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Factorial structure, measurement invariance and reliability of the Emotion Regulation Checklist (ERC) in a sample of Portuguese parents

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Abstract: Emotion regulation is important for socioemotional and mental health development, with lifelong implications. The Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1997) is a widely used tool to assess emotional regulation and dysregulation in children. Despite wide use and translate into several languages, inconsistent findings have been found in its factorial structure across studies. This study addresses this gap by examining the factorial structure, reliability, and measurement invariance of the ERC in a Portuguese sample. A sample of 789 parents (mostly mothers, 90.9%) with children between 3 to 12 years old (49.3% preschoolers and 50.7% School-age) completed the scale. Confirmatory Factor Analysis (CFA) revealed that the original two-factor model (Emotion Regulation and Lability/Negativity) reached an acceptable fit, however three items had to be removed, and two item residuals correlated. Full invariance was achieved regarding boys and girls. While, regarding age, only configural invariance was achieved, meaning that, different loadings should be expected between preschool and school-age children. Considering the final model the Cronbach's alphas (α) was .66 for Emotion Regulation and .80 for Lability/Negativity. These findings provide some support for the use of the Portuguese parents' version of the ERC with preschool and school-age children.

Keywords: Emotion regulation, ERC, Factor structure, Reliability, Parents of preschool and school-age.

Introduction

The study of emotion regulation has grown over the past decades becoming central to child development research, from infancy to adolescence (Blair & Diamond, 2008; Kim-Spoon et al., 2013). Emotion regulation is defined as the ability to manage, maintain, or modify emotional arousal to adjust to contextual demands (Campos et al., 1994; Denham et al., 2010; Gross, 2014; Kim-Spoon et al., 2013; Schlesier et al., 2019; Thompson, 1994; Vingerhoets et al., 2008). This ability can be understood as a dynamic process that develops over time. More specifically, emotion regulation relies on innate physiological mechanisms and caregiver support during infancy (Kopp, 1989; Sroufe, 1996). Through consistent caregiver interactions, children move from external co-regulatory processes to internal regulatory mechanisms, achieving an increased independence in self-regulation (Cole & Hollenstein, 2018; Sameroff, 2010). During the preschool years, children

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acquire cognitive skills that enhance emotional understanding and regulation, which are crucial for social and academic success (Calkins & Bell, 2010; Colwell & Hart, 2006). Although school-aged children are still prone to experience difficulties in controlling their emotions, especially in harsh situations (Shields & Cicchetti, 1997), the integration of biological and behavioural domains support the achievement of a more stable emotional functioning during middle childhood and adolescence (Calkins & Bell, 2010; Calkins & Marcovitch, 2010). Effective emotion regulation is essential for healthy socioemotional development and mental health outcomes, with implications throughout the lifespan (Berking & Wuppermann, 2012; Robson et al., 2020). This process involves two phases: (1) emotion generation, that refers to the emergence of emotions in response to an internal or external stimulus, and (2) emotion regulation that encompasses the modulation of emotions (Bunford et al., 2015; Fernandez et al., 2016; Sheppes et al., 2015). Difficulties can emerge in both phases and any valence (positive and negative), leading to dysregulation and hampering emotional functioning (Silverman et al., 2022). Difficulties in regulating emotions can lead to maladaptive socioemotional and mental health outcomes, including internalizing and externalizing problems, behavioural disorders, and social relationship difficulties (Kim & Cicchetti, 2010; Silva et al., 2018). A recent meta-analysis (Robson et al., 2020) showed that impaired emotion regulation in childhood predicts internalizing and externalizing problems, even 30 years later.

Therefore, assessing emotion regulation is crucial to understand both typical and atypical development (Cole et al., 1994; Gross, 2014) and to redirect children who experience emotion regulation difficulties to healthy developmental trajectories and enhance their psychological well-being (Lopes et al., 2005; Raikes & Thompson, 2006; Vural & Gürşimşek, 2009). Despite its relevance, the assessment of emotion regulation might be challenging, due to theoretical and methodological complexity (Cole et al., 2004).

Different tools, including self-reports, informant reports, observational measures, and physiological indicators, provide insights into emotional processes (Adrian et al., 2011). Among them, the *Emotion Regulation Checklist* (ERC; Shields & Cicchetti, 1997) is one of the most widely used scale to assess children's emotion regulation in preschool and school-age children from the caregivers' point of view (e.g., Danisman et al., 2016; Lucas-Molina et al., 2022; Molina et al., 2014; Morgan et al., 2010; Nader-Grosbois & Mazzone, 2015). The ERC is a 24-item hetero-evaluation method that can be answered by caregivers (parents or teachers). This scale was initially validated in a sample of children aged 6 to 12 years old from maltreating (abusing) and non-maltreating families (Shields & Cicchetti, 1997). A principal component analysis with varimax rotation yielded two reliable factors: (1) *Emotion Regulation* (ER) referring to context-appropriate affective displays, empathy, and emotional self-awareness; and *Lability/Negativity* (L/N), that describes impulsivity in responding to emotion-eliciting stimuli and simultaneous difficulty in recovering from adverse emotional reactions (Shields & Cicchetti, 1997).

Since its development, ERC has been translated into several languages, including European-Portuguese (Melo, 2005), Brazilian-Portuguese (Reis et al., 2016), Spanish (Lucas-Molina et al., 2022), Italian (Molina et al., 2014), Icelandic (Hansen, 2015), Turkish (Danisman et al., 2016), Iranian/Persian (Meybodi et al., 2018; Shafietabar et al., 2020; Vahidi et al., 2022), Norwegian (Oseland, 2019), and Malay (Jamal et al., 2021). Nonetheless, most studies report cross-loadings and low factor loadings (e.g., Molina et al., 2014; Reis et al., 2016). For instance, the Brazilian-Portuguese study (Reis et al., 2016), conducted with children aged 3 to 12 years, confirmed the original structure using EFA. However, two items displayed cross-loadings, and one item had to be excluded. Similarly, in the Spanish (Lucas-Molina et al., 2022), the CFA revealed an acceptable fit for school-age children, but not for preschoolers, with seven items presented cross-loadings and residual correlations required adjustment. To address this, the authors also used ESEM, which supported the original two-factor model of the ERC, except for item 23. In the Italian study

(Molina et al., 2014), involving children aged 3 to 11 years, EFA partially confirmed the ERC structure, though two items presented cross-loadings, and nine items exhibited low loadings. A subsequent CFA on school-age children provided modest support for the two-factor structure. Finally, in the Turkish (Danisman et al., 2016), conducted with preschoolers, the original structure was not confirmed through CFA, subsequent EFA supported the two-factor structure though item 12 being included in the Emotion Regulation factor.

Given the importance of using culturally and linguistically appropriate tools, validating the ERC to Portuguese-speaking populations is crucial. To our knowledge, no previous studies have examined the factorial structure of the ERC in Portugal. Thus, this study seeks to fill this gap by examining the reliability and validity of the ERC in a Portuguese context. Specifically, evaluating the factor structure, assessing the internal consistency of the ER and L/N subscales, and examining measurement invariance across child age and sex. The findings will contribute to the broader applicability in cross-cultural research and provide a reliable tool for assessing emotional regulation in Portuguese-speaking children.

Method

Participants

The sample included 789 parents, mostly mothers (90.9%) with children between 3 to 12 years old (*M*=80.27 months; *SD*=26.41; range: 30-148 months; 47.1% girls and 52.5% boys). Mothers' age ranged between 24 and 56 years (*M*=40.16; *SD*=5.43) and fathers between 32 and 67 years (*M*=44.03; *SD*=5.39). Mothers' education level varied between 6 and 21 years (*M*=15.70; *SD*=2.90) and fathers between 5 and 21 years (*M*=14.27; *SD*=3.40). Most parents lived together (81.7%, with 59.1% being married and 22.6% cohabiting), 8.5% of the families were separated or divorced, 9.6% were in another situation. Parents reported working mostly full-time (84.2% mothers; 74.7% fathers).

Considering the previous studies results, sample was explored separating preschoolers (49,3 %, M_{age}=57.38; SD_{age}=12.22; range: 30 to 77 months; 45.2% girls and 54.2% boys) from school-age children (50.7%, M_{age}=102.53; SD_{age}=14.99; range: 78 to 148 months; 49% girls and 50.7% boys).

Instruments

Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1997; Melo, 2005). The Emotion Regulation Checklist (ERC) was used to assess emotion regulation of children in preschool and school age. Parents completed the 24-item scale with a 4-point Likert response (1=never, 2=sometimes, 3=often, 4=almost always). ERC comprises two subscales: *Emotion Regulation* (ER), that includes 8 items measuring adaptive regulation processes, such as socially appropriate emotional displays and empathy. Six items are scored positively (Items 1, 3, 7, 15, 21, and 23), while two items are reverse scored (Items 16 and 18). Higher scores indicate greater emotion regulation capacity; and *Emotional Lability/Negativity* (L/N), that includes 15 items assessing mood lability, inflexibility, dysregulated negative affect, and inappropriate affective displays. Eleven items are scored positively (Items 2, 6, 8, 10, 13, 14, 17, 19, 20, 22, and 24), and four are reverse scored (Items 4, 5, 9, and 11). Higher scores reflect greater emotional dysregulation. Item 12 does not load on any factor (Shields & Cicchetti, 1997).

The Portuguese version of the ERC, translated by Melo (2005), was used in this study. The original scale developed by Shields and Cicchetti (1997) demonstrated good internal reliability, with Cronbach's alpha values of .83 for the ER subscale and .96 for the L/N subscale.

Procedures

This study is part of wider research projects approved by the ISPA Ethics Committee. The research projects were presented to the boards of participating schools to obtain the necessary authorizations for data collection. Parents were asked to complete an informed consent and those who agreed to participate were sent the self-report questionnaire to be completed at home.

Results

The descriptive statistics (means, standard deviations, skewness and kurtosis) for the ERC items were calculated (see Table 1). The highest mean score was on item 1 "... cheerful child." (M=3.72; SD=0.46) and the lowest was on item 24 "... negative emotions when attempting to engage others in play" (M=1.21; SD=0.53). The results were similar when we analyse the preschool sample. For the school sample, the lowest mean score was on item 19 "... negative response to another child attempt to play". When comparing preschool with school samples, significant differences were found for nine items. Preschoolers presented higher scores on item 1, 12 and 19 [t(783)=3.15, p<.001, t(780)=6.43, p<.001 and t(783)=4.26, p<.001 respectively] and school-aged children presented higher scores on items 4, 5, 9 and 17 [t(780)=-6.21, p<.001, t(785)=-2.08, p<.05, t(769)=-2.00, p<.05 and t(778)=-2.17, p<.05 respectively] from Emotional Lability/Negativity (LN) dimension and items 16 and 18 [t(782)=-2.00, p<.05 and t(783)=-2.17, p<.05 respectively] from Emotional Regulation (ER).

Table 1

Descriptive statistics for the ERC scores

	Full sample				Preschool sample				School sample			
Itens	*M*	*SD*	*Sk*	*Ku*	*M*	*SD*	*Sk*	*Ku*	*M*	*SD*	*Sk*	*Ku*
Item 1	3.72	0.46	2.47	0.54	3.79	0.48	-2.22	4.25	3.67	0.56	-1.51	1.31
Item 2	1.85	0.48	1.98	0.72	1.85	0.74	0.72	0.54	1.84	0.68	0.74	1.23
Item 3	3.43	0.53	1.83	0.77	3.45	0.78	-1.04	-0.35	3.42	0.75	-0.93	-0.38
Item 4*	2.59	0.64	1.38	1.04	2.17	1.06	0.31	-1.20	2.63	0.99	-0.43	-0.86
Item 5*	2.66	0.72	1.06	0.94	2.26	0.96	0.11	-1.04	2.39	0.91	-0.17	-0.92
Item 6	2.15	1.16	1.36	0.71	2.12	0.72	0.56	0.50	2.14	0.69	0.54	0.65
Item 7	3.57	0.78	0.94	0.68	3.54	0.72	-1.30	0.50	3.61	0.64	-1.48	1.20
Item 8	1.91	1.09	1.17	0.75	1.91	0.76	0.65	0.36	1.89	0.73	0.67	0.59
Item 9*	2.69	0.71	0.73	0.90	2.24	0.89	0.12	-0.84	2.37	0.91	-0.08	-0.91
Item 10	1.30	0.74	0.67	0.53	1.32	0.54	1.70	3.06	1.27	0.52	1.98	4.35
Item 11*	2.52	0.72	0.71	0.91	2.42	0.94	-0.09	-0.93	2.52	0.90	-0.28	-0.74
Item 12	2.13	0.72	0.72	0.83	2.32	0.82	0.41	-0.25	1.95	0.80	0.73	0.37
Item 13	1.64	0.83	0.53	0.73	1.67	0.74	1.08	1.19	1.60	0.71	1.06	0.86
Item 14	1.97	0.71	0.56	0.73	1.95	0.73	0.76	0.98	1.96	0.71	0.73	1.08
Item 15	3.27	1.01	0.20	0.86	3.30	0.88	-0.91	-0.34	3.26	0.83	-0.64	-0.86
Item 16*	1.80	0.92	0.19	1.11	2.99	1.25	-0.73	-1.17	3.50	0.84	-1.77	2.40
Item 17	1.74	1.05	0.07	0.78	1.67	0.77	1.05	0.76	1.79	0.78	0.83	0.42
Item 18*	1.71	0.94	0.04	1.19	3.04	1.33	-0.78	-1.28	3.64	0.86	-2.38	4.36
Item 19	1.24	0.90	-0.03	0.48	1.31	0.53	1.57	2.21	1.17	0.40	2.59	8.02
Item 20	1.94	0.80	-0.76	0.72	1.97	0.76	0.70	0.61	1.91	0.69	0.72	1.19
Item 21	3.29	0.85	-0.77	0.80	3.26	0.83	-0.79	-0.33	3.31	0.78	-0.72	-0.57
Item 22	1.44	0.77	-0.96	0.63	1.44	0.64	1.38	1.82	1.45	0.65	1.43	1.95
Item 23	2.48	0.68	-1.39	1.01	2.43	1.00	0.29	-0.98	2.50	1.03	0.13	-1.14
Item 24	1.21	0.53	-1.77	0.46	1.20	0.42	2.13	5.30	1.22	0.48	2.61	8.44

Note. *Inverted items; *M*=mean, *SD*=standard deviation, *Sk*=skewness, and *Ku*=kurtosis.

Significant sex differences were also found in eight of the items. Boys presented higher values on items 6, 8, 10, 20 and 22 from LN compared to girls. Whereas girls presented higher values on items 15 and 21 from ER.

Several items presented normality problems. Considering the full sample, item 1 presented skewness (*Sk*) value outside recommend (-2 to 2 range; see Field, 2018; Hair et al., 2014). When considering the preschoolers, items 1, 10, 19 and 24 were outside recommend values for Sk or kurtosis (*Ku*). Whereas for school-aged, outside recommend values were items 16, 18, 19 and 24.

Confirmatory factor analysis

The original Shields and Cicchetti (1997) two-factor structure was tested using confirmatory factor analyses (CFAs) estimated with Jamovi (Version 2.3; Jamovi project, 2022) using Weighted Least Squares Mean and Variance Adjusted (WLSMV) to count for the ordinal origin of the data has well has for the normality issues.

Model fit adjustment was established considering the following indices: Comparative Fit Index (CFI≥.95 good and ≥.90 acceptable); Tucker-Lewis Index (TLI≥.90); Standardized Root Mean Square Residual (SRMR<.05 and Root Mean Square Error of Approximation (RMSEA≤.05) with a 95% confidence interval (Brown, 2015; Hair et al., 2014; Hu & Bentler, 1999; Yu & Muthén, 2002).

The two-factor model presented a poor fit (CFI=.80, TLI=.77, SRMR=.08, RMSEA=.08 with CI 95% [.07, .08], p<.001). For model fit improvement, on the first model, the residuals for *items 16* and *18* were correlated (see Marsh et al., 2014), as their sentences were very similar and they are both inverted items (CFI=.85, TLI=.83, SRMR=.070, RMSEA=.064 with CI 95% [.060, .069]). On the second model, standardized factor loadings were considered (<.30 poor; see Tabachnick & Fidell, 2013): *item 23* (ER, l=.00, p=.99), *item 4* (L/N, l=.10, p=.06), were deleted and the model presented almost an acceptable fit (CFI=.90, TLI=.85, SRMR=.064, RMSEA=.056 with CI 95% [.051, .061]). On the third model, *item 11* was deleted (L/N, l=.11, p=.02) and an acceptable fit was reached for most of the indices (CFI=.91, TLI=.90, SRMR=.063, RMSEA=.054 with CI 95% [.049, .060]). Although some factor loadings remained low, the model achieved an acceptable fit. To preserve the structure as close to the original as possible, no additional items were removed (see Table 2).

Table 2

Standardized factor loadings for two-factor model CFA

Subscale	Item	λ
Emotion Regulation	Item 1	.41
	Item 3	.49
	Item 7	.65
	Item 15	.46
	Item 16*	.26
	Item 18*	.26
	Item 21	.48
	Item 23	-
Lability/Negativity	Item 2	.59
	Item 4*	-
	Item 5*	.22
	Item 6	.62
	Item 8	.72
	Item9*	.24
	item 10	.36
	Item 11*	-
	Item 13	.65
	Item 14	.70
	Item 17	.36
	Item 19	.34
	Item 20	.56
	Item 22	.54
	Item 24	.32

Note. *Inverted items, - Excluded items.

Measurement invariance (Child's age and sex)

Child's sex and age (preschool vs school sample) invariance was tested using Multi-Group Confirmatory Factor Analyses (MG-CFA). Factor structure was analysed with same items being associated with same construct (configural invariance), examining the equivalence of the loadings (metric invariance) and the equivalence of intercepts (scalar invariance) (Geiser, 2014). When differences in fit indices (ΔCFI and ΔRMSEA) between a model and the (preceding) less constrained model was ≤.01 for ΔCFI and ≤.015 for ΔRMSEA level of measurement invariance was achieved (Chen, 2007).

Considering sex, configural, metric and scalar invariance between two groups was observed as the differences between successive models were below standard thresholds (ΔCFI=.006, .003, .005 and ΔRMSEA=-.003, -.001, -.003) (Chen, 2007). For age only configural invariance was achieved (ΔCFI=.005 and ΔRMSEA=.001). Meaning that, strength of the relationships (loadings) between the latent factors and their observed items are not equivalent across groups.

Finally, considering the final model (with 3 LN items removed and the correlation between two residuals), the Cronbach's alpha (α) coefficient with a CI 95%, was calculated as an estimation of the reliability of the ERC subscales. The results revealed an α=.66 for ER and an α=.80 for LN.

Discussion

The main aim of the present study was to examine the psychometric properties and the factorial structure of the Portuguese version of the Emotion Regulation Checklist (ERC) across preschool and school-aged children, while testing for sex and age invariance. To our knowledge, although ERC Portuguese version has been widely used in previous studies, its structural validity or measurement invariance was not tested.

The descriptive analysis revealed some variations in mean scores across items and between preschool and school-aged children. For instance, item 1 ("... cheerful child") showed the highest mean score, indicating this trait's high prevalence across age groups, while item 24 ("... negative emotions when attempting to engage others in play") scored the lowest. Notably, significant differences emerged between preschoolers and school-aged children on nine items, highlighting developmental variations in emotional regulation and lability. Preschoolers scored higher on items reflecting positivity and emotional reactivity, while school-aged children scored higher on items indicating more nuanced regulatory behaviours. No significant sex differences were found between the items mean scores.

As in previous studies (e.g., Lucas-Molina et al., 2022), the original two-factor model proposed by Shields and Cicchetti (1997) demonstrated poor fit to the data, reflecting potential cultural or developmental differences in the expression of emotional regulation and lability/negativity. To improve model fit, modifications were applied based on both theoretical and empirical considerations. The correlation of residuals for items 16 and 18, which shared inversion and semantic similarity (both referring to apathy), resulted in moderate improvement. Subsequently, three lability/negativity items (items 8, 13 and 14), with low standardized factor loadings were removed, leading to a final model with acceptable fit indices. These items regarded outbursts behaviours. This may reflect differences in cultural acceptance of children's negative emotions, excitement, and energetic behaviour, or even language-related factors, compared to the original study. Similar results were found in the Brazilian-Portuguese (Reis et al., 2016), Spanish (Lucas-Molina et al., 2022), and Italian (Molina et al., 2014) studies.

The results of the MG-CFA revealed full configural, metric, and scalar invariance for sex, supporting the equivalence of the ERC across boys and girls. This indicates that the ERC can reliably assess emotional regulation and lability/negativity regardless of sex, allowing for meaningful comparisons. However, only configural invariance was achieved for age groups. This suggests that while the basic factor structure is consistent across preschoolers and school-aged children, the strength of the relationships (loadings) between items and latent factors varies. Such findings may reflect developmental differences in how emotional regulation and lability manifest or are interpreted by caregivers. Previous studies have also presented some group ages differences (e.g., Lucas-Molina et al., 2022). Future research should explore whether specific items are more developmentally sensitive and adapt them accordingly.

The reliability analyses revealed acceptable internal consistency for the lability/negativity subscale (α=.80), while the emotional regulation subscale showed lower reliability (α=.66). Previous studies have also reported better LN reliability compared to ER (e.g., Meybodi et al., 2018; Molina, 2014). This discrepancy suggests that the emotional regulation dimension may require further refinement, such as the inclusion of additional items to better capture the construct or improvements in the clarity of existing items.

Limitations should be considered when interpreting the findings. First, the reliance on caregiver reports introduces potential bias, as responses may reflect caregivers' perceptions rather than children's actual behaviours. Second, the relatively low reliability of the emotional regulation subscale highlights the need for further refinement of this dimension. Finally, the inability to achieve metric invariance across age groups limits the generalizability of findings related to developmental comparisons.

Our findings highlight the importance of considering developmental and cultural contexts when assessing emotional regulation. The lack of metric invariance for age groups highlights the need for cautious interpretation when comparing scores across developmental stages. Exploration of age-specific modifications to enhance the ERC's applicability should be addressed in future studies. Larger and more diverse samples should be used to confirm these findings and explore alternative models that better capture emotional regulation's cultural nuances. Additionally, qualitative approaches may offer deeper insights into how caregivers interpret and rate their children's behaviours, particularly for items susceptible to non-normality.

Overall, the Portuguese ERC demonstrates promise as a tool for assessing emotional regulation and lability/negativity in children, with modifications improving its psychometric properties. However, further refinement and validation are needed to enhance its developmental sensitivity and cultural relevance.

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Authors contribution

Conceptualization: MF, MV; Methodology: MF, IM, CS, MG, OR, CF, EP, AFS, AJS, MV; Project administration: MF; Supervision: AJS, MV; Funding acquisition: MF, MG, CF, AJS, MV; Writing – Review and edit: MF, IM, CS, MG, OR, CF, EP, AFS, AJS, MV.

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Estrutura fatorial, invariância de medida e fiabilidade da Emotion Regulation Checklist (ERC) numa amostra de pais portugueses

Resumo: A regulação emocional é fundamental para o desenvolvimento sócio-emocional e da saúde mental, com implicações ao longo da vida. O Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1997) é um instrumento amplamente utilizado para avaliar a regulação e a desregulação emocional das crianças. Apesar do seu uso generalizado e de estar traduzido em diversas línguas, os resultados relativamente a estrutura fatorial não são consistentes. Este estudo examina estrutura fatorial, a fiabilidade do ERC, bem como a invariância da medida, numa amostra portuguesa. A amostra incluiu 789 pais (maioritariamente mães, 90.9%) com crianças entre os 3 e os 12 anos de idade (49.3% em idade pré-escolar e 50.7% em idade escolar), que preencheram a escala. A Análise Fatorial Confirmatória (AFC) revelou que o modelo original de dois fatores (Regulação Emocional e Labilidade/Negatividade) apresentou um ajustamento aceitável. No entanto, foi necessário remover três itens e correlacionar os resíduos de dois outros itens. Foi alcançada invariância total em relação ao sexo (rapazes e raparigas). Contudo, relativamente à idade, apenas foi obtida invariância configural, indicando que devem ser esperadas diferenças nos pesos fatoriais entre crianças em idade pré-escolar e escolar. No modelo final, os coeficientes alfa de Cronbach (α) foram de .66 para Regulação Emocional e .80 para Labilidade/Negatividade. Estes resultados suportam a utilização da versão portuguesa para pais do ERC, para crianças em idade pré-escolar e escolar.

Palavras-chave: Regulação emocional, ERC, Estrutura fatorial, Fiabilidade, Pais de crianças em idade pré-escolar e escolar.

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