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MEASUREMENT INVARIANCE BETWEEN STUDENT AND EMPLOYEE GROUPS OF THE POLISH VERSION OF THE MINI-IPIP SCALE FOR BIG FIVE PERSONALITY TRAITS

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Abstract

Short scales are becoming increasingly popular in social and behavioral sciences. Often times they are convenient, valid and reliable which makes them particularly useful in certain contexts, such as large scale surveys. The aim of the study was to investigate measurement invariance of the Polish version of the *Mini-IPIP Shortened Measures of the Big-Five Domains* (the Mini-IPIP) between a student sample (927 persons) and an employee sample (723 persons). The instrument consists of 20 items, four for each subscale and has a 5-point Likert-type response format ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*). Data were gathered between 2013 and 2017 as a part of subsequent research projects. The results showed that the scale has satisfactory model fit in both samples and indicated strong measurement invariance between the groups of students and employees. The data supports the validity of the Polish version of the Mini-IPIP.

Keywords: *Big Five, employees, measurement invariance, Mini-IPIP, students*

1 INTRODUCTION

Short scales are becoming increasingly popular in psychological research. They have numerous advantages, which include the convenience of application, saving time of both the participants and the researchers, reducing risk of bias introduced by the excessive burden on participants with long questionnaires, and often satisfactory psychometric properties for particular analytical purposes (Rammstedt & Beierlein, 2014). The shortest psychological scales consist of only one question, such as measure of overall job satisfaction (Wanous, Reichers & Hudy, 1997), measure of stress symptoms (Elo, Leppänen & Jahkola, 2003), measures of general quality of life, general health and sleep quality (Atroszko, Bagińska, Mokosińska, Sawicki & Atroszko, 2015), measures of meaning in life and satisfaction with life (Atroszko, Krzyżaniak, Sendal & Atroszko, 2015; Atroszko, Sawicki, Mąkinia & Atroszko, 2017), measure of social support (Atroszko, Pianka, Raczyńska, Sęktas & Atroszko, 2015), and measure of global self-esteem (Atroszko, Sawicki, Sendal & Atroszko, 2017).

A precise individual diagnosis requires larger number of items in order to adequately distinguish different levels of latent construct under investigation. In such cases a smaller pool of items comes with a significant loss in precision, therefore, short scales are not applicable for this purpose (Kemper, Trapp, Kathmann, Samuel & Ziegler, 2018). However, when conducting a large scale research focused on the relationships between multiple variables and controlling for a broad range of confounding variables, more concise psychological tools usually perform almost as good as their lengthier alternatives (Kemper et al., 2018; Rammstedt, & Beierlein, 2014; Gogol et al., 2014). Some studies suggest that they can even have good predictive validity (Bergkvist & Rossiter, 2007). Accordingly, short instruments with good psychometric properties are invaluable. It should be noted that short measure need proper analytical approach to provide evidence to support their adequate psychometric properties, and different measures pose specific challenges. For instance, reliability of single-

item scale may require test-retest coefficients such as intraclass correlation coefficient (ICC), and cannot be substantiated with internal consistency coefficients.

It should be noted that the Polish version of the *Mini-IPIP Shortened Measures of the Big-Five Domains* (the Mini-IPIP) is not used and should not be used for precise diagnosis of individuals but to investigate the relationships of Big Five personality traits with other variables or as a means to control for a covariates.

The shortest scales for the assessment of Big Five personality traits, consisting of 5 or 10 items, despite being frequently used, have also been rather problematic. Typically, they demonstrate lower reliability measured with internal consistency coefficients such as Cronbach's alpha or Spearman-Brown's coefficient, which makes them somewhat psychometrically more problematic to their longer counterparts, because they require less biased estimates of test-retest reliability (Credé, Harms, Niehorster & Gaye-Valentine, 2012; Gosling, Rentfrow & Swann, 2003; Muck, Hell & Gosling, 2007). Furthermore, *Ten Item Personality Inventory* (TIPI) has consistently shown to have low criterion validity, especially for the agreeableness and openness to experience/intellect factor (Burns et al., 2017; Iwasa & Yoshida, 2018; Oshio, Abe, Cutrone & Gosling, 2014; Rojas & Widiger, 2013). However, the 20-item Mini-IPIP scale could be a possible solution for situations requiring short Big Five measurement, as it shows satisfactory psychometric properties and poses limited burden upon completion (Baldasaro, Shanahan & Bauer, 2013; Cooper, Smillie & Corr, 2010; Donnellan, Oswald, Baird & Lucas, 2006; Laverdière, Morin & St-Hilaire, 2013; Oliveira, 2017). Another advantage of the scale is that being a part of International Personality Item Pool (IPIP), which is a large-scale collaborative repository of public domain personality items for measuring constructs in personality research (Goldberg et al., 2006), it is free to use, making it very convenient for the researchers. Moreover, when compared to the for-pay alternatives for the Big Five measurement, the free scales have similar or even better psychometric properties (Hamby, Taylor, Snowden & Peterson, 2015).

While considering the validity of Big Five scales, it must be also taken into account that according to Hopwood & Donnellan (2010, p. 332): *Personality trait inventories often perform poorly when their structure is evaluated with confirmatory factor analysis (CFA)*. This is due to the complexity of personality, issues related to measurement of personality, and issues related to the application and interpretation of confirmatory factor analysis models (Hopwood & Donnellan, 2010).

The aim of this study was to investigate measurement invariance of the Polish version of the *Mini-IPIP Shortened Measures of the Big-Five Domains* (the Mini-IPIP) between a student sample and an employee sample. Providing evidence for good validity and reliability of the Mini-IPIP, can contribute to wider use of this tool in Poland.

2 METHODS

2.1 Participants

Sample 1 consisted of 927 students of various faculties, courses, modes and years of studies from nine different Polish universities, of which 597 (64.4%) were female, and 309 (33.3%) were male. Twenty-one respondents did not specify their gender. Participants mean age was 20.4 years ($SD = 2.7$). Table 1 presents data on respondents' course of study, mode of study, and years of study.

Tab. 1. Descriptive data on Sample 1

		Number (percent)
Course of study	Psychology	237 (25.6)
	Building engineering	123 (13.3)
	Criminology	120 (12.9)
	Automatics and robotics	110 (11.9)
	Biomedical engineering	85 (9.1)
	Geography	68 (7.3)
	Special education	64 (6.9)
	Polish philology	24 (2.6)
	Social work	20 (2.2)
	Political science	15 (1.6)
	Other	21 (2.3)
Mode of study	Full time	727 (78.4)
	Part time	168 (18.1)
Year of study	First	665 (71.7)
	Second	195 (21.0)
	Third	30 (3.2)
	Fourth	1 (0.1)
	Fifth	3 (0.3)
	Sixth	1 (0.1)

Note. Forty respondents (4.3%) did not specify their course of study. Thirty two (3.5%) respondents did not specify whether they were studying full-time or part-time. Thirty two respondents (3.5%) did not specify their year of study.

Sample 2 consisted of 723 employees from a wide range of professions, including lawyers, managers, IT specialists, academics, researchers, medical doctors, psychologists, teachers, engineers, accountants, commercial trades, librarians and functionaries of which 513 (71.9%) were female, and 200 (27.7%) were male. Ten respondents did not specify their gender. Participants mean age was 36.4 years ($SD = 11.3$). Table 2 presents data on respondents' professional position and educational level.

Tab. 2. Descriptive data on Sample 2

		Number (percent)
Professional position	Top-level management	43 (5.9)
	Mid-level management	56 (7.7)
	Other managerial tasks	113 (15.6)
	Non-managerial positions	448 (62)
Educational level	26 or more years of education	17 (2.4)
	20 to 25 years of education	94 (13)
	16 to 20 years of education	473 (65.4)
	10 to 15 years of education	126 (17.4)
	Less than 10 years of education	3 (0.4)

Note. Sixty-three participants (8.7%) did not report their professional position. Ten persons (1.4%) did not report their educational level.

2.2 Measures

The Mini-IPIP Shortened Measures of the Big-Five Domains (the Mini-IPIP) consists of a 20-item inventory with four items measuring each of the five personality factors: Extraversion,

Agreeableness, Conscientiousness, Neuroticism and Intellect (Donnellan et al., 2006). Participants indicate how well each statement describes them using a 5-point Likert-type scale ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*).

The Mini-IPIP Shortened Measures of the Big-Five Domains has been translated into Polish and showed good validity and reliability in previous studies (Atroszko, Pallesen, Griffiths & Andreassen, 2017; Czerwiński & Atroszko, 2019). Since validation of a measure is an ongoing process, more studies are necessary to provide more information on the psychometric properties of the scale across different samples.

In the presented study Cronbach's alpha reliability coefficient were: .79 for extraversion, .76 for agreeableness, .75 for conscientiousness, .73 for neuroticism and .73 for intellect in sample 1 and .77 for extraversion, .75 for agreeableness, .76 for conscientiousness, .71 for neuroticism and .72 for intellect in sample 2.

2.3 Procedure

Student sample. Data collection used convenience sampling. Students were invited to participate anonymously in the study during regular university classes. More than 95% of all present students agreed to participate. It was a 'paper and pencil' cross-sectional study. No monetary or other material rewards were given for participation. Data were gathered between 2013 and 2017 as a part of subsequent research projects.

Employee sample. Data collection used convenience sampling. Employees were invited to participate anonymously in the study through their employers or directly. It was also a 'paper and pencil' cross-sectional study. No monetary or other material rewards were given for participation. Written informed consent was obtained from each participant. Data were gathered between January 2014 and July 2016 as a part of research project on behavioral addictions.

2.4 Statistical analyses

Confirmatory factor analyses were performed using Mplus 6.11 (Muthén & Muthén, 1998-2010). Due to strictly ordinal character of the response scale, the CFA models were tested using the weighted least square mean and variance adjusted (WLSMV) estimator. Following measures were used to evaluate fit of the model: χ^2 divided by degrees of freedom (χ^2/df), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI) and Root Mean Squared Error of Approximation (RMSEA). Measurement invariance the samples was assessed using multiple-group procedures in which sets of parameters were freed sequentially in a series of four hierarchically nested models. Configural invariance tests whether the overall constructs are equivalent across groups. Metric invariance tests whether the matrix of factor loadings applies to all groups. Scalar invariance tests equality of item thresholds. Strict invariance tests the equality of residual variances across groups. Because the models for each level of invariance are nested within the earlier models, they are compared using the change in fit indices (Putnick & Bornstein, 2016). A change in CFI (Δ CFI) less than .01 and a change in RMSEA (Δ RMSEA) less than .015 suggest no meaningful decrease in model fit and supports measurement invariance (Chen, 2007).

3 RESULTS

The five factor model of personality showed satisfying model fit in both samples (see Table 3). According to van de Schoot, Lugtig & Hox (2012, p. 487): *Fit is considered adequate if the CFI and TLI values are > .90, and better if they are > .95.* In employee sample TLI

values was lower than .90. Insignificantly lower values of TLI and CFI are congruent with previous research (Czerwiński & Atroszko, 2019). While considering the validity of Big Five scales, it must be also taken into account that for these types of models Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) model fit indices are often lower, consequently researchers' approach should be less restrictive (Hopwood & Donnellan, 2010; Marsh et al., 2010).

Tab. 3. Model fit indices for five factor model in both samples

Sample	χ^2	df	χ^2/df	CFI	TLI	RMSEA	90% CI
Student sample	922.60	160	5.77	.91	.90	.072	[.067-.076]
Employee sample	731.28	160	4.57	.91	.89	.071	[.065-.076]

At the stage of testing scalar invariance, the changes in CFI were too large, but the changes in RMSEA were acceptable (see Table 4). It is crucial to note that the used cutoff points are for the Maximum Likelihood (ML) estimator (Chen, 2007), as there are no cutoff points for the WLSMV estimator, making the results hard to interpret.

Tab. 4. Model fit indices for measurement invariance

Model	χ^2	df	CFI	Δ CFI	RMSEA	90% CI	Δ RMSEA
Configural invariance	1654.271	320	.911	—	.071	[.068, .075]	—
Metric invariance	1725.609	335	.907	-.004	.071	[.068, .074]	.000
Scalar invariance	2022.299	390	.891	-.016	.071	[.068, .075]	.000
Residual invariance	2107.345	410	.887	-.004	.071	[.068, .074]	.000

Table 5 presents data on standardized item factor loadings in the five factor model in student sample and employee sample.

Tab. 5. Standardized item factor loadings in the five factor model in each sample

Item	Extraversion		Agreeableness		Conscientiousness		Neuroticism		Intellect	
	Student sample	Employee sample	Student sample	Employee sample	Student sample	Employee sample	Student sample	Employee sample	Student sample	Employee sample
1. Am the life of the party.	.83	.85								
6. Don't talk a lot. (R)	.73	.71								
11. Talk to a lot of different people at parties.	.77	.73								
16. Keep in the background. (R)	.63	.62								
2. Sympathize with others' feelings.			.76	.74						
7. Am not interested in other people's problems. (R)			.73	.72						
12. Feel others' emotions.			.71	.75						

17. Am not really interested in others. (R)	.75	.74		
3. Get chores done right away.		.53	.52	
8. Often forget to put things back in their proper place. (R)		.68	.77	
13. Like order.		.68	.70	
18. Make a mess of things. (R)		.89	.90	
4. Have frequent mood swings.		.73	.75	
9. Am relaxed most of the time. (R)		.67	.69	
14. Get upset easily.		.64	.70	
19. Seldom feel blue. (R)		.66	.54	
5. Have a vivid imagination.				.70
10. Am not interested in abstract ideas. (R)				.66
15. Have difficulty understanding abstract ideas. (R)				.66
20. Do not have a good imagination. (R)				.83

Note. (R) = Reverse Scored Item.

4 DISCUSSION

This study investigated the psychometric properties of the Polish version of the Mini-IPIP scale for Big Five personality traits, including measurement invariance between student and employee samples. The scale showed satisfactory model fit in both samples and generally strict measurement invariance between student and employee groups. The findings are congruent with previous research on Mini-IPIP Big Five questionnaires (Czerwiński, Atroszko, 2019), despite CFI and TLI being slightly below the usual cut-off point. All the subscales showed satisfactory reliability. The results suggest that the scale measures Big Five personality traits in the same way in different demographic groups. These groups represent also different age demographics. This study provides some initial support for usage of this scale across different adult age groups in Poland.

The main limitation of the study is that both samples are predominantly female convenience samples, which puts restrictions on the generalizability of the results to other populations. Regarding the strengths, the study comprised relatively large and diverse sample sizes providing high statistical power.

Mini-IPIP proves to be a valid instrument. The scale has the advantage of being short and free, while having good psychometric properties, making it a valuable option for researchers.

This is especially valuable in large scale surveys, in which many covariates need to be included (see for example Atroszko, Pallesen et al., 2017).

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