046]	.003
M4	.986	.001	.987	0	.043 [.041-.046]	0
M5	.986	0	.987	0	.043 [.041-.046]	0
M6	.986	0	.986	.001	.044 [.041-.046]	-.001

Note. M1: Configural; M2: Weak; M3: Strong; M4: Strict; M5: Latent variance-covariance; M6: Latent Means.

Internal consistency for each dimension was then estimated using the omega coefficient for the total sample and for the Buenos Aires and Córdoba subsamples. Values ranged from adequate to optimal. The omega coefficients for each dimension were compared across the three groups—Total, Buenos Aires, and Córdoba—and showed similar internal consistency in all cases except for the dimensions Value Regulation, Situational Interest Regulation, and Performance-Avoidance Goal Regulation (Table 4).

Table 4

Internal Consistency Analysis

	Buenos Aires (*n* = 412)	Córdoba (*n* = 529)	Total (*n* = 941)
Regulation of Value	.768 [.729-.803]	.684 [.638-.726]	.726 [.696-.754]
Self-consequence	.915 [.901-.927]	.924 [.913-.934]	.920 [.912-.928]
Environmental Structuring	.823 [.791-.851]	.812 [.782-.838]	.818 [.797-.837]
Regulation of Situational Interest	.890 [.872-.906]	.861 [.841-.879]	.876 [.863-.888]
Regulation of Performance-Approach Goals	.928 [.916-.938]	.922 [.911-.932]	.925 [.917-.932]
Regulation of Performance-Avoidance Goals	.963 [.957-.968]	.944 [.936-.951]	.954 [.949-.958]
Regulation of Mastery-Approach Goals	.898 [.882-.913]	.902 [.888-.915]	.901 [.891-.911]
Regulation of Mastery-Avoidance Goals	.933 [.922-.943]	.924 [.913-.934]	.928 [.920-.935]

Concurrent Validity Evidence Analysis

The dimensions of the Motivational Self-Regulation Strategies Questionnaire (MRSQ) were correlated with those of the Approaches and Study Skills Inventory for Students (ASSIST) and the Tuckman Procrastination Scale (TPS). Several statistically significant associations, coherent with theoretical expectations, were observed (Table 5). Next, normative data for Buenos Aires students were calculated by establishing cutoff scores at the 25th and 75th percentiles (Table 6).

Tabla 5

Concurrent Validity Analysis (n = 249)

MRSQ	TPS	ASSIST		
	Procrastination	Deep Approach	Superficial Approach	Strategic Approach
Regulation of Value	-.105	.495**	-.085	.281**
Self-consequence	-.079	.133**	-.011	.264**
Environmental Structuring	-.244**	.282**	-.050	.331**
Regulation of Situational Interest	-.190**	.277**	-.032	.300**
Regulation of Performance-Approach Goals	.058	.100	.207**	.141**
Regulation of Performance-Avoidance Goals	.124	.016	.332**	.017
Regulation of Mastery-Approach Goals	-.246**	.331**	-.187**	.422**
Regulation of Mastery-Avoidance Goals	-.088	.206**	.072	.256**

Table 6

*Statistical Norms (*n = *412)*

	Low P < 25	Moderate 25 ≤ P ≤ 75	High P > 75
Regulation of Value	< 12	12-17	>17
Self-consequence	< 10	10-19	> 19
Environmental Structuring	< 8	8-12	> 12
Regulation of Situational Interest	< 7	7-14	> 14
Regulation of Performance-Approach Goals	< 5	5-14	> 14
Regulation of Performance-Avoidance Goals	< 5	5-15	> 15
Regulation of Mastery-Approach Goals	< 18	18-24	> 24
Regulation of Mastery-Avoidance Goals	< 10	10-20	> 20

Discussion

This study aims to overcome the methodological, conceptual, and applied limitations of previous research (Góes & Boruchovitch, 2017; Guo & Tang, 2022; Park, 2021; Rojas-Ospina & Valencia-Serrano, 2019; Sánchez-Rosas et al., 2019). To this end, an instrument with a solid operational definition and theoretical framework was validated, applying a rigorous methodology that included appropriate analyses for categorical variables as well as evidence of internal and external validity.

Within this framework, the psychometric properties of the Argentina-adapted version of the MRSQ (Sánchez-Rosas et al., 2019) were investigated. Its internal structure was examined, and evidence of concurrent validity in university students from Buenos Aires was gathered with the goal of transferring this technology into practice via a psychometric tool that facilitates motivation assessment.

Moreover, the instrument's practical utility in educational settings was prioritized by developing statistical norms that enable practitioners not only to use a valid and reliable measure but also to interpret its results correctly.

The procedure began with the analysis of the locally adapted MRSQ's internal structure. Several confirmatory factor analysis (CFA) models were tested—eight first-order factors (Model 1), eight second-order factors (Model 2), and a bifactor model (Model 3)—as well as exploratory structural equation models (ESEM): eight factors (Model 4), eight hierarchical factors (Model 5), and a bifactor structure (Model 6). Among these, the first-order eight-factor CFA demonstrated the best fit indices. All estimated parameters in this model were statistically significant, and 34 of the 37 items showed optimal factor loadings above .70 (i.e., $R^2 > .50$), indicating that each of these items explains more than 50 % of its variance by the associated latent factor (Chicco et al., 2021). The three items falling below the .70 threshold were item 1 ("I imagine situations in which knowing the material or skills would be useful to me") and item 3 ("I strive to relate what I'm learning to my personal interests"), both within the Value Regulation factor, and item 12 ("I change my environment to make it easier to concentrate on my work"), from the Environmental Structuring dimension. Although these items are somewhat less representative of their respective dimensions, their loadings exceed .40 and are therefore acceptable. Practically, this finding allows users of the instrument to pinpoint the most salient items and, in reporting, highlight students' strengths and weaknesses based on their responses to these specific items. Overall, these results provide additional empirical support for the proposed model in the Argentinean Cordoban adaptation.

Then, in order to provide additional evidence concerning the instrument's internal structure, a measurement invariance analysis was conducted between the Buenos Aires and Córdoba student samples. This study tested the metric equivalence of the locally adapted MRSQ. Invariance of the instrument's structure across both provinces was confirmed, meaning that students in Córdoba and Buenos Aires interpret and respond to the items in the same way (Putnick & Bornstein, 2016).

Continuing our examination of internal structure, the internal consistency of each dimension was assessed by estimating McDonald's omega coefficient. All dimensions yielded values in the adequate-to-excellent range. In the Avoidance-Performance Goal Regulation dimension, omega exceeded .95 in both the Argentina sample and the overall sample. Such a high coefficient may indicate item redundancy, which can lead to under-representation of the construct. Accordingly, developing additional items with more heterogeneous content is recommended to improve construct coverage; this will be considered in future revisions (Panayides, 2013).

After evaluating consistency, the coefficients obtained in the present study were compared with those reported for the Córdoba sample and the total combined sample to determine whether item homogeneity differed across the three groups. Significant differences were found in the dimensions of Avoidance-Performance Goal Regulation, Value Regulation, and Situational Interest Regulation: items in these three dimensions demonstrated higher consistency in the Buenos Aires sample. This discrepancy may stem from differences in academic programs represented in the Buenos Aires versus Córdoba samples, since students' use of motivational strategies can vary by discipline (American Educational Research Association et al., 2014). Therefore, it would be important to replicate this analysis with more homogeneous samples to ascertain whether program-level differences truly affect score reliability.

Turning to concurrent validity, theoretically coherent results that further support the instrument's quality were observed. With respect to procrastination, consistent with Wolters and Benzon (2013), not all motivational regulation strategies correlated significantly with this construct. Negative associations emerged only between procrastination and Environmental Structuring, Situational Interest Regulation, and Mastery-Approach Goal Regulation, which Wolters and Rosenthal (2000) likewise identified as key strategies students use to sustain effort and persist in academic tasks.

Regarding learning approaches, positive associations between the Deep approach and all MRSQ dimensions were found, except Performance-Approach and Performance-Avoidance Goal Regulation—a predictable pattern, since these performance-goal strategies, while related to striving for good grades,

do not necessarily reflect interest in understanding academic content (Entwistle et al., 2013; Sánchez-Rosas et al., 2019).

The Surface approach was positively associated with Performance-Approach and Performance-Avoidance Goal Regulation and negatively associated with Mastery-Approach Goal Regulation. This result aligns with the fact that both performance-goal dimensions—whether approach or avoidance—focus on achieving high academic performance for reasons such as competition, recognition, or fear of failure or embarrassment. In contrast, Mastery-Approach Goal Regulation is driven by the desire to understand the material being studied, which explains its negative relationship with the Surface approach (Sánchez-Rosas et al., 2019; Wolters & Rosenthal, 2000).

The Strategic approach, in turn, was significantly correlated with all MRSQ dimensions except Performance-Avoidance Goal Regulation. This lack of association is reasonable when considering that the Strategic approach focuses on the resources that students deploy to achieve good academic results—such as organization and time management. By contrast, the Performance-Avoidance Goal Regulation dimension concerns everything students do to avoid academic failure (Entwistle et al., 2013; Sánchez-Rosas et al., 2019).

Finally, statistical norms were calculated to enable the interpretation of dimension scores in applied settings. In this vein, education professionals who wish to use this tool can administer the MRSQ, interpret its scores, and then make decisions aimed at improving students' learning processes.

This study has some limitations. One pertains to the student sample, which was composed of nearly 50 % psychology majors, making it impossible to analyze measurement invariance across students from different academic disciplines. Data is expected to be continually collected from other degree programs to obtain a more representative and heterogeneous sample that will allow to study the metric equivalence of the instrument across students with different academic orientations. Another limitation is the absence of an objective measure of academic performance, which precluded conducting a study of the instrument's predictive validity with respect to that construct. Diverse information—such as years of study, total courses passed, and total courses failed— will be gathered to analyze the explanatory role of the instrument's dimensions in relation to university students' academic achievement. A final limitation worth mentioning relates to the cross-sectional nature of the study, which made it impossible to examine score stability over time and the longitudinal invariance of the MRSQ's structure. Conducting such studies becomes important when evaluating the effects of an intervention in applied settings; it is therefore expected to incorporate this type of evidence in the future.

In conclusion, this research aimed to transfer technology to the university-level context so that it can be used by education professionals. To that end, the psychometric properties of the MRSQ version adapted in Córdoba Province, Argentina were analyzed. The information provided by the tool is expected to facilitate the planning of activities both for instructors—through the implementation of teaching strategies—and for students—through workshops that teach them to self-regulate their motivational strategies—with the ultimate goal of promoting not only higher achievement but also increasingly effective learning.

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