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NEO-FFI: Psychometric Properties of a Short Personality Inventory in Portuguese Context

NEO-FFI: Propriedades Psicométricas de um Inventário Reduzido de Personalidade no Contexto Português

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Abstract

The aim of this study was to assess the psychometric properties (validity and reliability) of the Portuguese adaptation of the *NEO Five-Factor Inventory* (NEO-FFI) and to compare the obtained structure to the original North American version. The methods of analysis used for cross-validation of the factorial structure were the Principal Axis Factoring (PAF) and the Confirmatory Factor Analysis (CFA). PAF reproduced the original structure of NEO-FFI and CFA revealed a satisfactory fit of single-factor models for the five dimensions. The reliability analysis showed high values of internal consistency which are congruent with previous international adaptations of the NEO-FFI. Multidimensional analysis showed significant main effects of gender and academic qualifications on personality using age as covariant. The findings suggest that the Portuguese version of the NEO-FFI is a reliable instrument to measure the five dimensions of personality.

Keywords: NEO-FFI, personality, psychometrics, Portuguese context.

Resumo

O objetivo deste estudo foi avaliar as propriedades psicométricas (validade e fidelidade) da adaptação portuguesa do NEO-FFI e comparar a estrutura obtida com a versão original americana. Como métodos para a validação cruzada da estrutura fatorial foram usados a Análise Fatorial de Eixos Principais (PAF) e uma Análise Fatorial Confirmatória (CFA). A PAF reproduziu a estrutura original do NEO--FFI e a CFA revelou modelos uni-factoriais de ajustamento satisfatório para cada uma das cinco dimensões. A análise de fidelidade revelou elevados valores de consistência interna, congruentes com as adaptações prévias internacionais do NEO-FFI. A análise multidimensional revelou efeitos principais significativos do género e das qualificações académicas na personalidade, usando a idade como co-variante. Os resultados sugerem que a versão portuguesa do NEO-FFI é um instrumento fiável para medir as cinco dimensões da personalidade.

Palavras-chave: NEO-FFI, personalidade, psicometria, contexto português.

The Five-Factor Model (FFM) organizes human personality traits across cultures under a comprehensive framework (Costa & McCrae, 1992; Muck, Hell, & Gosling, 2007) of five dimensions – Neuroticism, Extraversion, Openness to Experience, Agreeableness and Conscientiousness. The dimensions are empirical generalizations that reflect enduring differences in behavioural, emotional and cognitive patterns between individuals (Costa & McCrae, 1992; Rolland, Parker, & Stumpf, 1998). The Revised NEO Personality Inventory (NEO-PI-R; Costa & McCrae, 1992) is a measure of the five dimensions of personality and of the six facets that underlie each dimension. The original NEO-PI-R has high internal consistency levels, good test-retest reliabilities as well as convergent and discriminate validity and the translations available in several idioms are also psychometrically sound (e.g., McCrae et al., 1999; McCrae, Terracciano, & Personality Profiles of Cultures Project, 2005).

The NEO-PI-R is a 240-item measure of the FFM's and takes about 45 minutes to complete. The NEO-Five Factor Inventory (NEO-FFI), with 60 items is a shortened version of the NEO-PI-R with equivalent comprehensive-

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ness, but amenable to be applied in research projects that require the administration of a brief instrument to measure the FFM (e.g., Aluja, Garcia, Rossier, & Garcia, 2005; Lucas & Donnellan, 2009). The original NEO-FFI's reliability has been demonstrated in the North American context (Costa & McCrae, 1989), with values of internal consistency ranging from .68 to .86, and the same is true for adaptations developed for other cultures (e.g., Aluja et al., 2005 found values ranging between .70 and .87; Egan, Deary, & Austin, 2000, found values ranging between .72 and .87). Alike the NEO-PI-R, the NEO-FFI is cross-culturally stable (Aluja et al., 2005; Lucas & Donnellan, 2009) although there are some exceptions related to failures in the reproduction of structure (e.g., Aluja et al., 2005; Furham, 1997; Korner et al., 2008). The following strategies have addressed reliability and validity issues with initial versions of the NEO-FFI (McCrae & Costa, 2004): (a) minimization the effects of acquiescence; (b) increase the correlations with NEO-PI-R factor scores; (c) diversification of the item content by selecting items from underrepresented facets, and increase the intelligibility of the items. Validity and reliability (Cronbach alpha range from .75 to .82) of the new version has been demonstrated (McCrae & Costa, 2004).

A Portuguese adaptation of NEO-PI-R is available with good psychometric properties (Lima, 1997). The factor structure of the Portuguese NEO-PI-R corresponded to the Five-Factor Model, as revealed by varimax-rotated principal components analysis. The factors explained 21% of the variance. This is similar to the North American context, in which the five factors could explain 23% of the variance (Costa, McCrae, & Dye, 1991). When the 30 facets were factored, five components could account for 55% of the variance as compared to 58% reported by Costa et al. (1991). Procrustes rotation showed that all factors and all variables had statistically significant patterns of loadings. Overall structures of the Portuguese and the North American were similar. The process of translation complied with international guidelines (e.g., Van de Vijver & Hambleton, 1996):

1. Translation by four Portuguese university faculty fluent in English with various backgrounds on social sciences;
2. Pilot testing with a small group of 20 subjects and subsequent item editing and reviewing to improve clarity and comprehension by the reader;
3. Determination of the judgmental evidence using a back-translation of the final version by an English native fluent in Portuguese and
4. Approval by the authors of the original instrument after minor modifications (Lima, 1997). The application of the NEO-PI-R adapted to Portuguese, replicated the FFM, and variations in personality related to age, occupation, education and gender equivalent to many countries: (a) Women were associated with higher scores for Neuroticism and Agreeableness and lower for Extraversion; (b) Older subjects were less neurotic, extravert and open to experience; (c) As compared to non-students, students were more extraverts, neurotic and open to experience and less agreeable and conscientious (Lima, 1997; McCrae, Costa, Del Pilar, Rolland, & Parker, 1998).

The present study reports the development of the Portuguese NEO-FFI to meet research demands in Portugal. Like the original version, the Portuguese NEO-FFI was created with the 12 items of NEO-PI-R from each dimension with the highest correlations with validimax factor scores (McCrae & Costa, 2004). The primary research objectives of this study were: (a) to assess the psychometric properties of the Portuguese NEO-FFI, (b) to analyze the structure of the Portuguese NEO-FFI relatively to the original North American version.

Materials and Methods

Sample

Thousand two hundred and ninety participants answered the Portuguese NEO-FFI. The study excluded subjects with missing values from the analysis (absence of data for more than 30 items of the scale, N=53) and for participants with lower than 30 missings (n=9) a regression imputation (according to each of the personality's dimensions) was performed. The absolute values of skewness and kurtosis for all items were within the acceptable range of the normal distribution (lower than 3.0 and 8.0, respectively; Kline, 2005).

The sample included 1237 subjects, 843 were females (68.4%) and 390 males (31.6%), with ages within the range of 18-92 years old (M=42.95; SD=22.77). Participants' educational levels (according to International Standard Classification of Education) included Primary/Level 1 (27.2%), Lower Secondary/Level 2 (9.3%), Secondary/Level 3 (42.9%) and Tertiary Education/Level 5 and 6 (16.7%). The sample and the Portuguese population have similar distributions for further academic qualifications and age groups as reported by Institute of National Statistics (2010; the entity responsible for ensuring the production and dissemination of official statistical information), apart from slightly over-representations of Secondary Education (+27%), of age group of 18-24 years old (+25.6%) and females (+16.3%).

Measure

The Portuguese NEO-FFI includes 60 items and can be completed in approximately 15 minutes. The answer format is a 5-point likert scale ranging from 0 (strongly disagree), 1 (disagree), 2 (neutral), 3 (agree) to 4 (strongly agree).

Procedures

Participants answered voluntarily and individually (926 answered on paper and 311 online in a secured computer facility) and confidentiality was guaranteed. In Portugal, the law on experiments on humans does not require

ethics approval for studies developed outside biomedical or health sciences which involve human persons the goal of developing knowledge. College age participants were recruited in university contexts and responses from older subjects were collected with *snowball* sampling started by students in the context of a course assignment. Confidentiality was guaranteed. Data were analysed with PASW Statistics 18 (Predictive Analytics Software) and AMOS 18 (Arbuckle, 2009). The factorial structure of NEO-FFI was tested with a holdout method for cross-validation randomizing the full sample into two sub-samples of 619 participants (A) and 618 (B). A Principal Axis Factoring (PAF) was applied to extract the personality dimensions in Sub-sample A. In sub-sample B, cross-validated factor models of Confirmatory Factor Analysis (CFA) were applied (Sample 1=309; Sample 2=309) with Maximum Likelihood estimation method for each dimension (as Gignac, Bates, & Jang, 2007) and for all five factors. The reliability of the five dimensions was tested with Cronbach's alpha and with estimates of an equally weighted composite (as Gignac et al., 2007). Additionally, as personality factors structure can be different considering education level, a PAF was performed with whole sample (N=1237) divided into two groups of education: Level 1 and 2 *vs* Level 3, 4 and 5.

Results

Principal Axis Factoring (PAF)

The underlying assumptions for PAF (with direct oblimin rotation) fixed for five factors were guaranteed: KMO=.85 and Bartlett's Test of Sphericity significant (p<.001). The structure reproduced the five dimensions of personality (Table 1). There were 10 items either with the highest loadings on unintended factors (i.e., items 164, 87, 19, 162, 104 and 67) or on the intended factor but with loadings less than .30 (i.e., items 1, 45, 93 and 109; grey highlights on Table 1). The total explained variance before oblimin rotation was 35.2%.

PAF analysis considering the educational background produced two different structures and guaranteed underlying assumptions - significant Bartlett's Tests of Sphericity (p<.001) and adequate KMO (KMO=.86 and .84, respectively for "secondary and tertiary education" and "primary and lower secondary education"). The "secondary and tertiary education" group revealed a five factor structure with 11 items with incongruent loadings and an explained variance of 35.39%. For the "primary and lower secondary education" group, the number of items with incongruent loadings was higher (18 items) and the explained variance was similar (34.48%; Tables 8-9 supplementary material).

Table 1
Principal Axis Factoring with Direct Oblimin Rotation Solutions of NEO-FFI Items

Item	Factor					
	Communalities	E	C	N	A	O
177	.64	**.75**	-.01	-.15	.17	-.04
237	.49	**.68**	-.10	.03	.16	.08
147	.52	**.59**	-.02	-.24	.22	.06
122	.44	**.59**	.11	.06	.21	.00
107	.35	**.49**	.03	-.04	-.25	.14
37	.22	**.49**	-.06	.00	.04	-.10
227	.52	**.44**	.37	-.20	-.13	.14
142	.28	**.40**	.07	-.05	-.17	.20
164	.28	**.34**	.21	-.04	.24	-.22
197	.17	**.31**	.10	.04	-.12	.17
85	.51	.06	**.70**	-.06	-.06	.01
110	.45	.10	**.65**	.01	-.10	.03
200	.46	.23	**.60**	-.01	-.16	-.02
25	.39	.02	**.60**	-.10	.00	-.06
50	.36	.10	**.55**	-.06	-.05	.12
55	.34	-.13	**.52**	-.16	.08	-.16
135	.30	.04	**.51**	-.03	.06	.09
15	.33	.12	**.51**	.07	.09	.09
130	.29	-.15	**.50**	-.14	.10	-.01
40	.28	.05	**.48**	.12	.07	-.13

70	.16	-.12	**.42**	.04	-.06	.07
104	.33	.13	**.35**	.17	.33	.10
45	.09	-.05	**.19**	-.17	.14	-.01
91	.39	.06	.08	**.59**	-.18	-.06
86	.33	.10	-.01	**.57**	-.11	.05
221	.37	.01	-.20	**.51**	.03	-.18
71	.44	-.39	-.04	**.50**	.05	.06
26	.39	-.02	-.26	**.50**	-.03	-.16
11	.33	-.23	.01	**.49**	.04	-.05
136	.30	-.11	-.14	**.47**	-.11	.03
61	.25	-.06	-.15	**.46**	.05	.02
6	.29	.02	.07	**.44**	-.29	-.05
41	.35	-.17	-.24	**.43**	-.07	-.04
87	.32	.26	.07	**-.41**	.03	.12
76	.19	.07	-.23	**.31**	-.08	.18
19	.16	.08	.13	**.27**	.23	.11
1	.08	-.11	.07	**.25**	.09	.06
162	.09	.01	-.08	**-.23**	-.14	.09
74	.41	.15	.06	-.01	**.60**	-.07
59	.26	.04	-.11	-.01	**.51**	.06
39	.32	-.06	.24	.02	**.48**	-.01
14	.23	.01	.10	-.09	**.44**	.02
4	.24	.11	-.07	-.06	**.42**	.16
229	.24	.04	.24	-.05	**.38**	-.08
64	.24	-.03	-.16	-.24	**.36**	.17
44	.31	.11	.29	.26	**.35**	.07
67	.16	.03	-.11	-.14	**.31**	.18
109	.10	-.04	-.09	.12	**.24**	-.14
188	.34	.03	.05	.15	.04	**.57**
23	.37	.18	-.09	-.03	-.12	**.52**
128	.26	-.05	.06	.09	.08	**.51**
203	.36	.11	.23	-.01	-.13	**.51**
163	.23	-.13	.05	-.10	.10	**.45**
28	.25	.11	.06	-.13	.12	**.39**
108	.20	.14	.02	-.08	-.13	**.36**
98	.17	.12	.07	.12	.02	**.36**
173	.12	-.05	-.01	-.01	.08	**.34**
88	.16	-.04	-.11	-.15	-.10	**.33**
78	.19	-.11	-.17	-.21	.07	**.31**
93	.13	.13	-.10	.16	.10	**.26**
Eigenvalues		8.10	4.20	3.37	3.05	2.38
% Variance		13.50	7.00	5.62	5.09	3.97

Note. Larger loadings are in bold for each component.

Confirmatory Factor Analysis (CFA)

In order to guarantee the adequacy of exploratory and confirmatory factor analysis statistical procedures a regression imputation was performed (according to each of the personality's dimensions) in nine participants (.7% of the total sample). The analysis revealed that such participants answered more than 30 items of the scale and their missing answers were not in a specific personality trait. Since the initial 1237 participants were divided into three subsamples (EFA, *n*=619; CFA subsample 1, *n*=309; CFA subsample 2, *n*=309) we have explored for possible univariate (through *z*-scores > |3.3|, *p*=.001 criteria) or multivariate (through Mahalanobis distance, *p*=.001 criteria) outliers. The proportion of participants that were not considered to be uni or multivariate outliers was substantially high (90.3% for EFA sample, 87.4% for CFA subsample 1 and 90.0% for CFA subsample 2) and the proportions of participants that were simultaneously uni or multivariate outliers was in fact very small (3.6% for EFA sample, 4.5% for CFA subsample 1 and 3.2% for CFA subsample 2).

The skewness and kurtosis values were within the acceptable range of the normal distribution (lower than 3.0 and 8.0, respectively; Kline, 2005). Furthermore, for the EFA sample skewness values varied between -1.207 (minimum) and .565 (maximum) and kurtosis values varied between -1.094 and 2.779. Similar results were obtained for the two CFA sub samples (skewness: CFA subsample 1, between -1.376 and .670; CFA subsample 2, between -1.361 and .545; kurtosis: CFA subsample 1, between -1.135 and 3.207; CFA subsample 2, between -1.116 and 3.649). Multicolinearity diagnosis was also performed based on *tolerance* scores. The minimum values obtained were .362 for EFA sample, .320 for CFA subsample 1 and .353 for CFA subsample 2, meaning that there was no multicolinearity problems. Based on these results we have decided to maintain all the participants and it gave us some guarantees to proceed with the subsequent analysis.

The fit statistics/indexes obtained with CFA for each personality dimension are summarized on Table 2. Single-models with "no correlated errors" ("Poor") showed poor fit indexes considering the Comparative Fit Index (CFI) and Root Mean Square Error of Aproximation (RMSEA; Hu & Bentler, 1999; Schermelleh-Engel, Moosbrugger, & Muller, 2003). Second single-models were tested to improve these indexes including correlated errors for the items that belong to the same facet and for other items based on Modifications Indices ("Satisfactory"). The model with five dimensions showed poor fit indexes with and without correlated errors (Table 2).

Table 2
Summary of Maximum Likelihood Model Fit Statistics/Indexes

	Sample 1						Sample 2					
	Fit Level	$\chi^2(df)$	*p*	SRMR	CFI	RMSEA (HI90)	Fit Level	$\chi^2(df)$	*p*	SRMR	CFI	RMSEA (HI90)
Neuroticism	Poor	167.870(54)	<.001	.061	.87	.083(.097)	Poor	229.268(54)	<.001	.077	.78	.103(.117)
	Satisfactory	80.104(37)	<.001	.045	.95	.062(.080)	Satisfactory	62.063(37)	<.001	.044	.97	.047(.067)
Extraversion	Poor	251.671(54)	<.001	.082	.77	.109(.123)	Poor	193.886(54)	<.001	.077	.76	.092 (.106)
	Satisfactory	71.584(39)	.001	.044	.96	.052(.071)	Satisfactory	74.233(39)	.001	.049	.95	.054(.073)
Openness	Poor	208.998(54)	<.001	.077	.72	.097(.111)	Poor	233.817(54)	<.001	.084	.63	.104(.118)
	Satisfactory	61.840(38)	.009	.047	.96	.045(.065)	Satisfactory	68.203(38)	.006	.048	.95	.051(.070)
Agreeableness	Poor	195.513(54)	<.001	.072	.77	.092(.106)	Poor	151.610(54)	<.001	.064	.79	.077(.091)
	Satisfactory	72.968(41)	.002	.047	.95	.050(.069)	Satisfactory	55.870(51)	.061	.040	.97	.034(.055)
Conscientiousness	Poor	263.688(54)	<.001	.087	.76	.112(.126)	Poor	245.151(54)	<.001	.076	.82	.107(.121)
	Satisfactory	72.941(37)	<.001	.045	.96	.056(.075)	Satisfactory	85.061(37)	<.001	.042	.95	.065(.083)
Global Model	1	3872.933(1710)	<.001	.119	.58	.064(.067)	1	4063.038(1710)	<.001	.114	.53	.067(0.69)
	2	2956.805(1622)	<.001	.085	.74	.052(.055)	2	3227.750(1622)	<.001	.092	.68	.057(.060)

Note. 1- Without correlated errors; 2 - With correlations between five factors and between the same errors to single models.

Reliability

Cronbach's Alpha values were: Conscientiousness =.81, Neuroticism = .81, Extraversion = .75, Agreeableness = .72 and Openness = .71, which are similar to the ones reported for the original NEO-FFI in the USA (McCrae & Costa, 2004).

The alternative estimates of internal consistency by standardized factor loadings (corresponding to χ) and standardized errors variances (corresponding to δ) are presented in Tables 1-5 in supplementary material. The standardized correlated errors are presented in Tables 6-7 in supplementary material. The summary of reliability estimates is presented in Table 3.

Table 3
Summary of Reliability Estimates for Samples 1 and 2

	Sample 1			Sample 2		
	ω A	ω B	Δω	ω A	ω B	Δω
N	.98	.92	.05	.97	.92	.06
E	.97	.90	.07	.97	.84	.13
O	.96	.87	.09	.95	.82	.13
C	.98	.92	.06	.99	.92	.06
A	.98	.93	.04	.97	.96	.02

Factors Inter-Correlation

Table 4 reports the inter-correlations between the five factors produced by PAF. Low, significant and positive correlations were found between: (a) Extraversion and Openness or Conscientiousness; (b) Conscientiousness and Agreeableness. Neuroticism and Extraversion, Openness or Conscientiousness showed negative correlations. Correlations ranged from -.01 to .24.

Table 4
Intercorrelations Matrix

Factor	Conscientiousness	Neuroticism	Agreeableness	Openness
Extraversion	.212***	-.116**	.046	.242***
Conscientiousness	-	-.085*	.157***	-.006
Neuroticism		-	-.042	-.125**
Agreeableness			-	.053

Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization

*p<.05; **p<.01; ***p<.001.

Multivariate Analysis

The academic qualifications diverged related to age [t (1173) = 32.26, p<.001]: subjects with "Primary/Lower Secondary Education" (M=61.4) were significantly older than those with "Secondary/Tertiary Education" (M=30). To control the effect of age on academic qualifications, a MANCOVA was performed after assuring assumptions of homogeneity of Covariance Matrices and Multicollinearity and Singularity.

Significant main effects of gender and academic qualifications on personality dimensions were found, using age as a covariant. Results indicated that females scored significantly higher on Neuroticism [F(1,1174)=54.12, p<.001; χ^2_p = .044, 95% CI (2.67, 5.01)], Conscientiousness [F(1,1174)=5.00, p<.05; χ^2_p = .004, 95% CI (.26, 2.27)] and Agreeableness [F(1,1174)=14.40, p<.001; χ^2_p = .012, 95% CI (.81, 2.60)]. Participants with "Primary Education/Lower Education" scored significantly lower on Openness [F(1,1174)=46.56, p<.001; χ^2_p = .038, 95% CI (-4.42, -1.87)] than those with "Secondary/Tertiary Education". In a bivariate analysis, significant, moderate and negative correlations were found between age and Extraversion (r =-.276, p <.001) and Openness (r =-.450, p <.001). Low but significant and positive correlation was found between age and Conscientiousness (r=.091, p<.01).

Discussion

The NEO- FFI is used across cultures to measure the five dimensions of personality. The present work assessed the psychometric properties of the Portuguese NEO-FFI, an instrument developed with items taken from the NEO-PI-R to meet the need for a shortened measure of personality in Portugal. The results obtained with Principal Axis Factoring and Confirmatory Factor Analysis showed

that the Portuguese NEO-FFI is largely equivalent to the original version (McCrae & Costa, 2004) and further confirms that the five dimensions of personality are present in the Portuguese population.

Research that involves the adaptations of psychometric instruments must deal with difficulties arising from cultural and linguistic differences between the source and target languages, and with higher item factor loadings in alternative dimensions. There were six such items in the present study, probably due to the following dissimilar interpretations: (a) "I usually prefer to do things alone" (item 67) is regarded a sign of individualism associated with arrogance/ overconfidence/ pride (connected to the absence of Agreeableness instead of Extroversion); (b) "Most people I know like me" (item 164) is commonly seen as conceit (connected to Extroversion instead of Agreeableness); (c) "I'm not a cheerful optimist" (item 87, which is originally from Extroversion) and "I would rather cooperate with others than compete with them" (item 19, which is originally from Agreeableness) can be seen as a sign of distress or neuroticism (connected to Neuroticism); (d) "I would rather go my own way than be a leader of others" (item 162) can be perceived as self-centeredness with a neurotic flavor (connected to Neuroticism instead of Extroversion); (e) "I generally try to be thoughtful and considerate" (item 104) can be viewed as an indicator or self-discipline (which relates to conscientiousness (.35) instead of Agreeableness (.33). We maintain that the Portuguese NEO-FFI should not be revised strictly according to the empirical factor loadings, since the dimensions measured are broad and the losses in internal consistency do not harm the reliability of any dimension. Within the context of the original and adaptations of NEO-FFI, previous circumstances of mismatches of item loadings, the primacy was conferred to theoretical / conceptual aspects over empirical loadings (McCrae & Costa, 2004).

Given the reported concerns on the robustness of NEO-FFI, we triangulated methods – cross-validation, reliability and inter-correlations – to study the Portuguese adaptation. We essentially found coherency between the results arising from the different methods. The values for the dimensional internal consistencies were congruent with values reported previously for other countries (McCrae & Costa, 2004), at the acceptable (for Openness, Extraversion and Agreeableness) and robust (for Neuroticism and Conscientiousness) levels. The intercorrelations revealed by PAF between personality factors were significant and could reflect a general factor of personality as suggested by other authors (Bäckstrom, Bjorklund, & Larsson, 2009). The construct validity of the Portuguese NEO-FFI was assessed with PAF and CFA single models that originated fit indexes above the consensus cutoff points for such circumstances (Hu & Bentler, 1999; Schermelleh-Engel et al., 2003). The international literature on validation of NEOFFI adaptations presents different approaches of CFA (Egan et al., 2000; Gignac et al., 2007). In the present study, CFA was performed based on current evidence that suggest an alternative factorial method for testing personality structure. Based on the relative interdependence of the five personality dimensions, the recommendation is that CFA is applied to each dimension individually instead of considering the 5 dimensions of personality as a single model (Gignac et al., 2007). In fact, the application of a CFA global model failed to originate fit indexes adjusted to data above the same cutoff points. A biasing effect on the reliability by the misfit CFA model was found in our data, as reported previously by Gignac and colleagues (2007).

The validity of the Portuguese NEOFFI is corroborated by congruencies of the Portuguese NEO-FFI and NEO-PI-R (Lima, 1997) and by with international studies (McCrae & Costa, 2004). Firstly, the study found a main effect of gender and academic qualifications on personality using age as covariate. Secondly, the study replicated the "crucial practical importance" (Hojat & Hu, 2004, p. 243) of the association between academic qualifications and personality, as higher education had a positive effect on personality scores (perhaps reflecting college students' relatively stronger will for stimulating experiences and for pursuing knowledge). Thirdly, there was a female gender effect on Neuroticism, Conscientiousness and Agreeableness - in this case with small effect size estimates (Colliver, 2007; Lecroy & Krysik, 2007). This result is theoretically plausible as the literature suggests that there are some psychosocial gender specificities, specifically, the more investment of women in nurturing than men (reflecting more agreeableness), the tendency to feel depressed or anxious more prevalent in women (higher neurotic scores), and the emphasis on social expectations of an appropriate behavior that is more prominent for females than males (Aluja et al., 2005; Costa, Terracciano, & McCrae, 2001). Finally, the age correlated with three personality dimensions (Lima, 1997; McCrae et al., 1999), negatively for Extraversion and Openness, and higher on Conscientiousness, a recurrent finding related to the "psychosocial maturity" of the participants (McCrae et al., 1999).

In summary, the Portuguese NEO-FFI is a reliable personality measurement tool, more convenient than the NEO-PI-R. As in the original version, gains in convenience are met at the expense of loss of information concerning NEO-PI-R facets. The study's main limitation was the use of samples of convenience mostly college age, which might condition the generalizability of the results to the Portuguese population. Nevertheless, the NEO-FFI revealed the primary dimensions of personality proposed in the Five Factor Model in Portuguese subjects. This study's demonstration of the validity and reliability of the Portuguese Neo-FFI contributes to international research on personality and paves the way for future comparative and collaborative research on the FFM incorporating Portuguese participants.

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Appendix

Table 1
Completely Standardized MLE Parameter Estimates for Poor and Satisfactory Fitting Single-Factor Models: Neuroticism

Items	Sample 1				Sample 2			
	Poor		Satisfactory		Poor		Satisfactory	
	χ	δ	χ	δ	χ	δ	χ	δ
1	.18	.10	.11	.10	.23	.09	.18	.09
136	.63	.07	.66	.07	.64	.07	.68	.07
86	.55	.09	.53	.10	.54	.10	.51	.11
11	.52	.08	.48	.09	.48	.08	.40	.08
91	.58	.07	.52	.07	.54	.06	.46	.07
41	.64	.08	.68	.08	.67	.08	.67	.09
61	.52	.07	.43	.08	.41	.08	.33	.09
6	.48	.07	.44	.08	.47	.08	.45	.08
221	.56	.08	.64	.08	.57	.08	.59	.08
71	.65	.06	.60	.07	.53	.07	.43	.08
26	.58	.07	.63	.07	.61	.08	.66	.08
76	.42	.11	.41	.11	.34	.11	.41	.11
Σ	6.31	.93	6.13	.97	6.02	.96	5.76	1.00
Σ^2	39.82		37.59		36.23		33.13	
	ωA .98		ωB .92		ωA .97		ωB .92	

Note. All factor loadings were statistically significant (p<.001); χ = standardized factor loadings; δ = standardized errors variances; Σ= Sum; Σ^2= Sum Square; ωA = reliability estimates for poor model; ωB = reliability estimates for satisfactory model.

Table 2
Completely Standardized MLE Parameter Estimates for Poor and Satisfactory Fitting Single-Factor Models: Extraversion

Items	Sample 1				Sample 2			
	Poor		Satisfactory		Poor		Satisfactory	
	χ	δ	χ	δ	χ	δ	χ	δ
37	.42	.07	.46	.07	.43	.08	.48	.08
237	.65	.06	.49	.08	.65	.05	.52	.06
147	.76	.05	.55	.07	.57	.07	.25	.09
122	.53	.04	.59	.04	.52	.05	.61	.05
142	.33	.06	.43	.06	.35	.07	.50	.07
67	.15	.09	.08	.09	.07	.08	.01	.08
107	.41	.07	.49	.07	.39	.07	.39	.08
177	.86	.03	.72	.05	.80	.04	.63	.05
87	.42	.09	.22	.10	.39	.09	.18	.10

197	.19	.07	.23	.07	.21	.07	.15	.07
227	.59	.05	.68	.05	.42	.06	.50	.06
162	.08	.09	.08	.09	.03	.07	-.01	.07
Σ	5.39	.75	5.01	.84	4.84	.79	4.22	.86
Σ^2	29.07		25.07		23.41		17.81	
	ωA .97		ωB .90		ωA .97		ωB .84	

Note. All factor loadings were statistically significant (p<.001); χ = standardized factor loadings; δ = standardized errors variances; Σ= Sum; Σ^2= Sum Square; ωA = reliability estimates for poor model; ωB = reliability estimates for satisfactory model.

Table 3
Completely Standardized MLE Parameter Estimates for Poor and Satisfactory Fitting Single-Factor Models: Openness to Experience

Items	Sample 1				Sample 2			
	Poor		Satisfactory		Poor		Satisfactory	
	χ	δ	χ	δ	χ	δ	χ	δ
93	.36	.09	.34	.09	.23	.10	.28	.10
78	.11	.09	.17	.09	.18	.07	.27	.07
98	.45	.06	.35	.06	.47	.05	.27	.06
28	.46	.08	.58	.09	.32	.09	.48	.10
128	.59	.09	.44	.11	.50	.09	.21	.11
108	.36	.10	.33	.11	.27	.11	.19	.12
163	.43	.07	.52	.07	.37	.08	.55	.08
88	.24	.12	.29	.12	.22	.13	.31	.13
188	.63	.08	.44	.10	.67	.08	.38	.09
173	.29	.09	.37	.09	.35	.09	.45	.10
203	.54	.05	.49	.06	.51	.06	.32	.07
23	.57	.07	.68	.11	.50	.08	.71	.15
Σ	5.02	1.01	4.99	1.09	4.60	1.03	4.41	1.15
Σ^2	25.18		24.94		21.18		19.41	
	ωA .96		ωB .87		ωA .95		ωB .82	

Note. All factor loadings were statistically significant (p<.001); χ = standardized factor loadings; δ = standardized errors variances; Σ= Sum; Σ^2= Sum Square; ωA = reliability estimates for poor model; ωB = reliability estimates for satisfactory model.

Table 4
Completely Standardized MLE Parameter Estimates for Poor and Satisfactory Fitting Single-Factor Models: Agreeableness

Items	Sample 1				Sample 2			
	Poor		Satisfactory		Poor		Satisfactory	
	χ	δ	χ	δ	χ	δ	χ	δ
44	.64	.03	.54	.04	.48	.04	.42	.04
229	.46	.06	.51	.06	.34	.07	.37	.07
14	.47	.07	.47	.07	.51	.07	.47	.08
19	.40	.04	.37	.05	.33	.05	.35	.05
4	.42	.08	.41	.08	.44	.08	.45	.08
64	.16	.10	.16	.10	.35	.09	.35	.09
164	.38	.03	.29	.04	.28	.04	.18	.04
74	.59	.07	.62	.08	.61	.07	.54	.09
59	.42	.08	.46	.08	.46	.07	.49	.08
104	.69	.02	.55	.03	.51	.03	.40	.04
109	.24	.09	.28	.09	.37	.08	.42	.08
39	.52	.06	.60	.06	.50	.06	.52	.07
Σ	5.37	.73	5.24	.76	5.16	.75	4.96	.79
Σ^2	28.87		27.50		26.59		24.59	
	ωA .98		ωB .93		ωA .97		ωB .96	

Note. All factor loadings were statistically significant (p<.001); χ = standardized factor loadings; δ = standardized errors variances; Σ= Sum; Σ^2= Sum Square; ωA = reliability estimates for poor model; ωB = reliability estimates for satisfactory model.

Table 5
Completely Standardized MLE Parameter Estimates for Poor and Satisfactory Fitting Single-Factor Models: Conscientiousness

Items	Sample 1				Sample 2			
	Poor		Satisfactory		Poor		Satisfactory	
	χ	δ	χ	δ	χ	δ	χ	δ
40	.42	.05	.38	.06	.51	.06	.47	.06
25	.59	.05	.56	.06	.65	.05	.62	.06
70	.40	.08	.34	.08	.49	.08	.42	.09
15	.53	.03	.56	.03	.63	.02	.68	.02
50	.61	.04	.59	.04	.54	.05	.53	.05
55	.35	.10	.23	.10	.46	.09	.37	.10
110	.57	.04	.56	.04	.64	.04	.64	.04
135	.61	.02	.62	.03	.53	.03	.54	.03
45	.21	.10	.18	.10	.27	.08	.25	.09
85	.72	.03	.72	.03	.72	.03	.73	.03

130	.49	.07	.40	.07	.50	.07	.39	.07
200	.60	.04	.60	.04	.66	.04	.68	.04
Σ	6.08	.64	5.73	.68	6.60	.64	6.31	.68
Σ^2	36.93		32.84		43.57		39.84	
	ωA .98		ωB .93		ωA .97		ωB .96	

Note. All factor loadings were statistically significant (p<.001); χ = standardized factor loadings; δ = standardized errors variances; Σ= Sum; ωA = reliability estimates for poor model; ωB = reliability estimates for satisfactory model.

Table 6
Completely Standardized MLE Residual Correlations for Satisfactory Fitting Single-Factor Models: Openness, Extraversion and Conscientiousness

Openness						Extraversion						Conscientiousness					
Correlated items			Sample			Correlated items			Sample			Correlated items			Sample		
			1	2	|dif|				1	2	|dif|				1	2	|dif|
98	<-->	128	.09	.16	.08	37	<-->	67	.11	.07	.04	40	<-->	130	.194	.285	.09
128	<-->	188	.44	.53	.09	107	<-->	197	.09	.14	.05	70	<-->	130	.408	.402	.01
78	<-->	108	.07	.05	.02	107	<-->	227	.08	.21	.12	40	<-->	70	.251	.235	.02
173	<-->	23	-.10	-.15	.04	197	<-->	227	.09	.13	.04	25	<-->	55	.185	.22	.04
173	<-->	203	-.15	.11	.27	147	<-->	87	.37	.35	.02	15	<-->	135	.242	-.09	.33
203	<-->	23	.13	.22	.10	177	<-->	87	.30	.25	.05	50	<-->	110	.112	.174	.06
28	<-->	88	.13	.17	.04	87	<-->	237	.21	.19	.03	135	<-->	45	.017	.092	.08
98	<-->	188	.33	.27	.06	147	<-->	177	.49	.49	.00	15	<-->	45	-.003	-.067	.06
78	<-->	88	.21	.10	.12	147	<-->	237	.37	.36	.01	110	<-->	200	.117	.183	.07
163	<-->	23	-.32	-.40	.08	177	<-->	237	.36	.28	.08	50	<-->	200	.126	.012	.11
108	<-->	203	.14	.25	.11	87	<-->	162	.21	.10	.11	25	<-->	85	.072	.024	.05
98	<-->	203	.03	.19	.16	147	<-->	67	.17	.08	.09	55	<-->	85	.185	.083	.10
28	<-->	23	-.11	-.35	.24	37	<-->	122	.31	.18	.13	55	<-->	130	.289	.258	.03
78	<-->	98	-.01	-.14	.13	107	<-->	87	.23	.04	.19	70	<-->	55	.206	.199	.01
108	<-->	88	.12	.14	.02	67	<-->	107	-.23	-.05	.19	70	<-->	15	-.173	-.055	.12
98	<-->	28	-.18	.07	.24							45	<-->	130	.175	.152	.02
												25	<-->	130	.15	.189	.04
		Σ	.83	1.24	.11			Σ	3.17	2.80	.08			Σ	2.55	2.30	.07
		$^2\Sigma$	1.66	2.47				$^2\Sigma$	6.34	5.60				$^2\Sigma$	5.11	4.59	

Note. Σ= Sum; |dif| = difference between 1 and 2.

Table 7
Completely Standardized MLE Residual Correlations for Satisfactory Fitting Single-Factor Models: Neuroticism, Agreeableness

Neuroticism						Agreeableness					
Correlated items			Sample			Correlated items			Sample		
			1	2	|dif|				1	2	|dif|
1	<-->	61	.16	.14	.02	4	<-->	64	.41	.18	.23
1	<-->	91	.15	.10	.04	44	<-->	14	-.05	-.12	.08
91	<-->	61	.15	.08	.07	14	<-->	74	.11	.25	.14
11	<-->	41	.05	.06	.01	14	<-->	104	.03	-.01	.04
11	<-->	71	.25	.48	.23	14	<-->	164	.11	.12	.01
11	<-->	221	-.22	-.11	.11	44	<-->	74	-.06	.00	.06
41	<-->	71	-.04	.07	.11	44	<-->	104	.44	.40	.05
41	<-->	221	-.13	.08	.20	44	<-->	164	.12	.18	.06
221	<-->	71	-.08	.02	.11	19	<-->	109	-.03	-.03	.00
6	<-->	76	.01	-.01	.02	164	<-->	104	.21	.16	.05
11	<-->	26	-.09	-.01	.08	74	<-->	104	.00	.11	.11
11	<-->	91	.15	.30	.15	229	<-->	19	-.02	-.02	.01
6	<-->	76	.07	-.18	.25	229	<-->	109	-.09	-.10	.01
11	<-->	76	-.07	-.17	.10						
11	<-->	61	.12	.25	.13						
61	<-->	71	.26	.20	.07						
91	<-->	6	.18	.16	.03						
		Σ	.93	1.48	.10			Σ	1.18	1.11	.07
		^{2}Σ	1.86	2.95				^{2}Σ	2.36	2.23	

Note. Σ= Sum; |dif| = difference between 1 and 2.

Table 8
Principal Axis Factors with Direct Oblimin Rotation Solutions of NEO-FFI Items for Secondary and Tertiary Education

Item		Factor				
	Communalities	N	C	E	A	O
91	.47	**-.65**	.12	.03	.22	.04
86	.39	**-.63**	.10	.01	-.02	-.01
41	.46	**-.59**	-.17	-.16	.06	.02
136	.42	**-.58**	-.14	-.14	-.08	-.03
26	.43	**-.56**	-.26	.00	-.01	-.08
221	.42	**-.55**	-.23	-.05	-.06	-.10
61	.30	**-.53**	-.02	-.07	-.08	.05
71	.48	**-.53**	-.01	-.40	.01	.11
11	.38	**-.48**	.03	-.34	.02	.13

87	.33	**.46**	.00	.25	-.02	.09
6	.25	**-.45**	.03	.01	.23	.06
76	.20	**-.41**	-.14	.13	-.01	.01
1	.16	**-.37**	.17	-.03	-.07	-.02
45	.12	**.29**	.16	-.05	-.06	.05
162	.06	**.17**	.06	-.01	.16	.02
78	.05	**.16**	-.11	-.10	-.03	.11
85	.42	.06	**.63**	.06	.02	-.06
110	.43	-.11	**.63**	.15	.01	.00
25	.39	.12	**.61**	-.06	.04	.01
200	.39	-.09	**.59**	.14	.11	.03
130	.39	.16	**.57**	-.19	-.08	-.08
70	.32	.01	**.56**	-.10	-.02	-.04
50	.37	.02	**.56**	.17	.04	.01
55	.36	.22	**.50**	-.21	-.13	.01
15	.31	-.04	**.49**	.14	-.10	.10
40	.27	-.08	**.49**	.01	-.11	-.10
135	.25	.02	**.46**	.02	.00	.15
177	.62	.19	.00	**.71**	-.19	-.04
147	.52	.26	.00	**.61**	-.20	-.04
237	.42	.07	-.11	**.61**	-.13	.07
122	.42	-.02	.07	**.59**	-.17	.07
107	.32	.03	.09	**.49**	.19	.13
227	.44	.15	.34	**.47**	.13	.09
37	.22	-.03	-.10	**.47**	-.09	-.05
142	.26	.01	.08	**.43**	.15	.15
197	.14	-.13	.10	**.32**	.05	.09
164	.17	.11	.11	**.29**	-.19	-.07
74	.38	.01	.07	.14	**-.58**	.02
59	.31	.08	-.05	.05	**-.55**	.01
4	.32	.10	-.07	.11	**-.52**	.10
39	.28	-.03	.11	-.08	**-.51**	.01
44	.28	-.19	.20	.03	**-.42**	.13
104	.30	-.14	.26	.05	**-.42**	.14
64	.22	.27	-.10	.01	**-.38**	.02
67	.16	.05	-.12	.11	**-.37**	.01
229	.21	.14	.20	-.03	**-.36**	-.09
14	.20	.21	.08	.06	**-.36**	.02
109	.15	-.12	-.06	-.14	**-.34**	.01
19	.17	-.25	.10	.06	**-.30**	.07
188	.50	-.15	-.01	-.06	-.09	**.70**
128	.40	-.07	.02	-.09	-.12	**.62**
98	.30	-.03	-.04	.04	-.05	**.53**

23	.29	-.04	-.08	.16	.16	**.47**
203	.33	.05	.23	.13	.18	**.45**
173	.15	-.02	-.01	.03	-.05	**.38**
163	.13	.11	.11	-.10	-.12	**.28**
108	.15	.13	-.03	.15	.15	**.28**
28	.14	.15	.03	.07	-.14	**.27**
93	.13	-.14	-.19	.11	-.11	**.22**
88	.09	.13	-.09	-.08	.16	**.20**
Eigenvalues		7.57	4.12	3.76	3.26	2.53
% Variance		12.61	6.87	6.27	5.43	4.22

Note. Larger loadings are in bold for each component. Grey highlights the expected factor of each item.

Table 9
Principal Axis Factors with Direct Oblimin Rotation Solutions of NEO-FFI Items for Primary and Lower Secondary Education

Item		Factor				
	Communalities	C	N	A	E	O
85	.62	**.67**	.02	-.04	.20	.14
200	.53	**.59**	.12	-.13	.20	.17
110	.45	**.57**	.02	-.16	.18	.10
25	.39	**.56**	-.04	-.02	.14	.04
50	.42	**.54**	-.04	-.20	.11	.21
130	.40	**.52**	-.21	.23	-.15	-.03
135	.43	**.51**	.11	.12	.14	.19
15	.41	**.50**	.20	.07	.13	.19
40	.29	**.49**	.18	.08	.03	-.03
55	.26	**.44**	-.22	.04	.01	-.14
70	.14	**.36**	-.06	.08	-.16	.00
76	.21	**-.34**	.28	-.06	.05	.08
45	.19	**.24**	-.21	.24	-.01	-.09
91	.31	.01	**.54**	-.04	.04	-.06
86	.29	-.06	**.51**	-.08	.06	.08
136	.35	-.16	**.51**	-.10	-.12	.15
87	.34	.05	**-.51**	.05	.23	.00
26	.35	-.23	**.47**	.02	-.08	-.13
6	.26	-.03	**.44**	-.20	-.06	.02
221	.31	-.26	**.41**	.00	.01	-.19
41	.28	-.32	**.36**	-.05	-.10	.03
64	.21	-.06	**-.33**	.23	-.15	.07
67	.13	-.13	**-.31**	.11	-.02	.07
162	.11	-.10	**-.31**	-.14	.01	-.05
11	.17	-.07	**.29**	.12	-.22	-.05

19	.21	.16	**.27**	.25	.14	.13
88	.13	-.22	**-.27**	-.04	-.03	.05
61	.16	-.16	**.25**	.13	-.16	-.11
78	.14	-.23	**-.25**	.06	-.08	.14
173	.08	-.07	**-.17**	.15	-.03	.13
74	.38	.09	-.09	**.56**	.16	-.06
14	.35	.10	-.13	**.52**	.02	.06
59	.25	-.21	-.08	**.47**	.06	.03
39	.36	.30	-.06	**.46**	-.01	.04
44	.38	.21	.24	**.39**	.25	.14
104	.50	.32	.26	**.37**	.26	.18
229	.25	.19	-.12	**.36**	.11	.07
109	.16	-.06	.11	**.34**	-.09	-.15
4	.16	-.01	-.10	**.33**	.11	.12
177	.63	-.04	-.17	.12	**.78**	-.02
237	.40	-.09	.00	.13	**.62**	.07
147	.44	.02	-.33	.17	**.56**	-.10
227	.45	.26	-.11	-.09	**.50**	.09
122	.36	.11	.11	.23	**.49**	.05
37	.22	.02	.06	.16	**.44**	.02
71	.30	-.12	.33	.10	**-.38**	.00
164	.33	.23	.11	.31	**.36**	-.08
107	.25	.01	-.04	-.22	**.34**	.21
142	.20	.12	.01	-.16	**.27**	.21
1	.05	.04	-.03	.10	**-.20**	.03
188	.37	.02	.11	.04	-.09	**.63**
203	.41	.16	-.04	-.13	.10	**.55**
23	.36	-.17	-.13	-.14	.18	**.49**
98	.31	.14	.24	.02	.08	**.46**
163	.25	.02	-.23	.15	-.13	**.40**
128	.13	.01	-.01	.06	-.10	**.36**
108	.18	.00	-.02	-.19	.10	**.34**
28	.15	.04	-.19	.13	.00	**.27**
93	.06	-.16	.04	.05	.09	**.19**
197	.09	.10	.01	-.15	.12	**.18**
Eigenvalues		8.68	4.23	3.26	2.47	2.05
% Variance		14.47	7.06	5.43	4.12	3.42

Note. Larger loadings are in bold for each component. Grey highlights the expected factor of each item.