

Development and preliminary evaluation of a brief five-factor personality instrument

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Instruments to measure personality traits in the five-factor model of personality are typically lengthy, which can hamper their use in studies with multiple measures. In this study we developed a brief five-factor instrument based on a bipolar statement response format and validated the instrument for use in the Singapore education context. The 20-item Brief Five-Factor Instrument (BFFI) comprises four items to measure each personality factor in the five-factor model. To evaluate the internal structure of the BFFI, students at two polytechnics in Singapore responded to the scale (Polytechnic A, $n = 421$; Polytechnic B, $n = 271$). Exploratory and confirmatory factor analyses were conducted to evaluate the factor structure of the measure. Results suggest that the BFFI has promise for use in the Singapore education context.

Keywords

five-factor model;
personality assessment;
scale development; scale
validity; brief personality
measure; Big Five; model
of personality

The five-factor model (FFM) of personality (McCrae & Costa, 1985) proposes that human personality can be described in terms of five broad traits: *openness*, which is the willingness to embrace ideas, values, feelings, actions, and aesthetics; *conscientiousness*, which is the tendency to be cautious, follow rules, be hardworking, and follow through with actions; *extraversion*, which is the tendency to be sociable, talkative, and have a dominant style; *agreeableness*, which is the tendency to prioritize social harmony over other considerations, and to be cooperative and sympathetic in dealing with others; and *neuroticism*, which is the tendency to worry excessively and experience negative emotions such as sadness and anxiety.

Since the FFM emerged as the dominant model of personality in the psychology literature, numerous instruments have been created to measure these personality factors, for example, the Neuroticism, Extraversion, and Openness Personality Inventory (NEO-PI; Costa & McCrae, 1985) and its various revisions and adaptations, such as Goldberg's 50-Bipolar Self-Rating Scales and 100 Unipolar Markers of the Big Five personality dimensions (Goldberg, 1992) and The Big Five Aspects Scale (DeYoung et al., 2007). These instruments provide a detailed view of personality through the lens of FFM traits. There are also shorter scales, which include the 44-item Big Five Inventory (BFI; John et al., 2008), the 40-item Big Five Mini-Markers (Saucier, 1994), the 20-item Mini-International Personality Item Pool (Mini-IPIP; Donnellan et al., 2006), and the Ten Item Personality Inventory (TIPI; Gosling et al., 2003). Although these shorter instruments are more practical for a quick personality overview, in terms of construct validity not all have demonstrated sound psychometric properties across a broad range of population cohorts (Clark & Watson, 2019).

Students' personality traits are potentially important constructs in education, because they predict many aspects of the learning process, such as preferences regarding the learning environment and approach (Holen et al., 2015). This study was conducted in the Singapore context, where consideration of personality

traits in education aligns with the Singapore Ministry of Education's 21st century skills vision that students should develop both desirable personal attributes and academic capabilities through their education. Although this vision has been embraced at various higher education institutions in Singapore, progress toward this goal is likely to be hampered by limited access to practical validated measures that can be used for ongoing monitoring in the affective domain. Instruments such as the NEO-PI (Costa & McCrae, 1985) are well-validated but provide a level of detail not required for broad monitoring purposes. Conversely, existing shorter instruments have exhibited inconsistent psychometric properties across studies, most of which have not been validated in the Singapore context.

Singapore is a multicultural country that has both native English speakers and a high proportion of residents for whom English is a second language. The items in most five-factor instruments were developed for native English speakers. For example, some single descriptive adjectives that are used may be difficult for participants to understand, particularly for those with English as a second language (Saucier, 1994). Other instruments, such as the BFI (John et al., 2008), are made up of short phrases incorporating words (e.g., imperturbable) that would also be difficult for participants whose native language is not English to understand. Thus, our goal in this study was to develop and provide a preliminary validation of a brief FFM instrument with simplified language content that is suitable for use in the Singapore context.

Method

Participants

To evaluate the internal structure of the instrument, students at two polytechnics (identified as A and B) in Singapore responded to the items in a single sitting (Polytechnic A, $n = 421$; Polytechnic B, $n = 271$). Data screening was then conducted to remove partially completed surveys and clearly disengaged responses (i.e., choosing the same response for all items). The final sample comprised 351 participants from Polytechnic A (157 men, 187 women, 7 no gender indicated) and 196 participants from Polytechnic B (85 men, 109 women, 2 no gender indicated). Participants' ages ranged between 16 and 25 years ($M_{\text{age}} = 18.00$, $SD = 1.57$, Polytechnic A; $M_{\text{age}} = 18.88$, $SD = 1.43$, Polytechnic B). All participants were of Asian ethnicity, with the majority being Singaporeans (89.9% Polytechnic A, 83.7% Polytechnic B).

Procedure

The BFFI was completed online and hosted on the Qualtrics platform. Online links were sent via email. Participants were encouraged to complete the survey in one sitting to avoid possible abandonment. They were offered no incentives to participate in the survey, and were told that their participation was voluntary and that they could withdraw from the survey at any time.

Instrument Development

The Brief Five Factor Instrument (BFFI) we developed comprises 20 items and has a 7-point, bipolar statement-based response format. To construct the instrument, we examined items in the long and short Big Five instruments listed in the introduction. We then generated an item pool to present the same essential content as these measures, but with a bipolar format. Bipolar response scales have been found to reduce acquiescence bias and to produce better model fit compared to Likert-based response formats (Friborg et al., 2006). The BFFI items are listed in Appendix A. Responses are scored from 1 to 7, with high scores indicating higher levels of the attribute indicated in the subscale title.

Results

To evaluate the internal structure of the BFFI, we conducted an exploratory factor analysis (EFA) and a confirmatory factor analysis (CFA). An EFA was first conducted on data from the 196 Polytechnic B participants to provide a preliminary assessment of internal structure (a random choice was made between

the samples for the EFA/CFA procedures). To cross-validate the EFA results, we conducted a CFA on data from the 351 Polytechnic A participants. All procedures associated with the EFA were conducted with SPSS 25.0, and those associated with the CFA were conducted with LISREL 8.80.

Exploratory Factor Analysis

Descriptive statistics and bivariate correlations for the Polytechnic B data are presented in Appendix B. We used maximum likelihood extraction in the EFA of Polytechnic B participants' BFFI scores ($n = 351$). We rotated the factors extracted to approximate a simple structure using the direct Oblimin method, allowing factors to correlate in the rotation. The criteria used to determine the number of retained factors were the Kaiser criterion of eigenvalues over 1.0, the Cattell scree plot, and a parallel analysis of obtained eigenvalues.

Data were screened to ensure compliance with all relevant assumptions prior to the EFA being conducted. No significant departure from normality was identified in the item distribution based on a comparison of skewness and kurtosis coefficients with Kline's (2005) criteria (skewness value < 3.0 and kurtosis value < 8.0). Relationships between all item score pairs were deemed to be linear through visual examinations of bivariate scatterplots. We identified no univariate outliers using standard (z) scores (all z scores < 3.0), and no significant multivariate outliers at the .001 level based on the obtained Mahalanobis distance, chi squared values. Results from the Kaiser–Meyer–Olkin (KMO) and Bartlett's sphericity tests also showed that assumptions of factorability had been met. The case-to-item ratio, which was 9.8, was adequate to yield reliable estimates of correlations among the variables.

The EFA identified five distinct factors, based on Kaiser's criterion, the scree plot, and a parallel analysis. These factors accounted for 64.11% of the item variance. Communalities and rotated factor loadings are shown in Table 1. Given that the factor rotation was oblique, we used the pattern matrix to interpret the factor item loadings from the EFA. As indicated, all items loaded most strongly on their proposed factor, with minimal cross-loadings on other factors. Cronbach's alpha for the five factors were .74 for the BFFI C subscale, .78 for the BFFI subscale, .82 for the BFFI N subscale, .86 for the BFFI E subscale, and .64 for the BFFI O subscale. Thus, the first four were well above the minimum level of .70 recommended by Nunnally (1978). As Cronbach's alpha obtained for the BFFI O subscale was lower than this minimum, this suggested that the openness factor was factorially more complex than the other factors. Collectively, however, our results indicated that the proposed five-factor BFFI model was tenable in the Polytechnic B sample.

Table 1. *Exploratory Factor Analysis Results for the Brief Five-Factor Instrument Items with Polytechnic B Participants*

Item	Communalities (extraction)	Pattern matrix loadings				
		Extraversion	Neuroticism	Conscientiousness	Agreeableness	Openness
BFFI_E1	.76	.85	.09	.05	.02	.07
BFFI_E4	.72	.84	.00	.04	.13	.07
BFFI_E2	.55	.67	-.02	.02	-.22	-.03
BFFI_E3	.62	.63	-.10	-.05	-.24	.14
BFFI_N4	.62	.21	.78	.03	.01	-.10
BFFI_N3	.56	-.01	.75	-.14	.02	.16
BFFI_N1	.64	-.06	.72	.15	-.13	.00
BFFI_N2	.59	-.25	.63	.12	-.12	-.08
BFFI_C4	.63	-.06	.05	.76	.04	.12
BFFI_C3	.50	.13	.05	.74	.06	-.14
BFFI_C1	.48	-.08	.00	.46	-.21	.28
BFFI_C2	.29	-.02	-.08	.42	-.13	.16
BFFI_A4	.71	.15	.05	-.02	-.79	.03
BFFI_A3	.55	-.02	.10	.09	-.69	-.05
BFFI_A1	.50	-.11	.17	-.03	-.68	.01
BFFI_A2	.36	.14	-.14	-.01	-.55	.01
BFFI_O1	.38	-.02	.02	.19	-.02	.54
BFFI_O3	.24	.06	.02	-.11	.08	.49
BFFI_O2	.41	.19	.06	.11	-.06	.49
BFFI_O4	.40	.03	-.11	.15	-.15	.49

Note. $n = 196$.

Confirmatory Factor Analysis

To cross-validate the EFA results, we conducted a CFA using scores from Polytechnic A ($n = 351$). Descriptive statistics and bivariate correlations for the Polytechnic A sample are shown in Appendix C. Prior to this analysis, we also conducted data screening to ensure that all relevant assumptions for CFA in terms of normality, linearity, factorability, and the absence of outlying univariate scores and multivariate score sets were met. These analyses all produced satisfactory results. Given the high case-to-item ratio of 17.55, the sample size was also deemed large enough to yield reliable estimates.

The overall chi square obtained for the five-factor model was $\chi^2(160) = 403.59, p < .05$ ($\chi^2/df = 2.52$). The goodness of fit (GFI) and adjusted goodness of fit (AGFI) values were .90 and .86, respectively, indicating that the proportion of variance accounted for by the estimated population covariance was just below recommended minimum levels (GFI $\geq .95$ and AGFI $\geq .90$). The normed fit index and nonnormed fit index values (.94 and .96, respectively) were within the recommended range (i.e., .95, or improvement of fit by 95% relative to the null model). The root mean square error of approximation, indicating the square root of the difference between the residuals of the sample covariance matrix and the hypothesized model (obtained value = .07), and the standardized root mean square residual, indicating the standardized difference between the observed correlations and the predicted correlations (obtained value = .06), were also within the recommended ranges ($\leq .08$ for both). The comparative fit index (obtained value = .96) and χ^2/df (obtained value = 2.52) were also within the recommended range for determining good fit ($\geq .90$ and ≤ 3.0 , respectively). Thus, the CFA results for the BFFI supported the proposed five-factor structure.

Discussion

In this study we aimed to provide a preliminary evaluation of a brief FFM instrument designed for use in the Singapore education context. Because the BFFI comprises only four items to measure each FFM personality factor, the instrument is very quick to administer, making it a viable option both for practical situations and for research in which multiple measures must be employed. A comparison of the psychometric properties of the BFFI with validation data published on other currently available brief instruments (indices from Boyle, 2008) is shown in Table 2.

Instruments	Internal consistency	Factors	RMSEA	SRMR	CFI
BFFI	.64–.86	5	.07	.06	.96
NEO-PI-R	.75–.85	5	.13	—	—
50-Bipolar	.71–.88	5	.58	.17	.78
50-item IPIP	.76–.87	5	.12	.07	.83
20-item Mini-IPIP	.68–.81	5	.07	.06	.82
44-item BFI	.69–.81	5	.06	.09	.64
15-item BFI	.42–.72	Not replicated	.09	—	—
10-item TIPI	.25–.71	4	.08	.05	—

Note. BFFI = Brief Five-Factor Inventory; NEO-PI-R = Neuroticism, Extraversion, and Openness Personality Inventory; 50-Bipolar = 50-Bipolar Self-Rating Scales; IPIP = International Personality Item Pool; BFI = Big Five Inventory; TIPI = Ten Item Personality Inventory; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; CFI = comparative fit index.

As the results show, the BFFI compared well with the 44-item BFI, according to comparable fit indices. In comparison to the 20-item Mini-IPIP, which comprised the same number of items, four of the five BFFI subscales exhibited higher internal consistency, with similar fit indices (although the BFFI had a higher CFI). According to the fit indices, the BFFI outperformed both the BFI-15 and the TIPI. In a comparison of the BFFI with the NEO-PI-R and Goldberg 50-Bipolar Self-Rating Scales, the BFFI had comparable internal consistency for four subscales, and better fit indices. These results show that this preliminary validation of the internal structure of the BFFI was favorable.

As noted, the alpha result for the openness factor (BFFI_O) from the Polytechnic B sample was lower than those obtained for the other four BFFI factors. Boyle (2008) reviewed a number of studies that showed FFM openness was multifactorial, rather than unidimensional, and that this factor, as operationalized in all the developed FFM instruments, might represent an oversimplification of this personality trait. The complex nature of the openness factor may explain its relatively low alpha result in this study. As the factor was operationalized in a similar manner to that used in other FFM instruments, however, it was deemed tenable to retain the factor in the overall instrument.

Further research is needed for the validation of the BFFI in contexts other than Singaporean polytechnics. It would also be useful to validate the BFFI by the correlation of the scores on this scale with those obtained through established instruments such as the NEO-PI-R or the Mini-IPIP. A study in which the BFFI subscales are correlated with measures of theoretically related constructs (e.g., anxiety scales for the BFFI_N subscale), and of the functioning of the BFFI in student cohorts from other age groups (e.g., those at secondary school) would also be useful for validation purposes. Although our results are preliminary, they support the promise of the BFFI for research and monitoring exercises in the Singapore education context.

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Appendix A

Item Statements in the Brief Five-Factor Instrument

Factor	Item label	Low-scoring statement (scored 1 at endpoint)	High-scoring statement (scored 7 at endpoint)
Conscientiousness (BFFI_C)	BFFI_C1	I put in just enough effort to finish the task.	If given a task, I will do it thoroughly, putting in extra effort where necessary.
	BFFI_C2	It is okay to skip recommended readings for my module.	I do not feel happy until I have read all the recommended reading for my module.
	BFFI_C3	I only make plans if I feel the need to.	I usually plan what I want to do and follow through with my plans.
	BFFI_C4	I do not normally review my assignments, preferring to submit them once completed.	I like to complete my assignments early so that I can thoroughly review them in case I miss out anything.
Agreeableness (BFFI_A)	BFFI_A1	I will do or say what I think is right regardless of how others may feel.	I always consider other people's feelings before doing or saying anything.
	BFFI_A2	I am usually suspicious of people's motives.	I believe in the goodness of mankind.
	BFFI_A3	I prefer to do things my way.	I will co-operate with people to get things done.
	BFFI_A4	I don't really care if people are comfortable with me.	I like to make people feel comfortable with me.
Neuroticism (BFFI_N)	BFFI_N1	I believe that there is no point in worrying about things.	I tend to worry unnecessarily.
	BFFI_N2	I think unfamiliar things give me the opportunity to learn.	When things are unfamiliar, I tend to become tense and anxious.
	BFFI_N3	I am generally calm in stressful situations.	I feel agitated in stressful situations.
	BFFI_N4	I am not too concerned about what others are saying about me.	I worry a lot about what my friends are saying about me.
Extraversion (BFFI_E)	BFFI_E1	I am mostly quiet and prefer to listen.	I enjoy talking and do that most of the time.
	BFFI_E2	I would rather spend my time alone, doing my own things.	I enjoy the company of others, I am a sociable person.
	BFFI_E3	No one seems to feel my presence, not that it matters to me.	Everyone says that I am a "livewire."
	BFFI_E4	I would rather listen than talk.	I tend to be talkative.
Openness (BFFI_O)	BFFI_O1	I am usually too lazy to think up new and original ideas.	My mind is always busy with new and original ideas.
	BFFI_O2	I prefer it when things remain constant.	I enjoy finding out about different things.
	BFFI_O3	I like routine work with minimal changes.	Routine work bores me.
	BFFI_O4	I generally use tried and tested solutions, even if they do not fit well.	I enjoy finding new solutions to problems.

Appendix B

Item	Descriptives		Correlations																				
	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1. BFFI_C1	4.84	1.47	—																				
2. BFFI_C2	4.55	1.31	.55*	—																			
3. BFFI_C3	4.28	1.58	.49*	.54*	—																		
4. BFFI_C4	4.79	1.44	.55*	.52*	.52*	—																	
5. BFFI_A1	5.09	1.49	.50*	.38*	.33*	.41*	—																
6. BFFI_A2	4.84	1.63	.38*	.35*	.24*	.29*	.49*	—															
7. BFFI_A3	5.20	1.42	.42*	.38*	.27*	.34*	.52*	.46*	—														
8. BFFI_A4	5.33	1.51	.42*	.37*	.24*	.40*	.59*	.47*	.65*	—													
9. BFFI_N1	4.85	1.63	.18*	.18*	.19*	.25*	.29*	.06	.31*	.37*	—												
10. BFFI_N2	4.70	1.59	.07	.04	.00	.08	.25*	.08	.31*	.31*	.61*	—											
11. BFFI_N3	4.28	1.61	.10	.03	.04	.06	.16*	-.03	.19*	.19*	.59*	.64*	—										
12. BFFI_N4	4.24	1.56	.07	.02	-.04	.10	.20*	.02	.23*	.21*	.47*	.43*	.48*	—									
13. BFFI_E1	4.32	1.58	.23*	.21*	.13*	.21*	.16*	.26*	.24*	.31*	.09	-.02	.11	.17*	—								
14. BFFI_E2	4.60	1.53	.33*	.26*	.17*	.30*	.25*	.39*	.34*	.41*	.08	.00	-.01	.11	.63*	—							
15. BFFI_E3	4.31	1.36	.32*	.29*	.16*	.27*	.17*	.26*	.28*	.34*	.05	-.14	-.03	.11	.55*	.62*	—						
16. BFFI_E4	4.38	1.65	.22*	.17*	.09	.15*	.07	.24*	.21*	.26*	.00	-.04	.01	.12*	.69*	.66*	.62*	—					
17. BFFI_O1	4.59	1.31	.35*	.32*	.29*	.34*	.23*	.33*	.37*	.34*	.12*	.01	.03	.07	.39*	.45*	.43*	.48*	—				
18. BFFI_O2	4.99	1.38	.41*	.38*	.31*	.38*	.35*	.38*	.46*	.46*	.16*	.10	.10	.11	.37*	.46*	.37*	.42*	.64*	—			
19. BFFI_O3	4.26	1.51	.16*	.15*	.00	.17*	.16*	.26*	.21*	.23*	.08	.06	.09	.19*	.34*	.26*	.36*	.37*	.34*	.34*	—		
20. BFFI_O4	4.64	1.34	.40*	.40*	.35*	.42*	.33*	.29*	.32*	.32*	.17*	.08	.07	.07	.27*	.37*	.32*	.27*	.46*	.59*	.34*	—	

Polytechnic A Descriptive Statistics and Correlations for the Brief Five-Factor Instrument

Note. n =351.

* Significant at α = .05.

Item	Descriptives		Correlations																				
	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1. BFFI_C1	5.04	1.51	—																				
2. BFFI_C2	4.10	1.55	.33*	—																			
3. BFFI_C3	4.27	1.63	.38*	.38*	—																		
4. BFFI_C4	4.61	1.61	.53*	.37*	.52*	—																	
5. BFFI_A1	5.07	1.50	.28*	.21*	.11	.19*	—																
6. BFFI_A2	4.77	1.56	.22*	.27*	.14*	.11	.41*	—															
7. BFFI_A3	5.24	1.34	.29*	.20*	.26*	.25*	.46*	.37*	—														
8. BFFI_A4	5.49	1.46	.38*	.23*	.18*	.21*	.56*	.45*	.61*	—													
9. BFFI_N1	4.90	1.71	.16*	.14*	.21*	.26*	.35*	.04	.31*	.22*	—												
10. BFFI_N2	4.76	1.55	.14*	.01	.15*	.22*	.26*	-.03	.22*	.17*	.17*	—											
11. BFFI_N3	4.60	1.56	.05	-.03	.03	.03	.17*	.00	.13*	.09	.51*	.48*	—										
12. BFFI_N4	4.36	1.68	.09	-.01	.15*	.09	.25*	-.04	.21*	.16*	.59*	.46*	.57*	—									
13. BFFI_E1	3.98	1.68	.15*	.13*	.10	.06	.03	.22*	.10	.33*	-.03	-.19*	.02	.11	—								
14. BFFI_E2	4.29	1.63	.06	.13*	.16*	.05	.13	.35*	.31*	.37*	-.02	-.17*	-.06	.09	.62*	—							
15. BFFI_E3	4.09	1.32	.19*	.15*	.07	.04	.13	.35*	.23*	.40*	-.06	-.31	-.10	.02	.64*	.56*	—						
16. BFFI_E4	3.90	1.63	.04	.04	.10	.04	-.03	.21*	.00	.20*	-.13*	-.31	-.06	.05	.73*	.55*	.60*	—					
17. BFFI_O1	4.30	1.31	.35*	.31*	.19*	.30*	.19*	.10	.16*	.16*	.12*	-.01	.02	-.02	.17*	.21*	.20*	.19*	—				
18. BFFI_O2	4.71	1.44	.32*	.19*	.16*	.25*	.14*	.14*	.19*	.27*	.11	-.01	.02	.04	.38*	.31*	.34*	.30*	.42*	—			
19. BFFI_O3	4.15	1.59	.07	.12	-.02	.06	-.07	.07	-.04	.07	-.09	-.09	.11	-.05	.15*	.11	.20*	.22*	.27*	.25*	—		
20. BFFI_O4	4.68	1.41	.37*	.27*	.16*	.31*	.09	.25*	.24*	.27*	.02	-.16*	.02	-.06	.24*	.21*	.31*	.20*	.35*	.39*	.20*	—	

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Note. n = 196.

* Significant at α = .05.