

## Assessment of the psychometric properties of the Academic Self-Regulation Questionnaire (SRQ-A) in Chilean university students

### Evaluación de las propiedades psicométricas del Cuestionario de Autorregulación Académica (SRQ-A) en estudiantes universitarios chilenos

### Avaliação das propriedades psicométricas do Questionário de Autorregulação Acadêmica (SRQ-A) em universitários chilenos

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#### Abstract

**Introduction:** The self-determination theory represents a framework to understand the factors that facilitate academic motivation, a relevant construct for educational contexts. One of the most used instruments to measure the construct is the Academic Self-Regulation Questionnaire (SQR-A), but there is a lack of psychometric background on the assessment of this measurement model of the Spanish version. **Objective:** To assess the factorial structure, internal consistency, and validity of the Academic Self-Regulation Questionnaire (SQR-A), in a sample of Chilean university students. **Method:** The participants were 808 students from two Chilean universities. The measurement model was evaluated using confirmatory factor analysis (CFA). The validity and reliability were assessed using mean-variance extracted and composite reliability. **Results:** The results show that the four-factor measurement model shows adequate levels of fit, in addition to adequate levels of validity and internal consistency. **Conclusion:** The Spanish version of the SRQ-A is a useful measure to be applied in higher education contexts.

**Keywords:** self-determination theory; academic motivation; confirmatory factor analysis; multigroup invariance analysis

#### Resumen

**Introducción:** La teoría de la autodeterminación representa un marco para comprender los factores que facilitan la motivación académica, constructo relevante para los contextos educativos. Uno de los instrumentos más utilizados para medir el constructo es el cuestionario de autorregulación académica (SRQ-A), pero se carece de antecedentes psicométricos sobre la evaluación de este modelo de medida en su versión en español. **Objetivo:** Evaluar la estructura factorial, consistencia interna y validez del cuestionario de autorregulación académica (SQR-A) en una muestra de estudiantes universitarios chilenos. **Método:** Los participantes fueron 808 estudiantes de dos universidades chilenas. El modelo de medida se evaluó mediante análisis factorial confirmatorio (AFC). La validez y confiabilidad se evaluaron mediante la varianza media extraída y la fiabilidad compuesta. **Resultados:** Los resultados muestran que el modelo de medida de cuatro factores presenta niveles de ajuste adecuados, además de niveles adecuados de validez y consistencia interna. **Conclusión:** La versión en español del SQR-A constituye una medida útil para ser aplicada en contextos de educación superior.



**Palabras clave:** teoría de la autodeterminación; motivación académica; análisis factorial confirmatorio; análisis de invariancia multigrupo

### Resumo

**Introdução:** A teoria da autodeterminação representa um marco para compreender os fatores que facilitam a motivação acadêmica, construto relevante para os contextos educacionais. Um dos instrumentos mais utilizados para mensurar o construto é o questionário de autorregulação acadêmica (SRQ-A), mas faltam antecedentes psicométricos sobre a avaliação do modelo de medida da versão em espanhol do instrumento. **Objetivo:** Avaliar a estrutura fatorial, consistência interna e validade do questionário de autorregulação acadêmica (SQR-A) em uma amostra de estudantes universitários chilenos. **Método:** Os participantes foram 808 estudantes de duas universidades chilenas. O modelo de medida foi avaliado por meio de análise fatorial confirmatória (AFC). Validade e confiabilidade foram avaliadas por meio da variância média extraída e da confiabilidade composta. **Resultados:** Os resultados demonstram que o modelo de medida de quatro fatores apresenta níveis adequados de ajuste, bem como níveis adequados de validade e consistência interna. **Conclusão:** A versão em espanhol do SQR-A constitui uma medida útil para ser aplicada em contextos de ensino superior.

**Palavras-chave:** teoria da autodeterminação; motivação acadêmica; análise fatorial confirmatória; análise de invariância multigrupo

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The theory of self-determination (TSD; Deci and Ryan, 1985; Gordeeva et al., 2020), is one of the most influential and empirically supported perspectives for addressing human motivation. This perspective has been applied in different disciplines of psychology, mainly in the educational area with school students (Gomes et al., 2019; Gordeeva et al., 2020; Kröner et al., 2017) and higher education (Vansteenkiste et al., 2009; Vergara-Morales, 2018; Vergara-Morales et al., 2019), as well as in the traditional field of sport and work (Howard et al., 2017).

From the TSD, it is “assumed that people are active organisms, with natural tendencies towards psychological growth, in a continuous effort to integrate their experiences coherently with their will” (Vargas, 2013, p. 157). In this process, different forms of orientation to the environment emerge associated with the degree to which the regulation and onset of behavior are perceived. In this way, an autonomous causal orientation can be observed when the “behavior is self-determined and emanates from an integrated sense of self. There is a consistency between behaviors, thoughts, feelings, and needs” (Stover et al., 2017, p.109). On the other hand, causal orientation is controlled when behavior is based on external impositions or internal imperatives that pressure its development.

In this regard, it is proposed that the orientations are distributed in a continuum according to the degree of autonomy or control of behavior (Deci & Ryan, 2012; Ryan & Deci, 2000) based on the perceived locus of causality (Stover et al., 2017; Turban et al., 2007). In this sense, while individuals perceive an internal locus of causality, they show higher effort and satisfaction with the development of activities (Ryan & Deci, 2000). This type of behavior can be oriented from *intrinsic regulation*, which in the educational field can be observed when students act with a heightened degree of autonomy, promoting

the interest and commitment inherent in the development of learning activities (Howard et al., 2016a). On the other hand, behaviors based on the internal locus of causality can also be oriented from the *identified regulation*, which, although it implies a lower degree of self-determination, represents behaviors accepted and valued personally as important, where students are involved and persist in the development of academic activities considered personally relevant (Litalien et al., 2017).

As behavior moves away from the pole of autonomy and external control becomes more relevant, *introjected regulation* arises, which involves engaging in behaviors to reduce negative feelings or to avoid anxiety, shame, or guilt for failure. Finally, at the end of the continuum, we find behaviors oriented from *external regulation*, which has been described as an impoverished form of motivation in which actions are performed by external restrictions (Gomes et al., 2019). Both introjected regulation and external regulation involve an external locus of causality, from which individuals feel induced or pressured to act for a contingency, rewards, or to avoid punishment (Ryan & Deci, 2020).

In education, research has shown that the quality and quantity of motivation concerning the autonomy versus control continuum are associated with cognitive, behavioral, and emotional outcomes (Gordeeva et al., 2020). Students who present greater autonomy (intrinsic and identified regulation), display a higher quality of motivation, which is associated with high levels of academic performance, increased commitment, and learning (Deci & Ryan, 2012; Taylor et al., 2014; Vergara-Morales, 2018). On the other hand, those who present a greater predisposition to control (introjected and external regulation), that is, manifest a lower quality motivation, evidence negative behaviors towards learning, related to greater distraction, anxiety, and lower academic performance (Ryan & Deci, 2020; Taylor et al., 2014; Vansteenkiste et al., 2009). In addition, it has been shown that academic motivation has a direct impact on university permanence (Díaz et al., 2019), is crucial in academic performance (Taylor et al., 2014), in the perception of self-efficacy (Fatima et al., 2018) and learning experiences (Pintrich, 2003), since it implies the degree to which students strive, they persist and direct their behavior towards academic activities (Maulana et al., 2016). Therefore, it constitutes a fundamental psychological process in behavior, since it raises the possibility that people differ in their interests, persistence and commitment when performing different tasks (Gomes et al., 2019).

According to the TSD, one of the most used instruments to measure academic motivation has been the academic self-regulation questionnaire (SRQ-A; Ryan & Connell, 1989), which measures how participants regulate their behavior to engage in learning activities. In this sense, it is composed of 16 items that evaluate four motivational orientations based on the perceived degree of relative autonomy: (1) intrinsic regulation, (2) identified regulation, (3) introjected regulation and (4) extrinsic regulation. Studies of factorial structure have supported its reliability and validity. Researchers Ryan & Connell (1989) initiated the continuum hypothesis by arguing that the four subdimensions are arranged in a simple pattern, characterized by strong correlations of adjacent regulations. This factorial structure has been observed in research conducted with primary school students (Alivernini et al., 2011; Gomes et al., 2019), secondary and university (Vansteenkiste et al., 2012). The subsequent application of the instrument involved the creation of two subcomponents calculated by averaging the intrinsic regulation and identified regulation scores (autonomous motivation), in addition to the introjected regulation and external regulation (controlled motivation) scores. Through the principal components analysis, it was observed that the subcomponents explained 48% of the motivation items (Vansteenkiste et al., 2009).

While the background shows that SQR-A has been highly used in educational research in countries such as Germany (Gnambs & Hanfstingl, 2014; Kröner et al., 2017), Belgium (Vansteenkiste et al., 2009), China (Vansteenkiste et al., 2005), Japan (Carreira, 2012) and Portugal (Gomes et al., 2019), whose results have shown adequate levels of adjustment for the original four-factor measurement model, no background was found on the evaluation of psychometric properties of the Spanish version. Because academic motivation “represents an indispensable part in the development of learning processes, since it activates behavior towards the achievement of academic goals” (Vergara-Morales et al., 2019, p.464), it is pertinent to extend the availability of instruments with adequate psychometric properties to measure the construct. Therefore, the objective of the study is to evaluate the factorial structure, internal consistency, and validity of the academic self-regulation questionnaire (SQR-A) in a sample of Chilean university students.

Based on the psychometric background of the SQR-A, a measurement model composed of four latent factors is evaluated: (a) intrinsic regulation, (b) identified regulation, (c) introjected regulation, and (d) extrinsic regulation (Ryan & Connell, 1989; Vansteenkiste et al., 2009). The research hypotheses focus on the evaluation of the internal structure, reliability, and validity of the measurement model: (1) for the CFA, an adequate fit is expected for the four-factor model, (2) in terms of the evidence of the internal consistency, composite reliability values  $\geq .70$  are expected, (3) for the convergent validity of the internal structure of the measurement model, an average variance extracted (AVE) value  $> .50$  is expected, and in the case of the discriminant validity, is expected a value of  $\sqrt{VME}$  greater than the coefficient of correlation between the factors.

## Method

### Participants

The participants were a total of 808 first-year university students from two Chilean universities. 61.6 % of the students were women ( $n = 498$ ), 37.9 % were men ( $n = 306$ ), and 0.5 % did not indicate a preference ( $n = 4$ ). The age of the participants ranged between 16 and 52 years, with a mean age of 19.80 years ( $SD = 3.23$ ). The highest percentage of participants was studying a career in the area of health sciences (32.9%), followed by the area of education sciences (25.5 %), engineering (20.5 %), social sciences (19.7 %), and sea sciences (1.4 %). An incidental non-probabilistic sampling was used, considering intact cohorts for the selection of students.

### Instrument

*Academic Self-Regulation Questionnaire* (SQR-A; Ryan and Connell, 1989): it is used a version developed by Vansteenkiste et al. (2005), which has been applied satisfactorily in previous studies, showing adequate validity and internal consistency (Del Valle et al., 2020; Vansteenkiste et al., 2009; Vansteenkiste et al., 2012; Vergara-Morales, 2018; Vergara-Morales & Del Valle, 2021; Vergara-Morales et al., 2019). It is composed of 16 items that measure the types of behavioral regulation that guide the way in which students engage in academic activities. The items are distributed in four factors: (a) intrinsic regulation (4 items, e.g., “Because it is fun), (b) identified regulation (4 items, e.g., “Because I want to learn new things”), (c) introjected regulation (4 items, e.g., “Because I would feel guilty if I didn't study”), and (d) external regulation (4 items, e.g., “Because I'm supposed to”). In this research, the Spanish version used by Vergara-Morales (2018) was applied, which comes from direct and reverse translation processes (translation-back translation), considering the stages of Beaton et al. (2000).

## Procedure

To carry out the research, the corresponding authorizations were requested from the academic institutions. The instrument was applied by a previously trained professional, considering the voluntary participation of the students. The research was carried out following the ethical criteria of the American Psychological Association (APA). After receiving approval from the Ethics Committee of the University of Playa Ancha, Chile, the instrument was applied. Informed consent was obtained from the students, guaranteeing confidentiality, anonymity, and voluntary participation. The administration of the instrument was carried out online, at the beginning of the 2021 academic year.

## Data analyses

The internal consistency of the data was assessed using the composite reliability coefficient (FC), considering a lower limit of 0.70 to identify acceptable reliability (Hair et al., 2010). The factor structure was assessed using confirmatory factor analysis (CFA), considering the WLSMV estimation method to assess the fit of the hypothetical model to the observed data. The adequacy of the measurement model was evaluated considering the following indices and criteria: (a)  $\chi^2/df$ : an acceptable fit is indicated with values  $< 5.00$  (Diamantopoulos & Sigauw, 2000); (b) comparative fit index (CFI) and Tucker-Lewis index (TLI): an acceptable fit is indicated by values  $\geq .90$  and a good fit is determined by values  $\geq .95$ ; (c) The root mean square error of approximation (RMSEA): an acceptable fit is determined by values  $\leq .08$  (90% CI  $\leq .10$ ), and a good fit is indicated by values  $\leq .06$  (90% CI  $\leq .08$ ) (Kelloway, 2015). The analyses were carried out with the statistical program Mplus version 8. To evaluate the equivalence of the SQR-A measurement model, a multi-group confirmatory factor analysis (CFAM) (Brown, 2006) was carried out, considering all the male and female participants. ( $N = 804$ ). To analyze the factorial invariance, a sequential evaluation of the configural, metric, and scalar invariance was performed. The invariance of the measurement model is accepted if the CFI values present a variation  $\leq .01$  in relation to the previous model (Cheung & Rensvold, 2002).

Internal structure validity was assessed through convergent and discriminant validity. Convergent validity was analyzed by calculating the average variance extracted (VME), from which the relationship between the variance captured by a certain factor with respect to the total variance due to the measurement error of said factor is observed (Cheung & Wang, 2017). VME values greater than .50 allow us to accept convergent validity (Hair et al., 2014). To calculate the discriminant validity, the  $\sqrt{AVE}$  was analyzed, from which it is evaluated if a specific factor differs from other constructs. Discriminant validity is accepted if the  $\sqrt{AVE}$  is greater than the correlation coefficient between the instrument factors (Henseler et al., 2015).

## Results

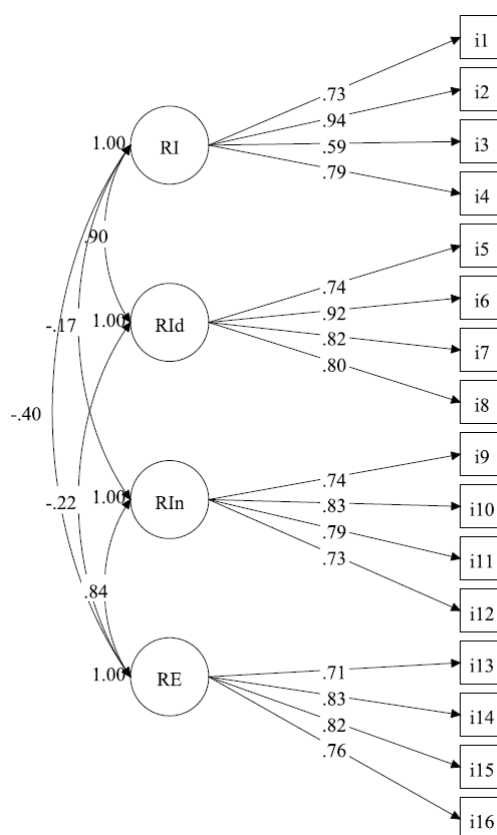
### Confirmatory factor analysis

Table 1 shows that the results obtained for the four-factor measurement model showed a good fit to the observed data since all the values of the indices were within the recommended limits ( $\chi^2/df = 4.82$ ; CFI = .97; TLI = .96; RMSEA = .07).

**Table 1**  
*CFA fit indices*

Model	$\chi^2/df$	CFI	TLI	RMSEA	RMSEA (90% CI)
4 factors	4.82	.97	.96	.07	.06-.08

The items of the four-factor measurement model were strongly correlated with the latent variables they measure since the standardized factor loads presented values greater than .50. Moreover, they were statistically significant at a level of  $p < .01$  (see figure 1).

**Figure 1**  
*Standardized coefficients*

*Note.* RI: Intrinsic regulation; RId: Identified regulation; RIn: Introjected regulation; RE: External regulation.

### Multigroup confirmatory factor analysis

Table 2 shows the results of the invariance analysis of the measurement model between female and male students. The analysis considered the following: (1) a base model that establishes the same factor loading pattern for both groups (*configural invariance*); (2) the base model was restricted to the factor loadings, evaluating the *metric invariance*; and (3) a restriction on the intercepts of the items was incorporated to assess *scalar invariance*. From the values of the fit indices, the invariance of the measurement model between men and women is accepted, since the variation in the CFI values was

less than .01. Furthermore, the TLI and RMSEA values are within the recommended limits for all invariance models.

**Table 2**

*Invariance measures between men and women*

Models	CFI	$\Delta$ CFI	TLI	RMSEA
Configural	0.92	-	0.90	0.07
Metric	0.92	0.00	0.91	0.07
Scalar	0.92	0.00	0.91	0.07

### Reliability and validity analysis

The results of the reliability analysis show that the four-factor measurement model showed scores with adequate levels of internal consistency since the values of the composite reliability coefficient (FC) were greater than .70. Furthermore, it was observed that the VME values were greater than .50, so the convergent validity of the measurement model is accepted. Finally, it was identified that the  $\sqrt{\text{VME}}$  values were higher than the correlation coefficients between factors of the scale, so discriminant validity is accepted (see Table 3).

**Table 3**

*Correlation, reliability and validity statistics*

Variables	1	2	3	4	FC	VME	$\sqrt{\text{VME}}$
1. Intrinsic regulation	1.00	.62**	-.06	-.23**	0.85	0.60	0.77
2. Identified regulation		1.00	.05	-.08*	0.89	0.68	0.82
3. Introjected regulation			1.00	.64**	0.86	0.60	0.77
4. External regulation				1.00	0.86	0.61	0.78

### Discussion and conclusion

The objective of the research was to evaluate the factorial structure, internal consistency and validity of SRQ-A in a sample of Chilean university students. The study emerged from the need to expand the coverage of instruments with adequate psychometric properties to observe academic motivation from the theory of self-determination, in the context of Chilean higher education. This is because the lack of psychometric background on the application of the SRQ-A version in the Spanish language was identified.

The results obtained through the TDS allow to support the four-factor structure of the SRQ-A measurement model, so there is sufficient statistical evidence to affirm that the factorial solution of the originally proposed scale is maintained (Ryan & Connell, 1989; Vansteenkiste et al., 2009). The structure has also been observed in studies carried out in different countries (Carreira, 2012; Gomes et al., 2019; Kröner et al., 2017; Vansteenkiste et al., 2012). It was observed that the adjacent loads of the four latent factors correlated significantly and the extremes negatively. These results reveal the simple structure consistent with the assumption of the TSD continuum, where theoretically contiguous subscales have stronger positive correlations than distant subscales which correlated negatively (Ryan & Connell, 1989; Howard et al., 2016b; Vansteenkiste et al., 2009).

The comparison of the measurement model between male and female university students showed that the four-factor model is equivalent in both groups. In this way, the factorial invariance of the measurement model in terms of factorial loads and intercepts was confirmed. Furthermore, the findings have an adequate level of validity and reliability in Chile's higher education system. This is because they show adequate scores in terms of internal consistency and consistency with the theoretical construct. Therefore, it can be concluded that the four-factor measurement model is consistent and stable relative to the original model.

Based on the findings, we conclude that the SRQ-A's factorial structure, validity, and reliability have been satisfactory, since a factorial solution like the original measurement model was obtained, with adequate and stable psychometric properties. Thus, the Spanish version of the SRQ-A allows for reliable and valid measurements of academic motivation of Chilean students in higher education. There are practical implications for the teaching-learning process, since it allows assessment of academic motivation according to different styles of regulating behavior, allowing the inference of orientations that facilitate and hinder engagement of students in academic activities. This could support the orientation of strategies that support student autonomy. In this sense, it will be possible to support the achievement of learning goals, through the promotion of teaching environments that facilitate the initiative and sense of choice of students to get involved in the educational process.

One of the limitations of the study refers to the restriction of the age range of the sample of university students, so it is considered important to check if the four-dimensionality of the measurement model is observed with participants of different ages. Another limitation is that SRQ-A scores were not correlated with external variables. It would be interesting if subsequent research were aimed at checking the predictive validity of the instrument, by contrasting it with other measures relevant to the educational context, to provide practical elements for the teaching-learning process. Therefore, it is relevant that subsequent studies incorporate this type of analysis to extend the evidence of the validity of the measurement model.

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