Rasch Analysis on the Academic Motivation Scale in Portuguese University Students

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ABSTRACT

Academic motivation has been associated with important outcomes in different education contexts. The goal of the current study was to explore the psychometric properties of the Academic Motivation Scale (AMS) based on the assumptions of the Rating Scale Model (RSM) to provide an effective instrument in assessing academic motivation in Portuguese students. The sample comprised 360 Portuguese university students that were assessed with the AMS adapted for online data collection. The results showed that the original version of the AMS with seven-category response scale might not work properly with Portuguese university students. Different alternatives were tested by collapsing anchors in the endpoints and midpoint of the original response scale. This analysis revealed that the most suitable solution relies on a five-category response system with midpoint anchors collapsed. This final solution showed good overall fit according to the guidelines proposed for the RSM.

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Introduction

The self-determination theory is a theoretical model proposing that humans have innate psychological needs that drive the development and growth of individuals. The degree to which this intrinsic motivation is fulfilled relates to the influence of different individual psychological needs. The fulfillment of these needs may be considered as the precursor of intrinsic motivation that results from three types of major needs: the need for competence, the need for autonomy, and the need for relatedness (Deci & Ryan, 1985; 2000; Ryan & Deci, 2000).

    The reasons such as willingness and volition that underlie human behavior comprise motivation (Lai, 2011). Motivation has been differentiated into intrinsic and extrinsic motivation, and amotivation. As regards to intrinsic motivation, this is defined as motivation that is caused by personal enjoyment, interest, or pleasure (Lai, 2011), which sustains activities through spontaneous satisfactions, being reflected in behaviors such as play, exploration, and challenge. Intrinsic motivation is often contrasted with extrinsic motivation, which is defined as motivation governed by reinforcement contingencies (Deci & Ryan, 2000; Ryan & Deci, 2000). Motivation may be also defined in terms of amotivation, in which individuals do not perceive contingencies between their actions and the outcomes of their actions, while they may experience feelings of incompetence and lack of control (Deci & Ryan, 1985).

    Motivation is one of the most important constructs in learning, working as a supplier of signs that direct learning process. Motivation creates goals and stimulates action towards those goals (Wang, Wang, & Kim, 2011).

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One of the most used instruments to assess motivation is the Academic Motivation Scale (AMS), which was developed to assess students' academic motivation and their underlying nature (Vallerand *et al.,* 1992). The AMS may be also an extremely useful instrument to assess the multidimensional nature of motivated behavior (Vallerand *et al.,* 1997).

The development of the AMS was based on the self-determination theory. This instrument is divided into seven subscales: one subscale for amotivation, three subscales for extrinsic motivation (External, Introjected, and Identified regulation), and three distinct subscales for intrinsic motivation (Knowledge, Accomplishment, and Stimulation). In the initial study, Vallerand, Blais, Briere and Pelletier (1989) reported good internal consistency by Chronbach's alpha (.83 to .86), with exception for extrinsic motivation (.62). In addition, test-retest reliability over a one-month period ranged from .71 to .83 for all the subscales. Also, confirmatory factor analysis of the seven-factor AMS structure in a sample of Canadian college students provided adequate model fit, but with 26 error covariances in the model (Vallerand *et al.*, 1992).

The psychometric properties of the AMS were also examined in the US. The results were consistent with those reported by Vallerand *et al.* (1992) regarding the factorial structure of the scale (CFI = .90), suggesting partial support for scale multidimensionality. These results also indicated the need for a clearer distinction among the intrinsic motivation sub-scales (Cokley, 2000; Cokley *et al.*, 2001).

The psychometric properties have also been studied in Europe. For instance, in the Greek population, the findings were consistent with those proposed in the original study. The confirmatory factor analyses supported the differentiation of the intrinsic types of motivation, as well as good scores for internal consistency. Test-retest coefficients were high in almost all the sub-scales supporting the scale reliability (Barkoukis, Tsorbatzoudis, Grouios, & Sideridis, 2008).

In Italy, Alvernini & Lucidi (2008) tested the five-factor model, considering that was the model that revealed best fit in prior studies (e.g., Grouzet, Otis & Pelletier, 2006; Otis, Grouzet, & Pelletier, 2005; Ratelle *et al.*, 2004). This five-factor model was appropriate for the Italian population, with the AMS subscales showing good internal consistency, despite the results found in

other studies suggesting that the Identified Regulation subscale is the least reliable of the AMS subscales (Cokley *et al.*, 2001; Vallerand *et al.*, 1992).

Taking into consideration that the assessment of motivation through the AMS may be sensitive to cultural differences (Cokley, 2001; Alvernini & Lucidi, 2008), the current study was done to clarify about the multi-dimensionality of motivation in a sample of Portuguese university students. This analysis was conducted according to the assumptions of the Rating Scale Model (RSM). The RSM is an extension of the Rasch model (RM) that is applied to polytomous items. These statistical models (Andrich, 1978; Wright & Mok, 2004) are especially recommended for testing psychological assessment instruments (Prieto *et al.*, 2010), because of conjoint measurement of data for persons and items. Moreover, the RSM is empirically useful in determining the quality of response categories in Likert-type scales (Bond & Fox, 2007). The overall fit of the model according to this theory is given by the analysis on eight guidelines created by Linacre (2002). Accordingly, the scale should have: 1) at least 10 valid cases for each response category; 2) regular distribution of observations for each response category; 3) monotonic increase of the average measure for the persons in the model; 4) outfit index below 2.00; 5) monotonic increase of the average measure for the analysis calibration steps; 6) categories implying measures, and the opposite; 7) increases in logits between steps should be greater than 1.40; and 8) increases in logits between steps should be less than 5.00.

We believe thus that examining the AMS according to the assumptions from the RSM will provide an effective assessment of this instrument, as this may also help in determining the dimensionality of the data obtained in the Portuguese context.

Methods
Participants
The sample for this study comprised 360 university students, 28.60% male (*n*=103) and 71.4% female (*n*=257), with a mean age of 24.50 years (*SD* = 7.10). Most of these participants were Portuguese native speakers (91.40%; *n*=329). The average years of schooling was 11.80 (*SD*=4.50), most students were in their first year of university, 38.10% (*n*=137).

Measures

The Academic Motivation Scale (AMS; Vallerand and colleagues, 1989) was used to assess students' motivation toward school activities. The AMS is composed of seven subscales containing four items each, three subscales for intrinsic motivation, three for extrinsic motivation and one subscale related to amotivation. The subscales for intrinsic motivation are related to Knowledge (items 2, 9, 16 e 23), Accomplishment (items 14, 21, 27 e 28); and Stimulation (items 4, 11, 18 e 25). For extrinsic motivation there is a subscale for Identified regulation (items 6, 7, 13 e 20), another for Introjected regulation (items 1, 3, 10 e 17), and the other for External regulation (items 8, 15, 22 e 24). There is an additional subscale that assesses Amotivation (items 5, 12, 19 e 26). The items are scored on a 7-point Likert scale (1 = "Does not correspond at all"; 2 = "Corresponds a little"; 3 = "Corresponds a little" 4 = "Corresponds moderately" 5 = "Corresponds a lot" 6 = "Corresponds a lot" 7 = "Corresponds exactly"). The psychometric properties of the AMS are considered good as assessed for internal consistency and internal validity (Vallerand *et al.*, 1992).

Procedure

The AMS along with a short questionnaire for socio-demographic data were adapted for GoogleDocs and were completed online. The authors asked permission to the original authors of the AMS for translation to Portuguese and adaptation to a digital format. The first stage of this study consisted of the translation to Portuguese language. Two experts in Psychology with high proficiency in Portuguese and English languages have conducted independently the translation from English to Portuguese. A third expert in the same area carried out the retroversion of the two Portuguese versions. Following this stage, the adaptation to digital format was done by one of the authors of this study.

The university students were recruited with a snowball technique from the faculty of Psychology, at Universidade Lusófona de Humanidades e Tecnologias, in Lisbon, and by advertisements on social and professional networks (e.g. Linkedin, Facebook). After informed consent, participants filled out a short sociodemographic questionnaire with questions about gender, age, nationality, native language and education, followed by the completion of the AMS.

Results

The statistical analysis was conducted according to the assumptions of the Rating Scale Model using the software Winsteps (v3.92.1) for Windows®.

In respect to the guidelines for the optimization of scale scores (Linacre, 2002), it was observed that in every dimension of the AMS, the scale scores were oriented with the latent variable. On the other hand, more than ten valid cases were observed in every category of the response scale. The distributions for each position of the response scale were regular and suitable, but with deviations for the dimension "Accomplishment", which is not in agreement with guideline 3) of Linacre (2002).

It was also observed in the dimension related to "Knowledge" that the increase in logits was not adjusted to the reference values between category 1 (c_1) and c_2. Also, in the dimensions related to "Accomplishment" and "Amotivation" the increase observed in logits was below the reference value for successive categories, namely between c_1 and c_5, as well as in the dimensions of "External regulation" and "Identified regulation", but on these latter two, only between c_1 and c_2.

In regard to guideline 4) of Linacre (2002), c_1 in the dimension related to "Knowledge" was not aligned with the recommendations from Linacre (2002) as shows severe infit and outfit scores (> 2.00), suggesting the need for collapsing response categories

The monotonic increase of the average measure through the calibration steps have also showed weaknesses in all dimensions with exception for one dimension of intrinsic motivation "Stimulation" and one of extrinsic motivation "Introjected regulation", indicating scores below 0.50 between successive categories.

At the coherence level there was also a lack of adjustment in c_1 for "Motivation for Stimulation"; in c_1 and c_7 for "Introjected regulation" and "Identified regulation", as well as in c_2 for "Knowledge" and c_7 for "Accomplishment".

The indexes were also below than expected for the c_2, c_3, c_4 and c_5, namely for "Accomplishment", "External regulation", "Identified regulation", and "Amotivation". In sum, the data revealed critical deviations from

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proposed guidelines for the RSM (Linacre, 2002). The alternative way, followed in the current study to improve scale fit was to collapse categories in the original response scale to improve the distribution of observations and scale outfit, but also to ensure that the average measures advance monotonically with categories. These adjustments improved external validity of the instrument along with their overall psychometric properties. Different alternatives regarding the response scale were tested and the most suitable solution was to collapse c2, c3 and c4 in the same response position. Thus, the response scale proposed is as follows: 1 = "Does not correspond at all"; 2 (prior c2 + c3 + c4) = "Corresponds a little"; 3 = "Corresponds moderately" (prior c5); 4 = "Corresponds a lot" (prior c6); 4 "Corresponds exactly" (prior c7). This arrangement indicated good fit in each of the guidelines of Linacre (2002), as shown in Figure 1.

Fit indexes for the AMS

The Rasch analysis depicted in Table 1 shows the model fit for this solution under study. Item outfit coefficients fall within the bounds of productive scores for both persons and items, suggesting a good fit in the productive measure (Linacre, 2009). At the precision level, the coefficients for Item Separation Reliability were high (.94 to .99), as well as for the Pearson Separation scores and Cronbach's alpha, with some exceptions, namely for the dimensions "Accomplishment", "Introjected regulation", and "Amotivation", showing scores below 0.70. Furthermore, there were no items with severe misfit in the final solution (outfit > 2.00), revealing also a small percentage of persons with severe misfit (5.28% to 13.89%).
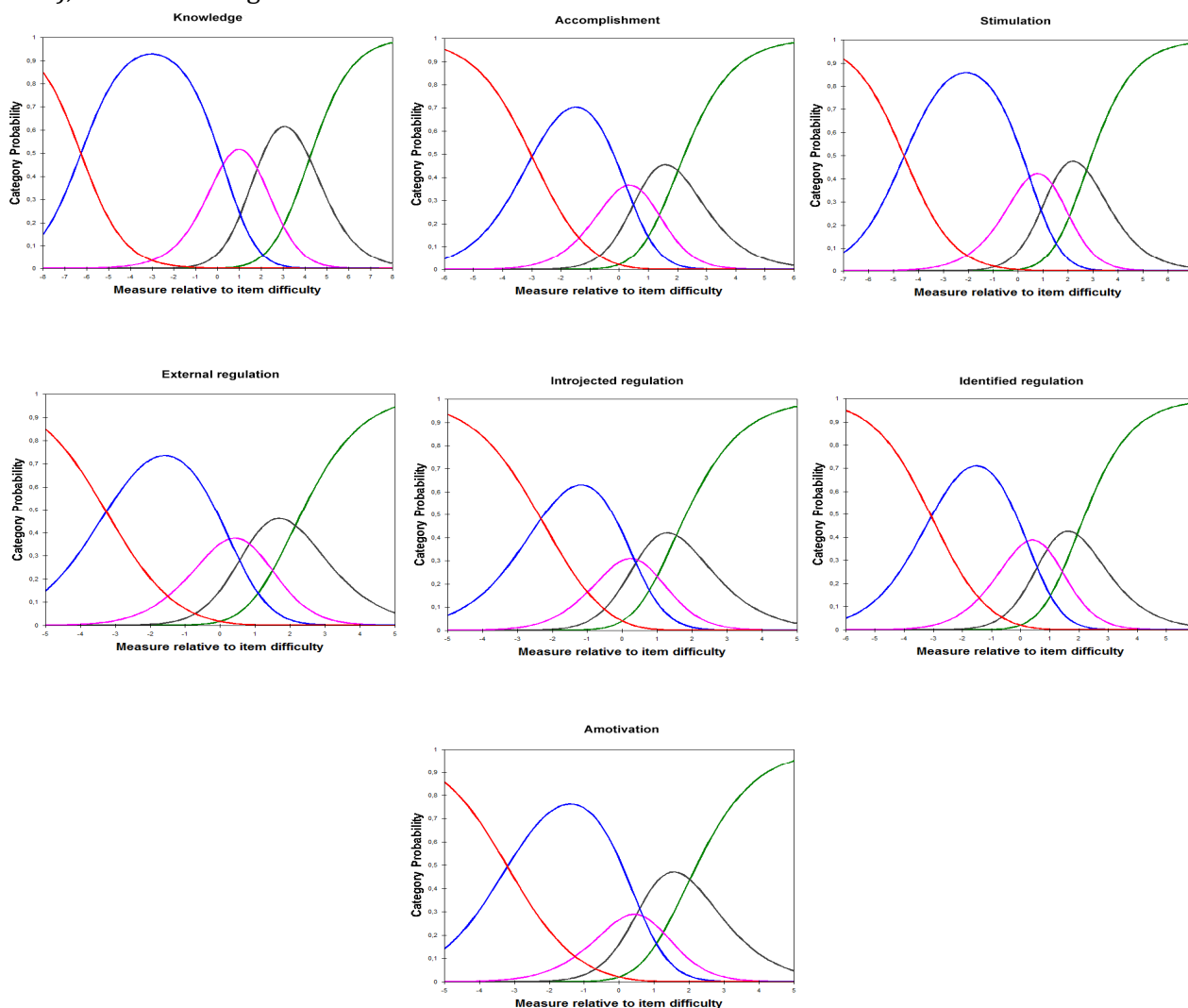
Figure 1. Overall fit

Table 1. Rating Scale Model statistics

	Intrinsic Motivation			Extrinsic Motivation			
	Know	Accomp	Stimul	ER	IR	IdR	A
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Item Outfit	1.00 (.12)	.98 (.24)	.99 (.30)	1.00 (.36)	1.00 (.22)	1.00 (.19)	1.01 (.05)
Person Outfit	.95 (.98)	.98 (.63)	.97 (.22)	1.04 (.19)	.99 (.90)	.99 (1.03)	.93 (.85)
ISR	.94	.96	.97	.95	.99	.98	.98
PSR	.81	.59	.83	.77	.66	.79	.47
Cronbach α	.88	.75	.79	.79	.64	.73	.81
%item outfit>2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
%person outfit>2	10.83%	7.61%	12.5%	11.67%	13.89%	12.78%	5.28%

Note: Item Separation Reliability; PSR – Pearson Separation Reliability; Know – Knowledge; Accomp – Accomplishment; Stimul – Stimulation; ER – External regulation; IR – Introjected regulation; Identified regulation; A – Amotivation. M - Mean; SD - standard deviation

Discussion

In this study psychometric properties of the AMS according to the RSM were examined. The original version of the AMS lies in a 7-category response scale anchored from "Does not correspond at all" (c1) to "Corresponds exactly" (c7), with a midpoint "Corresponds moderately" (c4). The current results suggested that this response scale for the AMS might not work properly in the sample studied, because: i) a monotonic increase in steps was not found in the motivation for knowledge and in the remaining successive response categories scores, which are below the reference values; ii) some outfit categories shows high misfit, which undermine overall fit; iii) step calibration advance reveals misfit above 5.00 logits. These measures indicated weaknesses in all of the AMS dimensions.

To improve the AMS response scale, we tested this response scale using five response positions. The analysis showed that this five-category response system works properly, with one exception in the step calibration advance between c3 and c4. These results thus recommend that the AMS might work better with a five-category system than the original seven categories. No items with severe misfit were found in this solution.

Summary statistics showed satisfactory scores for both items and persons outfits, score reliability through Item Separation Reliability (ISR) and Cronbach's alpha coefficients. The Person Separation Reliability (PSR) coefficient was considered high with some exceptions, as well as for PSR in Motivation for Accomplishment and Amotivation. Also, the dimension of extrinsic motivation related to Introjected regulation was also fair, suggesting that the overall scale may need more data to distinguish between high and low performers in the AMS.

The main limitations of this study are related to the sample selection process, which was collected using online tools to increase representativeness by regions of the country, but most available data were from Lisbon region. This may have created a bias as students' daily routines may differ depending on country region, which may also limit the comparison of the present results with prior studies (Alvernini & Lucidi, 2008; Vallerand *et al.*, 1992). In either case, the current results suggest that collapsing the response scale from seven to five categories may improve the overall fit. From a practical viewpoint these data may also suggest that a scoring system between five response positions might be easier for people to classify the reasons for academic motivations than the original seven-response system.

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