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RESEARCH PAPER

The Psychometric Properties of the Psychological Work Immersion Scale: An ESEM vs ICM-CFA Approach

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Abstract

This study investigates the psychometric properties and measurement invariance of the Psychological Work Immersion Scale (PWIS) scale within global organisational contexts. Data were gathered from 19134 working adults in the US, the UK, the Middle East, Africa, and Australia. To determine the best-fitting factorial model, a series of traditional ICM-CFA and less restrictive ESEM models were estimated and systematically compared. The results showed that a bifactor ESEM model, with one general factor of overall psychological work immersion and nine specific factors (strategic connection, manager credibility, appreciative feedback, enabling environment, team relations, strength use, employee voice, recognition and rewards, personal development) fitted the data best, was reliable and showed strong measurement invariance across genders and levels of education. The results show that psychological work immersion is a multidimensional construct that is both a function of yet separate from a dynamic interaction between the nine performance-enhancing conditions or enablers. Therefore, The PWIS can be used to measure psychological work immersion validly and reliably and could be used to make meaningful latent mean comparisons between genders and different levels of education.

Keywords Psychological Work Immersion · Work Immersion · Exploratory Structural Equation Modelling · Psychometric Evaluation

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1 Introduction

Psychological work immersion (PWI) has emerged as an important mechanism that captures the link between the factors driving high performance and those facilitating an employee's psychological attachment to the organisation (Veldsman & Coetzee, 2014). Grounded in Kahn's (1990) work, PWI encompasses the authentic expression of oneself within a work role and the socio-cultural factors present in organisational contexts that foster psychological attachment to work (Veldsman, 2018). PWI refers to a persistent state of deep emotional, cognitive, and physical identification with and psychological attachment to work, which arises from specific performance-enhancing conditions or "enablers" deemed essential within a given socio-cultural organisational context (Veldsman & Coetzee, 2015).

Veldsman (2018) identified nine performance-enhancing conditions or enablers contributing to PWI. These enablers aim to align employees' expectations of the work environment with organisational values, ensuring clarity regarding how their work contributes to overall team and organisational performance (Coetzee & Veldsman, 2016). Additionally, they emphasise the alignment between organisational conventions, practices, policies, and the enacted practices and values demonstrated by the organisation (Coetzee & Veldsman, 2016). The nine enablers are as follows:

(a) *A strategic connection with organisational goals:* The alignment between individual capabilities and contribution to the achievement of organisational goals
(b) *Manager credibility*: The perception of managerial practices as fair, respectful, and consistent, fostering trust between managers and their direct reports.
(c) *Appreciative feedback*: Receiving meaningful and appreciative feedback that focuses on individual strengths and performance.
(d) *Enabling environment*: The extent to which organisational policies and procedures and the physical work environment enable the employee to perform.
(e) *Team relations*: The support received from and the perceived competence of team members in achieving shared goals.
(f) *Strength use*: The opportunity for employees to leverage their personal strengths to achieve organisational goals.
(g) *Employee voice*: The extent to which employees feel heard and can freely express their perspectives without fearing negative consequences to their self-image, status, or career.
(h) *Recognition and rewards*: The level of appreciation employees feel, and the rewards received for their contributions.
(i) *Personal development*: Providing growth and development opportunities as part of employees' work experience.

These performance-enhancing conditions or enablers create a positive work environment conducive to personal well-being and performance (Meyer, 2019; Schaufeli, 2006). Research indicates that when these nine enablers are in place, it leads to higher levels of work engagement, intrinsic motivation, organisational commitment, job satisfaction, individual performance, and organisational profits

(Coetzee & Veldsman, 2016; Veldsman, 2018; Veldsman & Coetzee, 2014). They have also been associated with lower intentions to leave, staff turnover, and absenteeism (Coetzee & Veldsman, 2016). Therefore, PWI is a crucial metric for designing positive work environments that foster performance.

To measure PWI, Veldsman and Coetzee (2014) developed the PWIS. The PWIS is a 33-item self-report instrument that measures the nine performance-enhancing conditions or enablers required to facilitate an employee's emotional-cognitive identification with and psychological attachment to work and the organisation (Veldsman, 2018). Previous studies conducted in South African organisations have demonstrated acceptable levels of factorial validity and internal consistency for the PWIS (Veldsman & Coetzee, 2014, 2015). During its initial development, Veldsman (2013) tested three different first-order factorial models of the PWIS and found support for both the original nine first-order factorial model (Time $1 = \chi^2/df_{(414)} = 4.56$; CFI = 0.92; SRMR = 0.05; AIC = 159.03; Time $2 = \chi^2/df_{(482)} = 4.89$; CFI = 0.93; SRMR = 0.05; AIC = 129.73), and a first-order factor model where the originally conceptualised individual congruence and enabling environment, as well as strategic connection, manager credibility and appreciative feedback, was consolidated into one construct (Time $1 = \chi^2/df_{(414)} = 2.16$; CFI = 0.91; SRMR = 0.05; AIC = 637.829; Time $2 = \chi^2/df_{(482)} = 2.05$; CFI = 0.91; SRMR = 0.05; AIC = 612.44). Standardised factor loadings ranged from 0.35 to 0.77 to each a priori latent factorial model at both time points (Veldsman, 2013). Further, the inter-subscale correlations ranged from 0.27 to 0.83 at different time points, indicating acceptable levels of construct validity (Veldsman, 2013). Similarly, Veldsman and Coetzee (2015) found support for both the original nine-first-order factorial solution ($\chi^2/df_{(582)} = 2.07$; CFI = 0.92; TLI = 0.90; RMSEA = 0.04; SRMR = 0.05) and a second-order factorial model ($\chi^2/df_{(582)} = 4.78$; CFI = 0.94; TLI = 0.92; RMSEA = 0.08; SRMR = 0.05) of the PWIS. In this study, all standardised factor loadings were moderate to strong indicators (0.39 to 0.83) of the different first-order factors (Veldsman & Coetzee, 2015). Finally, Coetzee and Veldsman (2016) replicated the findings and found support for the nine-first-order factorial model in a South African sample ($\chi^2/df_{(1268)} = 3.52$; CFI = 0.92; TLI = 0.90; RMSEA = 0.05; SRMR = 0.04). Thus, there is sufficient support for assessing both a nine-first-order factorial structure and a higher-order factorial model for the PWIS. However, it is not clear whether the higher-order factorial model is a function of these nine first-order factors or if only a general PWI factor exists that is separate from these nine factors (i.e. a bifactor model).

In terms of internal consistency and reliability, the nine-first-order factorial model of the PWIS was shown to be reliable in different studies. Veldsman (2013) assessed the instrument's internal consistency with both Cronbach's Alpha and Composite Reliability ranging from 0.68 to 0.89 in two independent samples. The second-order PWI factor also showed to be reliable in both samples, with Cronbach's Alpha and Composite Reliability estimates ranging from 0.88 to 0.89. Veldsman and Coetzee (2014) found similar results for the nine first-order factorial model with Cronbach alphas ranging from 0.66 to 0.90. Further, Rasch item level reliability estimates, which indicate each individual item's difficulty level, showed that all items were easy to understand and that they could reliably measure each construct (Veldsman & Coetzee, 2015). This implies that the PWIS can be seen as a reliable instrument

within the South African context; yet questions remain about its internal consistency in other contexts.

Despite evidence as to the factorial validity and internal consistency of the PWIS, Coetzee and Veldsman (2016)

found significant differences between the nine enablers and different demographic factors. Coetzee and Veldsman (2016) reported small to moderate differences between genders (males and females) on appreciative feedback (Female Mean = 2.93 vs. Male Mean = 2.72; $d = 0.24$; $p < 0.01$), strategic connection (Female Mean = 3.13 vs Male Mean = 2.98 $d = 0.23$; $p < 0.01$) and enabling environments (Male Mean = 2.95 vs Female Mean = 2.81; $d = 0.20$; $p < 0.01$). Similarly, significant differences were found between different age cohorts on appreciative feedback ($d = 0.17$; $p < 0.01$), team relations ($d = 0.14$; $p < 0.01$), strengths use ($d = 0.30$; $p < 0.01$) and enabling environments ($d = 0.20$; $p < 0.01$). Differences were also found between different tenure groups in terms of enabling environments ($d = 0.21$; $p < 0.01$). Despite showing differences between groups, no evidence was presented regarding the factorial equivalence (or measurement invariance) between groups, limiting the usefulness of these group comparisons.

2 The Current Study

Despite showing promise as a measure of PWI, its validity, reliability, and invariance on socio-demographic factors in a global context is still to be investigated. Therefore, this paper investigates the psychometric properties and measurement invariance of the PWIS scale within global organisational contexts. Specifically, the study aims to explore the factorial validity of the scale by comparing traditional independent cluster modelling confirmatory factor analysis (ICM-CFA) with more modern exploratory structural equation modelling (ESEM) approaches. Additionally, it aims to examine the measurement invariance of the scale between genders and different levels of education. Furthermore, the study will investigate the instrument's measurement quality and internal consistency. The findings of this study will contribute valuable evidence supporting the use of the PWIS as a valid and reliable tool for measuring PWI, benefiting both researchers and practitioners in their efforts to enhance organisational performance.

3 Research Methodology

3.1 Participants and Procedure

An availability-based sampling strategy was employed to draw 19,134 participants from several global organisations in the United States, the United Kingdom, the United Arab Emirates, Australia, South Africa, Namibia, Botswana, Zambia, Nigeria, Kenya and Lesotho. Data collection took place between January 2016 to January 2020. The demographic characteristics of the sample are summarised

Table 1 Demographic characteristics of participants ($N = 19{,}134$)

Item	Category	Frequency (*f*)	Percentage (%)
Gender	Male	6759	35.33
	Female	10,254	53.59
	Prefer not to Say	261	1.36
	Missing	1860	9.72
Age (years)	21 to 25	141	0.74
	26 to 35	2679	14.00
	36 to 45	8115	42.41
	46 to 55	5935	31.02
	56 and Older	1264	6.61
	Missing	1000	5.23
Level of education	Did not complete Highschool	953	4.98
	Highschool Diploma	2056	10.75
	Vocational Diploma	890	4.65
	Bachelor's Degree	411	2.15
	Post-graduate Degree	376	1.97
	Missing	14,448	75.51
Tenure	Less than 1 Year	2057	10.75
	1 to 2 Years	3128	16.35
	3 to 5 years	5037	26.33
	6 to 10 years	4739	24.77
	10 years or more	3019	15.78
	Missing	1154	6.03
Industry	Banking	10,648	55.65
	Financial Services	2797	14.62
	Higher Education	113	0.59
	Information Technology	128	0.67
	Legal Services	543	2.84
	Manufacturing	3318	17.34
	Marketing	50	0.26
	Medical Services	248	1.30
	NGO	892	4.66
	Petrochemical	162	0.85
	Property Management	136	0.71
	Public Services	212	1.11
	Missing	113	0.59

in Table 1. The majority of the participants were women (53.59%) between the ages of 36 and 45 (42.41%) with at least a high school diploma (10.75%). Most individuals were employed within the banking industry (55.65%) and with their organisation between 3 and 5 years (26.33%).

3.2 Measures

The Psychological Work Immersion Scale (PWIS: Veldsman & Coetzee, 2014) was used to measure the drivers of psychological work immersion. The 33-item self-report scale is administered in English and measured nine elements of psychological work immersion: (a) strategic connection ('To what extent does the work you do help your organisation to achieve its goals?'), (b) manager credibility ('Does your direct manager treat everyone fairly and consistently?'), (c) appreciative feedback ('How often does your direct manager give you feedback on how well you are doing?'), (d) enabling environment ('Do the policies and procedures in your organisation enable you to do your job well?'), (e) team relations ('Do you feel that your co-workers treat you with dignity and respect?'), (f) strength use ('Do you get the opportunity to develop your strengths at work?'), (g) employee voice ('Do your ideas and opinions count at work?'), (h) recognition and rewards ('Do you feel fairly compensated for the work you are doing?') and (i) personal development ('Do you feel that you develop and learn new skills in your current job?'). The scale employed a 4-point Likert scale ranging from 1 ("Never") to 4 ("Always").

3.3 Statistical Analysis

Data were processed with both JASP 0.17 (JASP, 2022) and Mplus 8.10 (Muthén & Muthén, 2023). A sequential step-wise analysis strategy was employed through the structural equation modelling framework. Missing data was managed through the full maximum likelihood estimation approach (FIML).

The descriptive statistics (means, standard deviations, skewness, kurtosis) and Pearson correlation coefficients were estimated to explore the data and test assumptions. The results are summarised in Table 6. The PWIS's factorial validity was examined using a competing confirmatory factor measurement modelling strategy with the MLR estimation method.[1] Two approaches, namely the ICM-CFA and ESEM approach, were employed to estimate and compare different measurement models (Muthén & Muthén, 2020; Van Zyl & Ten Klooster, 2022). Traditional ICM-CFAs constrained items to load only onto their respective factorial models, while cross-loadings were set to zero. Bifactor ICM-CFA models were rotated using a target rotation method with orthogonal factors. The G-factor represented a general PWI factor, while S-factors reflected specific dimensions of flow at work. ESEM models adhered to the guidelines proposed by Van Zyl and Ten Klooster (2022), permitting cross-loadings between items and non-target factors while maintaining them close to zero. Target rotation was employed for ESEM models, similar to ICM-CFAs. Bifactor ESEM models allowed cross-loadings between S-factors, constrained to approach zero. The De Beer and Van Zyl (2019) ESEM code generator was used to estimate the ESEM models.

The best-fitting measurement model was determined by meeting both (a) traditional data-model fit criteria (c.f. Table 2) and (b) measurement quality indicators.

[1] Given that Likert Scales of 5 points or less are considered categorial, we also estimated the measurement models and measurement invariance using the WSLMV estimation method in Mplus (c.f. Brauer et al., 2023) and presented the results in Tables 7 and 8. No practical differences between the MLR and WSLMV estimation methods were found.

Measurement quality for the bifactor ESEM model was indicated by a well-defined G-factor ($\lambda > 0.30$, $p < 0.05$) and relatively well-defined S-factors ($\lambda > 0.10$, $p < 0.05$) (Morin, 2023; Morin et al., 2016). The G-Factor should explain the majority of the common variance, and for the S-factors, the most important criterion is that items should load significantly onto their a priori latent factors (Morin, 2023; Van Zyl & Ten Klooster, 2022). Further, item uniqueness ($0.10 < \text{uniqueness} < 0.90$), tolerance for cross-loadings and level of internal consistency were also considered as criteria to evaluate measurement quality (Kline, 2010). The standardised factor loadings and internal consistency of the best-fitting measurement model, which demonstrated both excellent model fit and measurement quality, were reported.

Internal consistency for the bifactor ESEM model was assessed using McDonald's Omega ($\omega > 0.50$; Morin, 2023; Perreira et al., 2018). In bifactor CFA and ESEM models, true score variance is divided across the general and specific factors, resulting in lower omega values by design compared to unidimensional models. Perreira et al. (2018) and Morin (2023) highlight that conventional thresholds like 0.70 or 0.80 are unrealistic, inappropriate and that "these guidelines are not suited to bifactor models" (p.70). To understand why more flexible reliability guidelines are needed for bifactor models, it is helpful to revisit the classical test theory (CTT) conception of reliability. In CTT, an observed score ($\sigma 2\text{total}$) is considered to be composed of two parts: true score variance ($\sigma 2\text{true}$) and random measurement error ($\sigma 2\text{error}$) (Perreira et al., 2018). The relationship between these components is expressed as: $\sigma 2\text{total} = \sigma 2\text{true} + \sigma 2\text{error}$ (Perreira et al., 2018). This leads to the definition of reliability (rxx) as the ratio of true score variance to total variance: $rxx = \sigma 2\text{true}/\sigma 2\text{total}$. An important implication is that $1 - rxx = \sigma 2\text{error}$. In a typical measurement model: (a) $\sigma 2\text{true}$ corresponds to $\lambda i2$ at the item level and $(\Sigma|\lambda i|)2$ at the scale level. (b) $\sigma 2\text{error}$ corresponds to δi at the item level and $\Sigma\delta i$ at the scale level. (c) $\sigma 2\text{total}$ corresponds to $\lambda i2 + \delta i$ at the item level and $([\Sigma|\lambda i|]2 + \Sigma\delta ii)$ at the scale level. Bifactor models are by definition more complex, with both G- and S-factors representing $\sigma 2\text{true}$. This divides $\sigma 2\text{true}$ across two distinct and competing factors (Perreira et al., 2018). Thus, $\sigma 2\text{total}$ corresponds to: $\lambda gi2 + \lambda si2 + \delta i$ at the item level and $([\Sigma|\lambda gi|]2 + [\Sigma|\lambda si|]2 + \Sigma\delta ii)$ at the scale level. Despite this bifurcation of true score variance, omega is calculated as: $(\Sigma|\lambda gi|)2$ / $([\Sigma|\lambda gi|]2 + \Sigma\delta ii)$ for G (ignoring the S factor) and $(\Sigma|\lambda si|)2$ / $([\Sigma|\lambda si|]2 + \Sigma\delta ii)$ for S (ignoring the G factor). Proposed alternatives by Rodriguez et al. (2016) fail to fully resolve this issue leading to the recognition that more flexible criteria are needed to evaluate the reliability of G and S factors in bifactor (ESEM) models (Morin, 2023; Perreira et al., 2018). Therefore, Perreira et al. (2018) suggest to use 0.50 as a cutoff for omega as a minimum threshold.

Finally, factorial equivalence or "measurement invariance" (MI) across genders and levels of education was assessed. MI was evaluated by comparing a series of increasingly restrictive models: (a) configural invariance, (b) metric invariance, (c) scalar invariance, and (d) strict invariance. Models were compared using Chen's (2007) criteria, considering changes in RMSEA ($\Delta < 0.015$; $p > 0.01$), SRMR ($\Delta < 0.02$), CFI ($\Delta < 0.01$), and TLI ($\Delta < 0.01$) (Chen, 2007; Wang & Wang, 2020). Chi-square and chi-square difference tests were reported for transparency, although they were not used as evaluation criteria due to current debates and challenges associated with the statistic (Morin et al., 2020; Wang & Wang, 2020). De Beer and Morin's (2022) BESEM invariance syntax generator was used to generate the code for the MI estimations.

Table 2 Model fit statistics

Fit indices	Cut-Off Criterion	Sensitive to *N*	Penalty for Model Complexity
Absolute fit indices			
Chi-Square ($\chi 2$)	Lowest comparative value between measurement models	Yes	No
	Non-Significant Chi-Square ($p > 0.01$)		
Approximate Fit Indices			
Root-Means-Square Error of Approximation (RMSEA)	0.06 to 0.08 (Marginally Acceptable); 0.01 to 0.05 (Excellent)	No	Yes
	Non-Significant RMSEA ($p > 0.01$)		
	90% Confidence Interval Range should not include Zero		
Standardized Root Mean Square Residual (SRMR)	0.06 to 0.08 (Marginally Acceptable); 0.01 to 0.05 (Excellent)	Yes	No
Incremental fit indices			
Comparative Fit Index (CFI)	0.90 to 0.95 (Marginally Acceptable Fit); 0.96 to 0.99 (Excellent)	No	No
Tucker-Lewis Index (TLI)	0.90 to 0.95 (Marginally Acceptable Fit); 0.96 to 0.99 (Excellent)	No	Yes
Akaike Information Criterion (AIC)	Lowest value in comparative measurement models	Yes	Yes
Bayes Information Criterion (BIC)	Lowest value in comparative measurement models	Yes	Yes

Adapted from Van Zyl and Ten Klooster (2022)

4 Results

4.1 Factorial Validity: Competing Measurement Models

A competing measurement modelling strategy was employed to investigate the factorial validity of the PWIS. Measured items were treated as observed indicators, no items were removed, and error terms were freely estimated. Seven competing measurement models were estimated and sequentially compared. A description of each model and the associated model fit statistics are summarised in Table 3.

The results showed that, with the exception of the baseline model (Model 0), all the estimated models fitted the data and met the measurement quality criteria. However, the *Bifactor ESEM Model 6* (cf. Fig. 1) with one general factor of overall Psychological Work Immersion and nine specific factors (Strategic Connection, Manager Credibility, Appreciative Feedback, Enabling Environment, Team Relations, Individual Congruence, Employee Voice, Recognition and Praise, and Personal Development) showed to fit the data comparatively better than any of the other estimated models ($\chi^2_{(19134)} = 1936.152$; $df = 243$; CFI = 0.99; TLI = 0.97; RMSEA = 0.03 [0.024, 0.026] $p = 1.00$; SRMR = 0.01; AIC = 776,741.65; BIC = 779,323.79). Model 6 also met the measurement quality criteria by showing acceptable standardised factor loadings ($\lambda > 0.35$; $p < 0.01$), standard errors, and item uniqueness ($\delta < 0.10$ but > 0.90; $p < 0.01$) (Asparouhov & Muthén, 2009; Kline, 2011).

4.2 Factor Loadings and Internal Consistency

Next, the standardised factor loadings, item uniqueness and the level of internal consistency were estimated for the *Bifactor ESEM Model 6*. The results are summarised in Table 4. Except for employee voice, the results show that both general and the other specific factors are measured reliably with McDonald's Omegas ($\omega > 0.50$) exceeding the suggested cut-off scores. Further, the General factor is well defined, and Specific factors are relatively well defined with significant factor loadings present on target factors. However, item 4 on the Recognition and Praise specific factor ('Does your organisation have a formal reward or recognition program for doing good work?') produced a non-significant loading, and therefore, it seems to be better represented by the General factor. Taken together, the Bifactor ESEM Model 6 with one General and nine Specific factors showed good measurement quality.

4.3 Measurement Invariance Across Genders and Levels of Education

Next, the factorial equivalence or measurement invariance of the *Bifactor ESEM Model 6* between genders (men and women) and different levels of education (grade 11 or below, high school diploma, national diploma, university degree and postgraduate degree) was explored. The results, summarised in Table 5, showed that the Bifactor ESEM Model 6 was equivalent for both genders and different levels of education as no statistically significant differences in terms of RMSEA ($\Delta < 0.015$), SRMR ($\Delta < 0.02$), CFI (< 0.01), and TLI (< 0.01) between the configural, metric, scalar and

Table 3 Competing measurement models

Model	Type	χ^2	*df*	CFI	TLI	RMSEA		SRMR	AIC	BIC	aBIC	Meets model fit criteria	Meets measurement quality criteria
Model 0	Unidimensional Model	29,544.24	495	0.78	0.77	0.07	[.071-.072]	0.06	810,494.67	811,222.97	810,908.36	No	Yes
Model 1	Nine First-Order Factor Model	9250.48	459	0.93	0.92	**0.04**	[.040-.041]	0.04	785,517.05	786,510.18	786,081.17	Yes	Yes
Model 2	Second-Order Model with Nine First-Order Factors	12,057.85	486	0.91	0.91	**0.05**	[.045-.046]	0.04	788,921.83	789,716.34	789,373.13	Yes	Yes
Model 3	Bifactor Model with One General- and Nine Specific Factors	10,294.20	462	0.93	0.92	**0.04**	[.042-.044]	0.04	786,774.46	787,745.52	787,326.04	Yes	Yes
Model 4	Nine First-Order ESEM Factor Model	2188.44	267	0.98	0.97	**0.03**	[.024-.026]	0.01	777,117.29	779,522.87	778,483.70	Yes	Yes
Model 5	H-ESEM Model with Nine First-Order Factors	2680.22	294	0.98	0.97	**0.03**	[.026-.027]	0.02	777,794.73	780,001.68	779,048.32	Yes	Yes
Model 6	Bifactor ESEM Model with One General- and Nine Specific Factors	1936.15	243	0.99	0.97	**0.03**	[.024-.026]	0.01	776,741.65	779,323.79	778,208.35	Yes	Yes

χ2 Chi-square, *df* degrees of freedom, *TLI* Tucker-Lewis Index, *CFI* Comparative Fit Index, *RMSEA* Root Mean Square Error of Approximation, *SRMR* Standardised Root Mean Square Residual, *AIC* Akaike Information Criterion, *BIC* Bayes Information Criterion, *aBIC* Adjusted BIC, *Bold* Non-significant

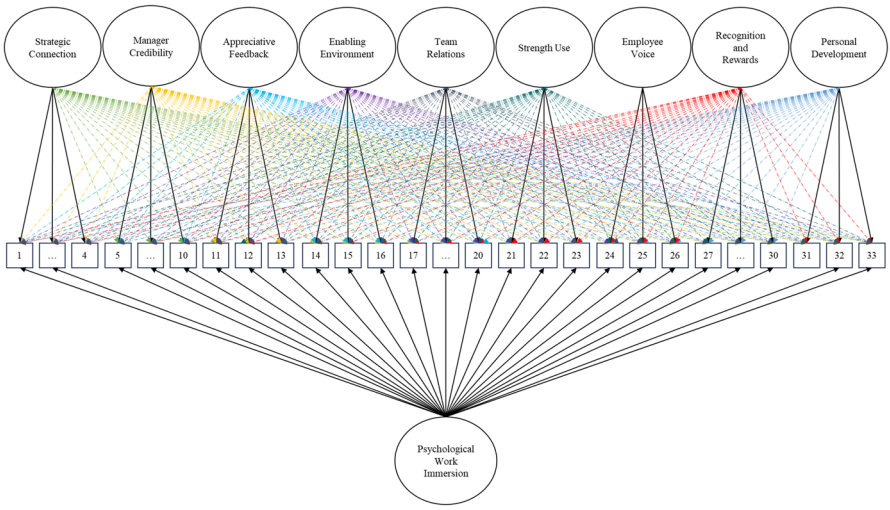

Fig. 1 Bifactor ESEM model

strict invariance models were found (Wang & Wang, 2020). This implies meaningful comparisons between groups can be made, and the overall score for the general and specific factors can be reliably used to compare groups (Wang & Wang, 2020).

5 Discussion

The present study investigated the psychometric properties and measurement invariance of the PWIS within diverse global organisational contexts. Results supported a bifactor ESEM model, comprised of one general factor representing overall psychological work immersion and nine specific factors corresponding to strategic connection, manager credibility, appreciative feedback, enabling environment, team relations, strength use, employee voice, recognition and rewards, and personal development. This model demonstrated sound reliability and strong measurement invariance across gender and education level subgroups. Findings suggest psychological work immersion is a multidimensional construct that both depend on yet is distinct from the synergistic interplay between the nine performance-enabling conditions. The results support the use of the PWIS as a valid and reliable measure to assess psychological work immersion and that it could be used to make valid latent mean comparisons between genders and education levels.

5.1 The Psychometric Properties of the PWIS

When considering the factorial validity of the PWIS, the results showed that the less restrictive ESEM models fitted the data significantly better than the traditional,

Table 4 Measurement invariance across genders and levels of qualification for the bifactor ESEM model

No	Model	χ^2	*df*	CFI	TLI	RMSEA		SRMR	Model comparison	S-B scaled $\Delta\chi^2$	ΔCFI	ΔTLI	ΔRMSEA	ΔSRMR	Meets Fit Criteria	Meets Invariance Criteria
Gender																
1	Configural invariance	1370.11	486	0.984	0.965	**0.028**	[0.026, 0.030]	0.013								
2	Metric (λ) invariance	1655.39	716	0.983	0.974	**0.024**	[0.022, 0.025]	0.018	1	331.28	-0.001	0.009	-0.004	0.005	Yes	Yes
3	Scalar (λ, ν) invariance	1785.11	739	0.981	0.972	**0.025**	[0.023, 0.026]	0.018	2	185.23	-0.002	-0.002	0.001	0.000	Yes	Yes
4	Strict (λ, ν, δ) invariance	1885.47	772	0.979	0.972	**0.025**	[0.024, 0.026]	0.021	3	97.07	-0.002	0.000	0.000	0.003	Yes	Yes
Qualification																
1	Configural invariance	3240.83	1440	0.974	0.952	**0.033**	[0.032, 0.035]	0.028								
2	Metric (λ) invariance	3529.14	2135	0.980	0.975	**0.024**	[0.023, 0.025]	0.028	1	621.924	0.006	0.023	-0.009	0.000	Yes	Yes
3	Scalar (λ, ν) invariance	3727.57	2227	0.978	0.974	**0.024**	[0.023, 0.026]	0.028	2	196.796	-0.002	-0.001	0.000	0.000	Yes	Yes
4	Strict (λ, ν, δ) invariance	4272.55	2359	0.972	0.969	**0.027**	[0.026, 0.028]	0.034	3	532.153	-0.006	-0.005	0.003	0.006	Yes	Yes

χ2 Chi-square, *df* degrees of freedom, *TLI* Tucker-Lewis Index, *CFI* Comparative Fit Index, *RMSEA* Root Mean Square Error of Approximation, *SRMR* Standardised Root Mean Square Residual, *AIC* Akaike Information Criterion, *BIC* Bayes Information Criterion, *aBIC* Adjusted BIC, *Bold* Non-significant

restrictive ICM-CFA models. This supports the assumption that PWI is a multidimensional construct that is a function of a dynamic interaction between the nine enablers rather than a model where each factor functions in isolation. In other words, when one allows for cross-loadings (constrained to be as close to zero as possible), it provides a more accurate representation of how PWI is formed and measured by capturing the interaction between factors (Van Zyl et al., 2022). This interaction between factors cannot be accurately modelled through traditional ICM-CFA approaches, as factor loadings or interactions between factors are constrained to be zero (Van Zyl et al., 2020, 2022). Therefore, the ESEM approach is more in line with Veldsman's (2013) original definition of PWI as a factor resulting from a dynamic interaction between different enabling factors. The ESEM approach also compensates for differences in the interpretations of items and potential cross-cultural differences in the experiences of each construct (Morin et al., 2020; Van Zyl & Ten Klooster, 2022; Van Zyl et al., 2022). As such, ESEM models seem to be a more viable modelling strategy for assessing or modelling PWI in global organisational contexts.

More practically, the results showed that the bifactor ESEM model fitted the data better than any other ICM-CFA or ESEM model. PWI can thus be seen as a general factor that is a function of, yet separate from, nine specific enabling factors (strategic connection, manager credibility, appreciative feedback, enabling environment, team relations, strength use, employee voice, recognition and rewards, personal development). This approach ignores the hierarchical superiority of PWI as a higher-order factor through the expression of cross-loadings on specific factors. Therefore, each of the specific performance-enabling factors has unique explanatory power, over and above the general PWI factor. This implies that each item of the PWIS shares some variance between the overall PWI factor and the nine specific enabling factors. Further, the general and specific factors within the current sample were reliably measured. Taken together, the results support the dynamic multi-dimensionality of the PWIS.

Despite showing support for the multi-dimensionality of the PWIS, our results are both similar to, yet different from, those of previous studies. First, like other positive psychological constructs (c.f. Van Zyl et al., 2023), there is a conceptual difference between how Veldsman (2013) conceptualised PWIS as a function of a dynamic interaction between different enabling factors and how the model was tested. Veldsman (2013) and others found support for a correlated nine first-order factorial model and a second-order factorial model as modelled through the traditional ICM-CFA framework. As stated above, the ICM-CFA framework does not accurately model "a dynamic interaction between factors" but instead assumes that each factor either works in isolation of others (i.e. a correlated first-order model) or that PWI is a direct function of the nine first-order factors (cf. Morin, 2023). Although our results support the ICM-CFA models tested in previous studies, we found that the ESEM models fit the data better, thereby supporting the theoretical construction of PWI. Second, Veldsman (2013) and Veldsman and Coetzee (2014) found support for a traditional hierarchical model, however, our results showed that PWI is better represented as a bifactor model. Our results showed that both the ICM-CFA and ESEM bifactor models fitted the data better than traditional second-order factor models. This supports the assumption that PWI is a function of, yet separate from,

Table 5 Factor loadings and internal consistencies of ESEM bifactor model

	G_{factor}		$S_{factor:}$ Strategic Connection		S_{factor}: Manager Credibility		S_{factor}: Appreciative Feedback		S_{factor}: Enabling environment	
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.
Strategic connection										
1. How well do you know what is expected of you at work?	**0.36**	0.01	**0.52**	0.10	0.03	0.01	0.02	0.02	0.08	0.03
2. To what extent does the work you do help your organisation to achieve its goals?	**0.40**	0.02	**0.34**	0.06	-0.02	0.02	0.01	0.02	0.03	0.02
3. Does your organisation have clear performance goals?	**0.59**	0.02	**0.24**	0.05	-0.07	0.02	0.02	0.02	0.18	0.02
4. Do you understand the vision of your organisation?	**0.56**	0.02	**0.28**	0.07	-0.17	0.03	0.01	0.02	-0.02	0.04
Manager credibility										
5. Do you believe that your direct manager acts in a way that is consistent with the organisational values?	**0.68**	0.01	0.00	0.03	**0.44**	0.01	0.03	0.01	0.08	0.02
6. Does your direct manager treat everyone with respect?	**0.61**	0.01	0.01	0.02	**0.59**	0.01	0.01	0.02	-0.03	0.03

Table 5 (continued)

	G_{factor}		$S_{factor:}$ Strategic Connection		S_{factor}: Manager Credibility		S_{factor}: Appreciative Feedback		S_{factor}: Enabling environment	
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.
7. Does your direct manager treat everyone fairly and consistently?	**0.68**	0.01	-0.02	0.02	**0.55**	0.02	0.00	0.02	-0.09	0.04
8. Do you trust your direct manager?	**0.67**	0.02	-0.05	0.02	**0.48**	0.02	0.01	0.02	0.03	0.04
9. Does your direct manager inspire you by his or her example?	**0.71**	0.01	-0.08	0.02	**0.41**	0.02	0.03	0.02	0.01	0.03
10. Does your direct manager set realistic and achievable goals for your business unit or team?	**0.67**	0.01	0.04	0.02	**0.19**	0.02	0.11	0.03	0.07	0.04
Appreciative feedback										
11. How often does senior management give you and your co-workers feedback on the achievement of organisational goals?	**0.56**	0.01	0.10	0.03	-0.09	0.01	**0.23**	0.02	0.07	0.02

Table 5 (continued)

	G_{factor}		$S_{factor:}$ Strategic Connection		S_{factor}: Manager Credibility		S_{factor}: Appreciative Feedback		S_{factor}: Enabling environment	
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.
12. How often does your direct manager provide you and your team with progress feedback regarding the achievement of team goals?	**0.59**	0.01	0.01	0.01	0.09	0.01	**0.61**	0.10	0.00	0.02
13. How often does your direct manager give you feedback on how well you are doing?	**0.62**	0.02	-0.02	0.02	0.06	0.02	**0.41**	0.08	-0.16	0.04
Enabling environment										
14. How physically safe and secure do you feel in your work environment?	**0.50**	0.01	0.07	0.02	0.07	0.02	-0.05	0.02	**0.22**	0.04
15. Do you have all the tools and equipment you need to do your job well?	**0.50**	0.01	0.07	0.03	-0.01	0.01	-0.05	0.01	**0.32**	0.04
16. Do the policies and procedures in your organisation enable you to do your job well?	**0.57**	0.01	0.18	0.02	-0.07	0.01	-0.08	0.01	**0.28**	0.03

Table 5 (continued)

	G_{factor}		$S_{factor:}$ Strategic Connection		S_{factor}: Manager Credibility		S_{factor}: Appreciative Feedback		S_{factor}: Enabling environment	
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.
Team relations										
17. Do you feel that your co-workers treat you with dignity and respect?	**0.48**	0.01	0.05	0.02	0.01	0.01	0.01	0.02	-0.03	0.02
18. How competent are your co-workers at their jobs?	**0.41**	0.01	0.10	0.02	-0.04	0.01	0.00	0.01	0.08	0.02
19. Do you trust your team members?	**0.49**	0.01	-0.04	0.03	0.07	0.02	-0.06	0.02	0.01	0.03
20. Do the people in your team help and support each other when you have to achieve a goal?	**0.50**	0.01	0.02	0.02	-0.01	0.01	-0.02	0.01	0.00	0.02
Strength use										
21. At work, how often do you get the opportunity to use your strengths (things that you are naturally good at)?	**0.62**	0.01	0.00	0.01	-0.01	0.01	-0.04	0.01	-0.02	0.02

Table 5 (continued)

	G_{factor}		$S_{factor:}$ Strategic Connection		S_{factor}: Manager Credibility		S_{factor}: Appreciative Feedback		S_{factor}: Enabling environment	
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.
22. Do you get the opportunity to develop your strengths at work (things that you are naturally good at)?	**0.69**	0.01	-0.06	0.02	0.00	0.02	-0.01	0.02	0.00	0.02
23. Do your co-workers know what your strengths are (things that you are naturally good at)?	**0.46**	0.01	0.11	0.02	-0.13	0.02	-0.03	0.02	-0.04	0.03
Employee voice										
24. Does your direct manager involve you in decisions that impact you?	**0.69**	0.01	-0.01	0.03	0.20	0.02	0.06	0.02	-0.09	0.02
25. Does your direct manager encourage you to speak up without holding it against you?	**0.70**	0.01	-0.06	0.02	0.24	0.02	0.09	0.02	-0.17	0.02
26. Do your ideas and opinions count at work?	**0.70**	0.01	-0.05	0.02	0.03	0.01	-0.06	0.02	-0.01	0.02
Recognition and praise										
27. Do you feel appreciated for the work you do?	**0.71**	0.01	-0.03	0.01	0.06	0.01	-0.03	0.01	-0.01	0.02

Table 5 (continued)

	G_{factor}		$S_{factor:}$ Strategic Connection		S_{factor}: Manager Credibility		S_{factor}: Appreciative Feedback		S_{factor}: Enabling environment	
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.
28. When last did you receive recognition or praise for doing a good job?	**0.61**	0.01	-0.09	0.02	-0.06	0.02	0.10	0.04	-0.15	0.03
29. Do you feel fairly compensated for the work you are doing?	**0.46**	0.01	-0.16	0.02	-0.01	0.01	-0.08	0.03	0.22	0.03
30. Does your organisation have a formal reward or recognition program for doing good work?	**-0.55**	0.01	0.04	0.03	-0.17	0.01	0.02	0.02	0.03	0.03
Personal development										
31. Do you believe you have good career opportunities at your organisation?	**0.58**	0.01	0.03	0.02	-0.03	0.01	-0.03	0.01	0.05	0.02
32. Does your organisation provide you with sufficient opportunities to develop and grow professionally?	**0.65**	0.01	0.00	0.01	-0.07	0.01	-0.05	0.01	0.05	0.02
33. Do you feel that you develop and learn new skills in your current job?	**0.62**	0.01	-0.03	0.02	-0.02	0.01	0.00	0.01	0.00	0.02
McDonald's Omega	0.92		0.70		0.93		0.79		0.80	

Table 5 (continued)

	S_{factor}: Team Relations		S_{factor}: Strength Use		S_{factor}: Employee Voice		S_{factor}: Recognition and Praise		S_{factor}: Personal Development		δ
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	
Strategic connection											
1. How well do you know what is expected of you at work?	0.05	0.01	0.03	0.02	0.08	0.05	0.05	0.02	0.01	0.02	0.59
2. To what extent does the work you do help your organisation to achieve its goals?	0.10	0.01	0.06	0.02	-0.07	0.03	-0.06	0.04	0.00	0.02	0.71
3. Does your organisation have clear performance goals?	-0.02	0.01	-0.06	0.02	-0.04	0.03	-0.09	0.04	0.04	0.03	0.54
4. Do you understand the vision of your organisation?	0.01	0.02	-0.06	0.03	-0.09	0.08	-0.19	0.05	-0.05	0.03	0.53

Table 5 (continued)

	S_{factor}: Team Relations		S_{factor}: Strength Use		S_{factor}: Employee Voice		S_{factor}: Recognition and Praise		S_{factor}: Personal Development		δ
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	
Manager credibility											
5. Do you believe that your direct manager acts in a way that is consistent with the organisational values?	-0.01	0.01	0.00	0.01	-0.03	0.02	-0.04	0.02	-0.06	0.02	0.33
6. Does your direct manager treat everyone with respect?	0.02	0.01	-0.01	0.01	-0.09	0.02	0.03	0.02	-0.04	0.02	0.27
7. Does your direct manager treat everyone fairly and consistently?	0.01	0.01	-0.04	0.02	-0.12	0.04	0.01	0.03	-0.06	0.02	0.21
8. Do you trust your direct manager?	0.06	0.02	0.00	0.02	0.21	0.03	0.00	0.04	0.07	0.02	0.28

Table 5 (continued)

	S_{factor}: Team Relations		S_{factor}: Strength Use		S_{factor}: Employee Voice		S_{factor}: Recognition and Praise		S_{factor}: Personal Development		δ
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	
9. Does your direct manager inspire you by his or her example?	-0.02	0.01	0.00	0.01	0.14	0.02	-0.01	0.03	0.03	0.02	0.30
10. Does your direct manager set realistic and achievable goals for your business unit or team?	-0.02	0.02	-0.05	0.02	0.14	0.02	-0.02	0.03	-0.03	0.03	0.48
Appreciative feedback											
11. How often does senior management give you and your co-workers feedback on the achievement of organisational goals?	-0.06	0.01	-0.03	0.01	-0.10	0.02	-0.03	0.02	-0.04	0.02	0.60

Table 5 (continued)

	S_{factor}: Team Relations		S_{factor}: Strength Use		S_{factor}: Employee Voice		S_{factor}: Recognition and Praise		S_{factor}: Personal Development		δ
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	
12. How often does your direct manager provide you and your team with progress feedback regarding the achievement of team goals?	-0.02	0.01	0.00	0.01	-0.01	0.02	-0.01	0.01	-0.02	0.02	0.27
13. How often does your direct manager give you feedback on how well you are doing?	-0.05	0.02	-0.07	0.03	0.10	0.03	0.00	0.04	-0.04	0.03	0.41
Enabling environment											
14. How physically safe and secure do you feel in your work environment?	0.08	0.01	-0.02	0.02	-0.12	0.03	0.03	0.03	0.02	0.02	0.67

Table 5 (continued)

	S_{factor}: Team Relations		S_{factor}: Strength Use		S_{factor}: Employee Voice		S_{factor}: Recognition and Praise		S_{factor}: Personal Development		δ
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	
15. Do you have all the tools and equipment you need to do your job well?	0.01	0.01	-0.03	0.01	-0.02	0.04	0.04	0.03	0.04	0.02	0.64
16. Do the policies and procedures in your organisation enable you to do your job well?	0.01	0.01	-0.03	0.01	0.00	0.03	0.01	0.02	0.09	0.01	0.54
Team relations											
17. Do you feel that your co-workers treat you with dignity and respect?	**0.56**	0.01	0.05	0.01	-0.08	0.02	0.04	0.03	-0.05	0.02	0.45
18. How competent are your co-workers at their jobs?	**0.39**	0.01	-0.05	0.01	-0.08	0.02	-0.03	0.02	-0.03	0.02	0.65

Table 5 (continued)

	S_{factor}: Team Relations		S_{factor}: Strength Use		S_{factor}: Employee Voice		S_{factor}: Recognition and Praise		S_{factor}: Personal Development		δ
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	
19. Do you trust your team members?	**0.59**	0.01	0.01	0.02	0.11	0.02	-0.04	0.04	0.05	0.02	0.39
20. Do the people in your team help and support each other when you have to achieve a goal?	**0.51**	0.01	0.00	0.01	0.01	0.02	0.02	0.02	-0.03	0.02	0.49
Strength use											
21. At work, how often do you get the opportunity to use your strengths (things that you are naturally good at)?	-0.06	0.01	**0.57**	0.02	-0.04	0.02	-0.01	0.02	-0.04	0.01	0.28

Table 5 (continued)

	S_{factor}: Team Relations		S_{factor}: Strength Use		S_{factor}: Employee Voice		S_{factor}: Recognition and Praise		S_{factor}: Personal Development		δ
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	
22. Do you get the opportunity to develop your strengths at work (things that you are naturally good at)?	0.00	0.01	**0.42**	0.02	0.04	0.02	0.03	0.02	0.16	0.02	0.32
23. Do your co-workers know what your strengths are (things that you are naturally good at)?	0.19	0.02	**0.25**	0.02	0.09	0.02	0.06	0.03	0.02	0.02	0.64
Employee voice											
24. Does your direct manager involve you in decisions that impact you?	-0.07	0.01	0.08	0.02	**0.08**	0.06	0.02	0.03	-0.11	0.02	0.45

Table 5 (continued)

	S_{factor}: Team Relations		S_{factor}: Strength Use		S_{factor}: Employee Voice		S_{factor}: Recognition and Praise		S_{factor}: Personal Development		δ
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	
25. Does your direct manager encourage you to speak up without holding it against you?	-0.03	0.01	0.00	0.02	**0.14**	0.08	-0.08	0.03	-0.08	0.02	0.38
26. Do your ideas and opinions count at work?	0.02	0.01	0.16	0.02	**0.10**	0.04	0.14	0.02	0.01	0.02	0.45
Recognition and praise											
27. Do you feel appreciated for the work you do?	0.03	0.01	0.02	0.01	0.05	0.03	**0.41**	0.06	0.07	0.02	0.32
28. When last did you receive recognition or praise for doing a good job?	-0.04	0.01	-0.02	0.02	0.02	0.05	**0.19**	0.04	-0.03	0.02	0.55

Table 5 (continued)

	S_{factor}: Team Relations		S_{factor}: Strength Use		S_{factor}: Employee Voice		S_{factor}: Recognition and Praise		S_{factor}: Personal Development		δ
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	
29. Do you feel fairly compensated for the work you are doing?	-0.02	0.01	0.13	0.02	-0.04	0.04	**0.24**	0.04	0.10	0.02	0.62
30. Does your organisation have a formal reward or recognition program for doing good work?	-0.01	0.01	-0.19	0.01	-0.13	0.04	**0.07**	0.03	0.04	0.02	0.61
Personal development											
31. Do you believe you have good career opportunities at your organisation?	-0.02	0.01	0.04	0.01	0.00	0.03	0.10	0.02	**0.47**	0.02	0.44

Table 5 (continued)

	S_{factor}: Team Relations		S_{factor}: Strength Use		S_{factor}: Employee Voice		S_{factor}: Recognition and Praise		S_{factor}: Personal Development		δ
	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	λ	S.E.	
32. Does your organisation provide you with sufficient opportunities to develop and grow professionally?	-0.03	0.01	0.03	0.01	-0.06	0.01	0.02	0.02	**0.38**	0.02	0.41
33. Do you feel that you develop and learn new skills in your current job?	-0.01	0.01	0.05	0.02	0.00	0.02	-0.02	0.02	**0.38**	0.02	0.46
McDonald's Omega	0.82		0.79		0.60		0.70		0.79		

Gfactor General Factor, *Sfactor* Specific factor, *Bold* Significant $p < 0.01$, *d* Item uniqueness

the nine-enabling conditions. This means that the manifested factor scores (for ESEM models) and aggregated mean scores (for ICM-CFA) for both the nine enabling conditions and overall PWI factors can be reliably used.

5.2 Measurement Invariance Between Genders and Levels of Education

To determine whether these sub-scores of the PWIS could be used to compare overall PWI and its nine performance-enabling conditions between genders and those with different levels of education, the Bifactor ESEM Model was subjected to invariance testing. The results showed that configural, metric, scalar and strict invariance could be established across both genders and qualifications, which supports the instrument's factorial equivalence. Configural invariance showed that the factor structure of the bifactor ESEM model was equivalent between genders and those with different levels of education. This implies that men and women and those with different levels of education viewed PWI similarly (when such is expressed through cross-loadings between the nine enabling conditions). Establishing metric invariances shows that similar factor loadings were produced between groups, which implies that the relationship between latent factors and genders/qualifications could be meaningfully compared (Wang & Wang, 2020). The scalar invariance indicates that intercepts were similar across the different groups. Finally, strict invariance showed that the residual variances of the measured items (i.e. the variance not accounted for by the latent factors) were equal across the different groups. Taken together, the results showed that the differences in scores on items/factors of the bifactor ESEM model could be meaningfully interpreted and that comparisons between genders and different levels of education are possible. Thus, Researchers can confidently examine differences in work immersion between subgroups, which may provide valuable insights into the influence of gender and qualifications in other studies. Moreover, practitioners can use the PWIS as a reliable tool to assess and compare levels of work immersion across diverse populations, aiding in the development of targeted interventions to enhance wellbeing and performance in the workplace.

5.3 Limitations and Recommendations

The study is also subjected to several limitations that should be acknowledged. Firstly, the cross-sectional nature and availability-based sampling strategy limits the ability to generalise the findings outside the current sample population. Further, it restricts the ability to determine whether the instrument's factorial structure and reliability are stable over time. Future research employing longitudinal designs could be used to evaluate the scale's temporal dynamics and determine whether it is invariant over time. Secondly, the items related to employee voice were poorly defined and seemed to be better represented by the general PWI factor. Each of the three items pertains directly to various elements of psychological safety, however, items do not fully capture the potential consequences due to a lack of such within the assessment context. It is suggested that additional items be introduced

relating to threats to career, promotion opportunities and status. Further, the three current items should be reformulated to include these consequences: “Does your direct manager involve you in decisions that impact your career?” or “Does your direct manager create an environment to share your opinions without fear of being reprimanded?”. Further, it is suggested that more specific voice-related wording be used to formulate the items relating to the expression of opinions and ideas. Using terms like "speak up" and "voice your views" may help target voice behaviours onto the specific factor rather than create the perception of general involvement or participation. It is also suggested that more items be added that specifically target voicing behaviours related to management decision-making, challenges related to the current status quo and those related to constructive suggestions about change. Example items to include in future studies: “Are you able to communicate your opinions about work issues to your manager?”, “Do you raise concerns to your manager when you see problems at work?”, “Do you feel comfortable speaking up to management with ideas for changes?”, “Are you able to challenge practices you believe are outdated or unnecessary without fear of repercussions?” or “Do you freely express your views about work matters to your manager”? These voice items emphasise expressing opinions, concerns, and ideas more directly, which may further help to distinguish such from the more general PWI factor. Additionally, if the current instrument is used without additional modifications, researchers should consider using the ESEM within CFA framework, and constrain the items to only moderately load onto the general factor in order to compensate for the overlap with the specific voice factor (Morin, 2023). Thirdly, measurement invariance was only investigated across genders and levels of education, but other demographic variables such as age, ethnicity, and job position were not considered. Further investigations examining measurement invariance across a broader range of demographic factors would enhance the generalizability and applicability of the PWIS. Lastly, despite drawing data from various global organisations, the cross-cultural equivalence of the scale could not be investigated. Replication studies across diverse contexts and within and between different cultures would provide valuable insights into the cross-cultural applicability and robustness of the PWIS.

6 Conclusion

In conclusion, this study showed that the PWIS has promise as a measure for overall PWI. It provided evidence of its factorial validity, reliability and measurement invariance across genders and levels of education. The factorial validity analysis supports the use of the Bifactor ESEM Model, which captures the multidimensional nature of PWI. Furthermore, the measurement invariance findings confirm that the scale measures work immersion consistently across different genders/levels of qualifications, allowing for meaningful comparisons. Thus, The PWIS offers researchers and practitioners a reliable and comprehensive tool for assessing work immersion. Overall, this study enhances our understanding of PWI and provides valuable insights for organisations seeking to foster a positive work environment and promote employee wellbeing and performance.

Appendix 1

Table 6 Descriptive statistics and pearson correlations

No	Factor	Mean	Std. Deviation	Skewness	Kurtosis	1	2	3	4	5	6	7	8	9
1	Psychological Work Immersion	2.94	0.53	-0.26	-0.39	—								
2	Strategic Connection	3.31	0.56	-0.81	0.45	0.67	—							
3	Manager Credibility	2.92	0.80	-0.49	-0.66	0.85	0.48	—						
4	Appreciative Feedback	3.22	0.69	-0.91	0.47	0.70	0.49	0.59	—					
5	Enabling environment	2.97	0.69	-0.40	-0.41	0.69	0.55	0.54	0.43	—				
6	Team Relations	3.08	0.65	-0.48	-0.31	0.65	0.45	0.47	0.40	0.47	—			
7	Strength Use	2.75	0.79	-0.28	-0.76	0.75	0.51	0.53	0.45	0.47	0.47	—		
8	Employee Voice	2.81	0.81	-0.43	-0.62	0.85	0.50	0.76	0.63	0.51	0.49	0.62	—	
9	Recognition and Praise	2.48	0.73	0.03	-0.71	0.80	0.48	0.62	0.53	0.57	0.47	0.58	0.64	—
10	Personal Development	2.64	0.85	-0.11	-0.89	0.78	0.50	0.55	0.46	0.54	0.41	0.58	0.58	0.63

Appendix 2

Table 7 Competing measurement models with WLSMV estimator

Model	Type	χ^2	*df*	CFI	TLI	RMSEA		SRMR	Meets model fit criteria	Meets measurement quality criteria
Model 0	Unidimensional Model	54,029.02	495	0.87	0.86	0.10	[.096-.097]	0.07	Partially	Yes
Model 1	Nine First-Order Factor Model	15,951.73	459	0.96	0.96	0.05	[.053-.055]	0.04	Partially	Yes
Model 2	Second-Order Model with Nine First-Order Factors	21,037.27	486	0.95	0.95	0.06	[.060-.061]	0.05	Partially	Yes
Model 3	Bifactor Model with One General- and Nine Specific Factors	18,705.24	462	0.96	0.95	0.06	[.058-.059]	0.04	Partially	Yes
Model 4	Nine First-Order ESEM Factor Model	2788.42	267	0.99	0.99	**0.03**	[.028-.030]	0.01	Yes	Yes
Model 5	H-ESEM Model with Nine First-Order Factors	3731.76	294	0.99	0.99	**0.03**	[.031-.033]	0.02	Yes	Yes
Model 6	Bifactor ESEM Model with One General- and Nine Specific Factors	2243.16	243	1.00	0.99	**0.03**	[.026-.028]	0.01	Yes	Yes

Appendix 3

Table 8 Measurement invariance across genders and levels of qualification for the bifactor ESEM model with the WLSMV estimator

Model	χ^2	df	CFI	TLI	RMSEA	90%CI	SRMR	CM	ΔCFI	ΔTLI	ΔRMSEA	ΔSRMR	Meets Fit Criteria	Meets Invariance Criteria
Gender														
1. Configural invariance	3641.449	536	0.995	0.99	**0.026**	[0.025, 0.027]	0.013							
2. Weak (λ) invariance	3877.678	752	0.995	0.993	**0.022**	[0.021, 0.023]	0.016	1	0.000	0.003	-0.004	0.003	Yes	Yes
3. Strong (λ, τ) invariance	4255.15	807	0.994	0.992	**0.022**	[0.022, 0.023]	0.016	2	-0.001	-0.001	0.000	0.000	Yes	Yes
4. Strict (λ, τ, δ) invariance	3904.508	840	0.995	0.994	**0.021**	[0.020, 0.021]	0.017	3	0.001	0.002	-0.001	0.001	Yes	Yes
Qualification														
1. Configural invariance	2269.499	1223	0.994	0.987	**0.030**	[0.028, 0.032]	0.017							
2. Weak (λ) invariance	3754.012	2359	0.992	0.991	**0.025**	[0.024, 0.027]	0.027	1	-0.002	0.004	-0.005	0.010	Yes	Yes
3. Strong (λ, τ) invariance	3960.204	2491	0.991	0.991	**0.025**	[0.024, 0.027]	0.030	2	-0.001	0.000	0.000	0.003	Yes	Yes
4. Strict (λ, τ, δ) invariance	3454.505	2711	0.996	0.996	**0.017**	[0.015, 0.019]	0.039	3	0.005	0.005	-0.008	0.009	Yes	Yes

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Data Availability The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Declarations

Ethics Before participation, participants were informed about the nature of the study, and their rights/responsibilities were highlighted. Participants were informed that participation was voluntary and that the right to confidentiality/anonymity was ensured. Data management procedures were in line with the requirements of the General Data Protection Regulation (GDPR).

Conflict of Interest The authors have no conflict of interest to declare.

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