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EDITED BY
Sarah M. Bonner,
Hunter College (CUNY), United States

REVIEWED BY
Martha Leticia Gaeta,
Popular Autonomous University of the State of Puebla, Mexico
Ricky Lam,
Hong Kong Baptist University,
Hong Kong SAR, China

*CORRESPONDENCE
Anabela Caetano Santos
anabela.caetano.s@gmail.com

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Validation and proposal of a short version of the Motivated Strategies for Learning Questionnaire (MSLQ) for Portuguese adolescent students

Eva Morais[1,2], Anabela Caetano Santos[3,4]* and Ana Mouraz[3,5]

[1]Department of Mathematics, University of Trás-os-Montes e Alto Douro, Vila Real, Portugal, [2]Centre of Mathematics (CMAT), University of Minho, Braga, Portugal, [3]Laboratório de Educação à Distância e eLearning, Universidade Aberta, Lisboa, Portugal, [4]Instituto Universitário de Lisboa (Iscte-IUL), CIS-Iscte, Lisboa, Portugal, [5]Centro de Investigação e Intervenção Educativas (CIIE), Faculdade de Psicologia e de Ciências da Educação, Universidade do Porto, Porto, Portugal

Self-regulated learning is one of the most relevant learning concepts, representing cognitive, metacognitive, emotional, behavioural and motivational aspects. The Motivated Strategies for Learning Questionnaire (MSLQ) is the most used instrument to measure self-regulated learning. Though, its 81-item structure is lengthy and presents psychometric issues. Additionally, there is no translation/validation of MSLQ for European Portuguese secondary students. This study involved two stages; in the first, the scale's psychometric properties were examined, and a short version with 56 items was proposed; in the second, the short version was re-analysed. The first sample consisted of 795 adolescents aged 14–19; 429 adolescents formed the second sample, aged 13–17. Confirmatory factor analyses using robust estimators showed a good fit to the data for the three separated first-order models. Also, good reliability values were found, and information reproduction between the original version and this reduced proposal was verified. These results suggest that the proposed Portuguese short version of the MSLQ (MSLQ-PTS) is a valid and reliable measure for adolescent Portuguese samples. Moreover, the shorter version length makes it a more effective tool for practitioners and researchers.

KEYWORDS

questionnaire, validation, psychometrics, self-regulated learning, adolescents

Introduction

The European Educative 2030 Agenda envisions an inclusive and equitable education and the promotion of lifelong opportunities for all (UNESCO, 2016). The ability to learn throughout life is closely related to and dependent on motivation and self-regulated learning (Field, 2012; Lüftenegger et al., 2016). Self-regulated learning (SRL) entails independent learners who guide themselves through skills acquisition (Zimmerman, 2000). Self-regulation encompasses essential metacognitive, motivational, and behavioural components, including tasks such as time management, looking for information and practising it in different ways, focusing on instructions, creating an advantageous workspace, and making effective use of social resources (Zimmerman, 1989).

Various school-based intervention programmes have been developed and validated with the aim of developing and promoting the acquisition of SRL-related competencies and strategies both face-to-face (Dignath and Büttner, 2008; Perry et al., 2019) and online

(Devolder et al., 2012; Wong et al., 2019), showing, in addition to the effectiveness of SRL interventions, their impact on academic performance and student engagement. Moreover, a meta-analysis of SRL interventions showed that SRL can be learnt, independently of the SRL students' level or ages (Donker et al., 2014).

One of the most used methods to collect data from big samples is self-report questionnaires (Roth et al., 2016), which participants in the experimental and control groups fill in before and after the intervention. The Motivated Strategies for Learning Questionnaire (MSLQ) is the most used instrument to measure self-regulated learning interventions (Roth et al., 2016), being also used to assess online interventions (Araka et al., 2020). MSLQ evaluate student motivation to engage with course material and their learning strategies, comprising 81 items that allow 15 different dimensions to be analysed (Pintrich et al., 1991, 1993). It can be divided in two main scales, the motivation scale with 31 items relative to students' goals, beliefs, skills, and anxiety related to their courses and tests and the learning strategies scale, with 50 items relative to includes cognitive, meta-cognitive, and resource management skills.

A characteristic of the MSLQ is that it was developed from a social–cognitive theoretical perspective, meaning that self-regulation is situation specific and, thus, can (1) inform about the differences between students in a specific task and (2) can inform about the difference of the same person on two difference academic tasks. Therefore, it provides course specificity, with the questions formulated in a way that students answer considering their learning and motivation in a specific class.

The present validation study is included in an intervention project focused on SRL promotion in class (Project WAY), including teachers of different courses and students in different learning paths (both general and vocational). Thus, students could not answer MSLQ considering the same subject. Therefore, students were asked to reflect on a course they perceived as an autonomy promoter or challenging. This decision was also aligned with the previous work of Duarte (2019) which preceded the mentioned project. In her work with engineering university students, SRL was more evident when students perceived the course as fostering their autonomy in comparison with a challenging/ heavy workload perspective. Despite the associated constraints of such an approach, researchers accepted this limitation as an opportunity to explore the transferability power of the intervention, and thus, in the present study, we analysed the measurement invariance between these two groups. The MSLQ has been translated into several different languages [e.g., Chinese (Zhou and Wang, 2021), Estonian (Saks et al., 2015), and Spanish (Ortega et al., 2019)] though, until now, a European Portuguese version has been lacking. Additionally, most of the time, MSLQ validation studies include university students (Pintrich et al., 1993; Zhou and Wang, 2021; Saks et al., 2015; Ortega et al., 2019; De Araujo et al., 2023), even though the measure is suitable to be applied to adolescent learners (Zhou and Wang, 2021) as demonstrated by some (Pintrich and De Groot, 1990; Wang et al., 2023).

Although it can be used by administering individual scales per se, the 81-item structure requires around 20 to 30 min to be filled in and can cause boredom, fatigue and demotivation among the students, which can decrease the quality and effectiveness of measurement (Wang et al., 2023). Moreover, it can hinder the concurrent application of other measures, which inhibits the analysis of more complex associations with the construct (Ziegler et al., 2014). Different versions with fewer items have been proposed, though with fewer dimensions, namely a version with 44 items but with only five out of the 15 subscales (i.e., task value, self-efficacy, test anxiety, self-regulation, and cognitive strategy, 18) or a Spanish short version comprising 40 items, distributed in nine dimensions (Ortega et al., 2019). Recently, Wang et al. (2023) proposed a shorter version by eliminating redundant items, which resulted in a 41-item version while maintaining 14 dimensions.

Besides the temporal issue that the 81-item structure imposed, MSLQ analysis studies have been reflecting on its psychometric issues and the redundancy of some items with Credé and Phillips (2011) proposing that eliminating some problematic items could result in a model structure with better adjustment and dimensions with higher reliability dimensions and increased predictive validity of MSLQ subscales for academic performance. Thus, the goals of the present study were: (1) to analyse the psychometric properties of the MSLQ and propose a new, shorter version of it while trying to maintain the same number of dimensions, with good model fit indices to our sample (stage 1); (2) use the achieved reduced version (MSLQ-PTS) and understand whether presenting the items by dimension (and not randomised by scale) improves model fit indices, and good psychometric evidence of validity (stage 2). Additionally, to the best of our knowledge, this will be the first translation and validation of the MSLQ to European Portuguese, and data will be collected from middle and secondary school students.

Methods

Participants

In this study, a convenience sampling method was applied. Data collection was performed in four Portuguese public schools in the northern region. In the first stage, all 9–11th-grade students were invited to participate, with a total of 795 students participating in this stage. In the second stage, only the students who were part of an intervention project regarding SRL were invited to participate (both experimental and control groups), with some of the 429 participants being the same.

First stage sample

The convenience collected sample consisted of 900 participants, though 105 were removed due to (i) total nonresponse, participants who opened the survey but failed to respond ($n = 82$), (ii) a standard deviation value equal to 0.00 between MSLQ variables ($n = 13$), (iii) participants who report having difficulties in the comprehension of Portuguese language and also that reported having difficulties in understanding the questionnaire ($n = 10$). The final sample comprised 795 participants aged 14–19 ($M = 15.8$, $SD = 0.92$), with the majority being Portuguese ($n = 757$, 95.2%) and self-identified as female ($n = 392$, 49.3%) or male ($n = 377$, 47.4%), with only 3.3% preferring not to answer. Moreover, most attended the regular school track ($n = 604$, 76.0%), with 43.9% in the 10th school level, 40.4% in the 11th and 15.7% in the 9th.

Second stage sample

In the second stage, there was a convenience collected sample of 460 cases, of which 31 were removed due to total nonresponse ($n = 9$), missing values above 50% on MSLQ (Hair et al., 2019)

($n = 16$), having a standard deviation value below equal to 0.00 between MSLQ variables ($n = 4$), one that took more than 1 h to submit questionnaire and one who reported having difficulties in the comprehension of Portuguese language and also that reported having difficulties in understanding the questionnaire ($n = 1$). The final sample comprised 429 participants, aged 13–17 ($M = 14.7$, $SD = 0.97$), attending the 8th ($n = 86$, 20.0%) or 10th ($n = 343$, 80.0%) school year, with the majority being Portuguese ($n = 401$, 93.5%) and self-identified as female ($n = 205$, 47.8%) or male ($n = 216$, 50.3%).

Measures

Sociodemographic data included the participants' age, gender, school, school year and nationality. Also, they were asked about their level of comprehension of the Portuguese language and of the questionnaire. Since the motivation to learn and the learning strategies are dependent on the subject, participants were asked answer a translated version of the MSLQ, with the 81 items in the same order as in the original version of the MSLQ. Participants should choose to answer the MSLQ items considering the subject that most contribute to their autonomy in learning or the subject they find most challenging.

In stage 2, participating students answered a short version of the MSLQ with items ordered according to their dimensions. Previous work showed that presenting items ordered by dimension can improve the model fit (Şahin, 2021). Moreover, after the first data collection stage, students argued that the presentation of items asking about similar things being asked more than once at different moments was annoying and confusing. Thus, we hypothesise that students might better understand the differences between items and answer more reflectively, easily, and faster with this form of item presentation.

The MSLQ original version comprises 81 items divided into 15 dimensions. Six dimensions (31 items) are related to motivation (Intrinsic and Extrinsic goal orientation, Task value, Control of learning beliefs, Self-efficacy, and Test anxiety). The other nine dimensions (50 items) are related to learning strategies that can be distinguished as cognitive and metacognitive strategies (Rehearsal, Elaboration, Organisation, Critical thinking, Metacognition) and resource management strategies (Time and study Environment, Effort regulation, Peer learning, Help-seeking) (Pintrich et al., 1991). All items used a 7-point Likert scale (from 1 = "not at all true of me" to 7 = "very true of me"), with eight being reversed coded. In the original study reliability scores, relative to Cronbach's alpha, ranged between 0.52 to 0.93 Cronbach's alpha.

Procedure

The questionnaire validation was part of a research project (Project WAY) regarding the promotion of self-regulated learning competencies in students in middle and high school in four Portuguese public schools. The Universidade Aberta Ethics Committee (ref. 15/2023) approved all procedures. The study followed the principles of the Declaration of Helsinki. Also, the procedures were approved by the grant institute and by each school's direction board.

The MSLQ was translated from English to Portuguese using the Committee approach, considered a labour, time and cost intensive method, used for both translation and translation assessment studies (Harkness and Schoua-Glusberg, 1998). In the present study the Committee included three independent expert research teams (each with two to three researchers), after which a consensus version was achieved. Afterwards, this version was discussed and culturally adapted using again the Committee approach. The committee consisted of eight experts in self-regulated learning, critical and creative thinking, students' agency and social and emotional competencies, one researcher with knowledge of educational measurement and assessment and five teachers with teaching experience in the aforementioned education levels during which item-content relevance was assessed. Finally, a language-comprehension pilot was performed.

The questionnaire was applied to students in the general and professionalising educative tracks in 9th, 10th, or 11th grades. All participants provided informed assent and completed the survey protocol online (through the Qualtrics software platform) in the computer room. In the first stage, items were presented as in the original version, where items of different dimensions were mixed. In the second stage, items from the same dimensions were presented together because students reported more difficulties in their completion and/or perception of repetition between items. Also, item order might increase reliability, validity, and item statistics (Şahin, 2021).

Data collection occurred between May and June 2023 (first stage) and between October and November 2023 (second stage).

Data analysis

First, we tested the original statistical model for a subject-nonspecific, Portuguese-translated MSLQ, using the first stage sample and 81 randomly ordered items (Pintrich et al., 1991). Confirmatory factor analyses (CFAs) and multi-group CFA's were estimated using R packages *lavaan* (Rosseel, 2012) maximum likelihood estimation with robust Huber-White standard errors and a scaled test statistic that is asymptotically equal to the Yuan-Bentler test statistic (for both complete and incomplete data), and *semTools* (Jorgensen et al., 2021). After this, we implied a set of rules of thumb to delete the redundant items based on the psychometric properties of the items, i.e., factor loading >0.30, modification indices, and item-total correlation >0.30 (Hair et al., 2019).

We considered the following indices for establishing model fit criteria: Comparative Fit Index (CFI) ≥ 0.95; Tucker-Lewis Index (TLI) ≥ 0.90; Standardised Root Mean Square Residual (SRMR) < 0.08; and Root Mean Square Error of Approximation (RMSEA) ≤ 0.08 with a 95% confidence interval (CI) between 0.05 and 0.10 (Hair et al., 2019). Further, measurement invariance by age, gender and subject was evaluated by a series of multiple-group CFA processes for configural, metric and scalar invariance. We evaluated the fit of successive models with increasingly stringent constraints, namely ΔRMSEA ≤ 0.015, ΔCFI ≤ -0.010. Also, two ΔSRMR thresholds were used, ΔSRMR ≤ 0.030 to test factor loading invariance and ΔSRMR ≤ 0.010 when testing intercepts invariance (Hair et al., 2019).

There was no missing data in the included participants (reasons for case exclusion explained in the participants' description section). Students were obliged to respond to all presented items in order to continue the questionnaire.

Results

Summary statistics

The participants were asked to answer the MSLQ reflecting upon a subject that they feel contributes the most to their learning autonomy or that they find more difficult, with 41.0% choosing the first option and 59.0% choosing the second option. The descriptive statistics and the item-total correlation of the 81 items are presented in Supplementary Table S1. The item-total correlation ranged between −0.02 and 0.86, with three items suggesting that they were not measuring the same construct as the other items as they correlated below the cut-off of 0.3.

In the second stage, the students answered the short version of the MSLQ (MSLQ-PTS) with the items ordered according to the dimension to which they belong (and not randomised within the scale). The participants answered that reflecting upon a subject they felt contributed the most to their learning autonomy (41.5%) or that they found more difficult (58.5%). The descriptives for each item of the MSLQ-PTS with ordered items are presented in Supplementary Table S2. Correlations between the MSLQ dimensions are statistically significant, except between "Test anxiety" and "Intrinsic goal orientation," "Task value," "Control of learning belief," "Critical thinking," "Time for study and environment" and "Effort regulation" (Supplementary Table S3).

Confirmatory factor analysis

In the first stage, the two subscale structures proposed by Pintrich et al. (1991) were tested considering the 81 items divided by 15 dimensions. Unfortunately, the software could not find a solution for the learning strategies subscale. Thus, this subscale was divided into two subscales: one related to cognitive and metacognitive strategies and another one regarding resource management strategies. A more thorough analysis of the constructs we measured with MSLQ was made possible using three scales.

The reduced version was obtained by following combined guidelines (Hair et al., 2019) and the procedures of other authors who analysed MSLQ before (Wang et al., 2023; Credé and Phillips, 2011). after the exclusion of items considering their factor loadings (deletion of those below 0.30), the modification indices, item-total correlation values (deletion of those below 0.30), and the theoretical meaning of each item for that dimension, three first-order models with 24, 21 and 11 items were obtained. The factor loadings are presented in Supplementary Table S4 and ranged between 0.292 and 0.885. The MSLQ-PTS has 56 items and presents an overall acceptable model fit information (Table 1), with better adjustment to the sample than the 81-item version. After 13 pairs of correlated errors were added, a relevant model fit increase was achieved (more details in the Supplementary Table S2).

For the second stage, the same structure of two subscales of dimensions as that proposed by Pintrich et al. (1991) was employed in the CFA. Similarly to the previous stage, the model fit improved by adding 13 correlations between errors (S2). The second stage's CFA indicated an overall acceptable fit of the model to the data, with better results than those observed in the first stage (Table 1), showing that the items should be grouped by dimension. Also, these results suggest that the MSLQ-PTS consistently measures the intended constructs, increasing our confidence in its validity for use with adolescent Portuguese students.

Measurement invariance

Measurement invariance was tested across groups of the first sample: gender, age and the students' chosen subject. The results presented in Table 2 show that the fit indices from the configural model revealed an overall acceptable fit.

After estimating the metric model, for which the factor loadings are set to be equal for the models of both groups, it was compared against the configural model. The results presented in Table 3 show that for the successive models, metric and scalar were below the threshold, except for the motivation and resource management learning strategies when testing the scalar model. The analysis of the configural models for each gender, age and discipline group is presented in the Supplementary Tables S5–S7.

Reliability

The Cronbach's coefficient alpha of the 15 dimensions for the MSLQ-PTS ranged from 0.52 to 0.89 and the McDonald's omega ranged from 0.54 to 0.92 (Table 3). There is acceptable reliability for all the dimensions except Help-seeking. The alpha for Help-seeking is the same as in Pintrich et al. (1991) for the 81-item version and is higher than the predicted reliability given by the Spearman-Brown formula (0.45) for this dimension.

The reliability results of the MTLQ-PTS in the second stage are comparable to those in the first stage, with Cronbach's alpha ranging from 0.69 to 0.88 in 14 dimensions, indicating good internal consistency (Table 3). As with Pintrich et al. (1991), the alpha of the Help-seeking dimension is low (0.52). This suggests that this dimension may require further investigation to improve its reliability.

Reproduced information

The correlations between the total MSLQ and the MSLQ-PTS dimensions ranged from 0.75 to 0.98 (Table 3). The short version of the MSLQ replicates much of the information included in the full version, as indicated by Levy's corrected correlation average of 0.73, which ranges from 0.42 to 0.91.

Discussion

The present study aimed to (1) analyse the psychometric properties of the MSLQ in a sample of adolescent students in

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TABLE 1 Confirmatory factor analysis (CFA) models fit statistics.

CFA model	CFI	TLI	RMSEA	90% CI RMSEA	SRMR
MSLQ					
Motivation	0.857	0.842	0.078	[0.075, 0.081]	0.082
LS–Met.	0.813	0.795	0.084	[0.081, 0.087]	0.065
LS–Res.	0.621	0.557	0.117	[0.112, 0.123]	0.12
MSLQ-PTS* (1st stage)					
Motivation	0.903	0.886	0.069	[0.065, 0.074]	0.074
LS–Met.	0.882	0.861	0.085	[0.079, 0.090]	0.057
LS–Res.	0.926	0.893	0.077	[0.066, 0.089]	0.055
MSLQ-PTS (1st stage)					
Motivation	0.911	0.895	0.067	[0.062, 0.071]	0.073
LS–Met.	0.906	0.885	0.077	[0.072, 0.083]	0.055
LS–Res.	0.935	0.901	0.075	[0.063, 0.087]	0.052
MSLQ-PTS* (2nd stage)					
Motivation	0.886	0.867	0.072	[0.066, 0.079]	0.07
LS–Met.	0.935	0.924	0.062	[0.053, 0.070]	0.048
LS–Res.	0.923	0.889	0.092	[0.075, 0.109]	0.059
MSLQ-PTS (2nd stage)					
Motivation	0.893	0.874	0.07	[0.064, 0.077]	0.07
LS–Met.	0.957	0.947	0.052	[0.042, 0.061]	0.045
LS–Res.	0.932	0.897	0.088	[0.071, 0.106]	0.055
MSLQ-PTS (2nd stage)**					
Motivation	0.909	0.892	0.065	[0.059, 0.072]	0.068
LS–Met and Res.	0.922	0.908	0.055	[0.049, 0.060]	0.05

LS–Met: Cognitive and Metacognitive Learning Strategies. LS–Res.: Resource Management Learning Strategies. CFA with the Maximum Likelihood Estimator with robust (Huber-White) standard errors. MSLQ-PTS: Portuguese short version of the MSLQ (CFA with correlated errors). MSLQ-PTS*: Portuguese short version of the MSLQ (CFA without correlated errors). MSLQ-PTS**: Portuguese short version of the MSLQ considering the original structure.

TABLE 2 Measurement invariance testing – first stage.

	CFI	Configural model				Metric model (differences)			Scalar model (differences)		
		TLI	SRMR	RMSEA	90% CI RMSEA	ΔCFI	ΔSRMR	ΔRMSEA	ΔCFI	ΔSRMR	ΔRMSEA
Gender											
Motivation	0.908	0.891	0.075	0.069	[0.064, 0.074]	−0.003	0.005	0	−0.012	0.003	0.003
LS–Met.	0.901	0.879	0.057	0.078	[0.072, 0.084]	−0.001	0.006	−0.001	−0.006	0.004	0.001
LS–Res.	0.925	0.885	0.053	0.081	[0.069, 0.093]	−0.003	0.008	−0.002	−0.026	0.007	0.008
Age											
Motivation	0.9	0.882	0.077	0.072	[0.067, 0.077]	0	0.006	−0.002	−0.002	0.001	−0.001
LS–Met.	0.908	0.887	0.059	0.077	[0.071, 0.083]	0	0.007	−0.002	−0.001	0.001	−0.002
LS–Res.	0.929	0.892	0.056	0.078	[0.065, 0.091]	0.001	0.006	−0.005	−0.004	0.002	−0.002
Discipline type											
Motivation	0.901	0.883	0.073	0.066	[0.061, 0.071]	−0.002	0.003	−0.001	−0.013	0.005	0.003
LS–Met.	0.894	0.87	0.058	0.081	[0.076, 0.087]	−0.002	0.006	−0.001	−0.002	0.002	−0.001
LS–Res.	0.935	0.901	0.052	0.073	[0.061, 0.086]	−0.002	0.006	−0.001	−0.002	0.002	−0.001

LS–Met.: Cognitive and Metacognitive Learning Strategies. LS–Res.: Resource Management Learning Strategies. CFA with the Maximum Likelihood Estimator with robust (Huber-White) standard errors.

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TABLE 3 Reliability and correlations between the MSLQ and the MSLQ-PTS – first stage.

Variables	Number of items		Cronbach's alpha			McDonald's omega		Reproduced information	
	MSLQ	MSLQ-PTS	MSLQ	MSLQ-PTS*	MSLQ-PTS**	MSLQ-PTS*	MSLQ-PTS**	Correlation	Levy's correction
Motivation									
1. Intrinsic goal orientation	4	4	0.75	0.75	0.69	0.85	0.81	1.00	0.75
2. Extrinsic goal orientation	4	4	0.72	0.72	0.71	0.75	0.83	1.00	0.72
3. Task value	6	4	0.89	0.82	0.80	0.87	0.87	0.98	0.85
4. Control of learning beliefs	4	3	0.69	0.67	0.69	0.66	0.70	0.94	0.67
5. Self-efficacy	8	5	0.92	0.89	0.88	0.92	0.90	0.98	0.91
6. Test anxiety	5	4	0.82	0.78	0.83	0.81	0.88	0.98	0.80
Cognitive and metacognitive learning strategies									
7. Rehearsal	4	4	0.76	0.76	0.78	0.79	0.88	1.00	0.76
8. Elaboration	6	4	0.82	0.79	0.78	0.85	0.84	0.96	0.81
9. Organisation	4	4	0.80	0.80	0.85	0.85	0.89	1.00	,80
10. Critical thinking	5	4	0.80	0.81	0.84	0.84	0.88	0.97	0.81
11. Metacognitive self-regulation	12	5	0.80	0.82	0.83	0.86	0.89	0.92	0.82
Resource management learning strategies									
12. Time and environment	8	3	0.61	0.71	0.80	0.69	0.79	0.75	0.58
13. Effort regulation	4	2	0.63	0.63	0.70	-	-	0.77	0.56
14. Peer learning	3	3	0.69	0.69	0.78	0.66	0.76	1.00	0.68
15. Help-seeking	4	3	0.22	0.52	0.53	0.54	0.55	0.90	0.42

*1st stage; **2nd stage.

Portugal, proposing a short version and (2) understanding if it is better to present the items randomly by scale, as the original authors propose, or to present the items of a dimension together. Thus, we collect two samples at two different moments. In the first stage, we analysed the psychometric properties of the MSLQ-short version, and in the second stage, the replication of the model structure found previously was addressed and the presentation of items in a random order.

After verifying that the original structure of the MSLQ was impossible to replicate with our population (two first-order models: motivation scale and learning strategies scale), a division of the learning strategies scale into two was tested: metacognitive and cognitive learning strategies and resource management learning strategies. The results showed a poor fit for the 81-item version and a generally good fit for our sample for the MSLQ-short version. The better fit for a shorter version of the MSLQ was also found by others (Ortega et al., 2019; Wang et al., 2023). However, it was required to proceed with the analysis by including *post-hoc* modifications, and to further CFA models in an iterative process. However, in the second stage, in which the items were presented in groups by dimension (and not randomly by scale), the model fit improved, allowing also the computation of the two first-order model structures. This is in line with Şahin (2021) work, in which a better solution was found when each dimension's items were together. The analysis of the order presentation was performed since, besides the literature discussion on this topic, the students in the first data collection stage argued that some of the items were the same but asked at different times, and they felt it was annoying and confusing. This presentation also appealed more to the teachers who were part of the project. We hypothesise that students can better understand the subtle differences between items and answer more reflectively with this form of item presentation.

The MSLQ-Short version showed adequate internal consistency values for the majority of the 15 dimensions, with only the help-seeking dimension being below the threshold, as also found by others (Credé and Phillips, 2011; De Araujo et al., 2023).

In addition, we assessed the measurement invariance. Functional, configural, metric and scalar invariance were tested since violations of measurement invariance can hinder significant data interpretation. The multi-group analyses showed that the three scales structure was adequate for different ages, gender and subject types, which strengthens this measure's use for group comparisons. As far as we know, this is the first study investigating measurement invariance between younger and older adolescent learners and between subject types. Our results show that the instrument can make a valid comparison between gender, age and subject types. Regarding gender, other studies stablished measurement invariance for gender but using the 81-item structure (De Araujo et al., 2023; Guo et al., 2021; Maun et al., 2020).

Before concluding, some limitations must be mentioned. First, the non-representativeness of the sample can limit the extent to

which the findings can be generalised since data collection was limited to four schools, though they were public schools and all students were invited to participate in the first stage, thus including students of different socio-economic status and in both rural and urban schools. Secondly, no concurrent analysis with other SRL measures or test–retest analysis were performed. Third, our study relied only on a self-report measure. Future studies should investigate the correlation of MSLQ with behavioural measures of SRL, to better advance our knowledge on the correspondence between self-report and self-regulated behaviours. Also, it would be relevant to analyse the measure in terms of its responsiveness to interventions. Finally, instead of students responding to the MSLQ considering a single course, they were invited to reflect on a subject that they felt contributed the most to their learning autonomy or found more challenging. This instruction was given to students because participants did not share the same learning paths and subjects. Despite the validity constraints of this decision, it allowed us to explore the suitability of the measure considering this innovative approach. We also analysed the measurement invariance between these two groups.

The present papers combined two studies, not only addressing the validation of a new translated version (English to European Portuguese) and the proposal of a shortened version (study 1), but we also collected data from secondary school students, who have been underrepresented in MSLQ validation studies. Additionally, we conducted a second study, in which the same translated version was used but, this time, presenting the items ordered according to its dimension, answering to the feedback received from students and teachers and verifying if that change could increase the model fit to the data as proposed and tested previously (Şahin, 2021).

In conclusion, this study uses a reliable and valid instrument to assess motivation aspects, metacognitive and cognitive learning strategies and resource management learning strategies in a Portuguese-speaking adolescent sample. Also, providing data that shows that this measure is suitable for secondary school students. The validation of short questionnaires to measure aspects of self-regulated learning is still rare and can benefit both educative practitioners and researchers. A short version can decrease the fatigue and demotivation associated with long questionnaires and promote the inclusion of this measure in more complex studies with the concurrent application of another measures, allowing the depth of knowledge advancement (Wang et al., 2023; Ziegler et al., 2014). Moreover, measure validation can benefit cross-cultural research. Portuguese language is spoken in five African countries (Angola, Mozambique, Guinea-Bissau, Cape Verde, and São Tomé and Príncipe). The present measure translation might be suitable for these populations. Thus, it can increase the possibility of collecting data with the same measure (and by this enhancing better comparability of findings) with non-WEIRD (Western, Educated, Industrialised, Rich, Democratic) populations that are less represented in SRL research field. Finally, even though SRL is subject-sensitive, we propose an alternative to study it on a broader group of students from different educative paths, emphasising the relation, knowledge or perspective that students have with the subject (i.e., sense of autonomy or difficulty that they associate with the subject).

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at: Open Science Framework, https://doi.org/10.17605/OSF.IO/2W437.

Ethics statement

The studies involving humans were approved by the Universidade Aberta Ethics Committee (ref. 15/2023). The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin because in Portugal, schools are sovereign in implementing questionnaires related to learning (in this case, only one questionnaire related to self-regulation of learning). Schools as partners in the project administered and carried out data collection. The questionnaire did not contain sensitive questions, and the anonymity and confidentiality of the participants were fully respected, so this procedure was unnecessary. In any case, the ethical principles were explained to the students, including free participation, and it was explained that their participation was voluntary and that they could interrupt participation at any time without any consequences.

Author contributions

EM: Data curation, Formal analysis, Methodology, Writing – original draft. AS: Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. AM: Conceptualization, Funding acquisition, Methodology, Project administration, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2025.1445548/full#supplementary-material

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