Psychometric properties of a new scale for measuring academic positive psychological capital

Pasquale Anselmi, Daiana Colledani, Luigi Fabbris, Egidio Robusto, Manuela Scioni

1. Introduction

The understanding of the factors that may influence the academic performance of students and the effectiveness of fresh graduates to stand the labor market is a crucial objective to develop adequate educational policies. Individual dispositions and personality traits are among the most important variables that should be considered to achieve this goal. Scholars attributed a relevant role to a set of traits developed within the framework of positive psychology (Seligman & Csikszentmihalyi, 2014), named "psychological capital" (PsyCap; Luthans et al., 2007). PsyCap is defined as an individual's positive psychological state of development, which is characterized by four traits: Self-efficacy, resilience, optimism, and hope. Self-efficacy (or confidence) represents one's awareness of having all the abilities and resources needed to accomplish his own tasks and duties. Resilience indicates the ability to overcome difficulties and "bounce back" from adversities and failure. Optimism reflects the subjective tendency to positively interpret events and circumstances and to consider both positive and negative aspects of reality to drawn new bits of knowledge (Youssef & Luthans, 2005). Finally, hope defines a positive motivational state that is typical of those people who are determined toward their goals and able to redirect, if needed, their strategies to achieve them.

Several instruments for the assessment of these traits can be found in the literature. The most popular is the PsyCap Questionnaire (PCQ; Luthans et al., 2007). Since these instruments are meant for workers, they may not be appropriate for assessing PsyCap traits among fresh graduates who are only about to enter the labor market. To overcome this limitation, a new instrument has been recently developed for measuring PsyCap among students and fresh graduates: The Academic PsyCap (Anselmi et al., 2021; Robusto et al., 2019). It includes four scales that measure the traits of the psychological capital (i.e., self-efficacy, resilience, optimism, and hope) and has been found to be significantly associated with several variables (e.g., entrepreneurial disposition and the number of actions taken to search for a job) that are relevant for students and young workers at the beginning of their careers.

In its last version, the Academic PsyCap includes 24 items, selected from an initial pool of 37, and is characterized by satisfactory psychometric properties (Anselmi et al., 2021). In this work, we present and discuss a refinement of the instrument through a bifactor approach aimed to improve it. The bifactor method allows for modeling the structure of a questionnaire through a general factor and a set of domain-specific factors. In the case of PsyCap, the general factor is the positive psychological capital, whereas the domain-specific factors are the four distinct dimensions it consists of. Using this method to refine the scale would allow for a better understanding of the structure of the positive psychological capital and for developing an instrument that, while assessing the four dimensions of PsyCap, also provides an effective measure of its general factor. This makes sense also in light of the findings of several studies that suggested the existence of a core underlying factor accounting for the overlap between the four PsyCap dimensions (Baron et al., 2016; Choisay et al., 2021; Luthans et al., 2007). The research supported the usefulness of considering the single

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PsyCap components but also showed that they often act synergistically and that a broader construct may be more effective than the distinct components in predicting individuals' attitudes and performances (Baron et al., 2016; Dawkins et al., 2013; Luthans et al., 2007, 2016).

2. Method

Participants

A sample of 1,603 fresh graduates (Males 38.5%, Mean age = 24.44, SD = 4.36), recruited in the context of the PETERE project, took part in the study. All participants were surveyed within one month after graduation at the University of Padua. The survey was administered via a CAWI (Computer-Assisted Web-based Interviewing) system. Students from medicine and nursing courses were not included in the sample.

Measures

The original pool of 37 items was used to measure the four facets of PsyCap: resilience (11 items), self-efficacy (9 items), optimism (9 items), and hope (8 items). All items were scored on a four-point Likert scale (from 1 "Completely disagree" to 4 "Completely agree").

Analytic approach

A bifactor Exploratory Factor Analysis (EFA) was run on the 37 items. Relying on the results of this model and the investigation of item content, 20 items (five for each dimension) were selected to compose the new Academic PsyCap. Thus, starting from the original full item pool, a new version of the scale was obtained that was based on a bifactor approach. This new scale differed from that developed by Anselmi et al. (2021) with a different (non-bifactor) approach.

The factor structure of the resulting scale was investigated through confirmatory factor analysis (CFA). Three models were tested and compared: a one-factor model, a correlated four-factor model, and a bifactor model. In the first model, all the 20 items of the scale were loaded on a single dimension (PsyCap). In the second model, four different and correlated factors were defined (i.e., self-efficacy, resilience, optimism, and hope), each consisting of five items. Finally, a bifactor model was run that included one general factor (i.e., positive psychological capital) measured by all the 20 items of the scale, and four domain-specific factors (i.e., self-efficacy, resilience, optimism, and hope), each measured by five items.

All models were run using Mplus7 (Muthén & Muthén, 2012), and the WLSMV estimator (weighted least squares mean and variance-adjusted; Muthén & Muthén, 2012), which is recommended for categorical observed data (e.g., Flora & Curran, 2004; Brown, 2006). The goodness-of-fit of the three models was evaluated using several fit indices: χ^2, Comparative Fit Index (CFI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA). A non-significant χ^2 ($p \geq .05$) suggests adequate fit. Since this statistic is sensitive to sample size, other fit measures were also considered. CFI indices close to .90 (over .95 for excellent fit), SRMR values less than .08, and RMSEA smaller than .06 (.06 to .08 for reasonable fit) are indicative of a good model fit (Marsh et al., 2004). To compare these competing factor structures, the Akaike Information Criterion (AIC; Akaike, 1974) was considered. To this aim, following Olatunji et al. (2019) and Rhemtulla et al. (2012), the 4-point Likert scale data were temporarily treated as continuous and the Robust Maximum Likelihood estimator (Muthén & Muthén, 2012) was used. Concerning AIC, smaller values are indicative of a better fit. Relative differences were considered meaningful if models differed in AIC (ΔAIC) by 10 or more (Burnham et al., 2011). Concerning the bifactor model, a series of indices were also considered, namely the Explained Common Variance (ECV; Sijtsma, 2009; Ten Berge and Sočan, 2004), and McDonald's coefficients (1999) omega (ω) and hierarchical

omega (ωh). The ECV represents the ratio of the common variance explained by the general factor to the total common variance (Reise, Bonifay et al., 2013; Reise, Scheines et al., 2013; Rodriguez et al., 2016). High values (.70 to .80) indicate that the factor loadings obtained from a unidimensional model well approximate those on the general factor obtained from the bifactor solution, and suggest that the scale is substantially one-dimensional (Rodriguez et al., 2016). McDonald's (1999) ω and ωh are factor-analytic "model-based" estimates of internal consistency. The former represents the proportion of variance of the scores that can be attributed to all sources of variance (i.e., general and domain-specific factors), whereas the latter quantifies the amount of variance that is accounted for by the general factor (Revelle & Zinbarg, 2009; Zinbarg et al., 2005, 2007). Both ω and ωh were computed for the general factor. Conversely, ω was also computed for the domain-specific factors. For this coefficient, values close to or greater than .70 are satisfactory. Concerning ωh, values larger than .75-.80 indicate that a factor can be interpreted as the measure of a single construct despite multidimensionality (Reise, Bonifay et al., 2013; Reise, Scheines et al., 2013).

The invariance of the scale across males and females and across bachelor and master graduates was tested through Multiple-Group Confirmatory Factor Analysis (MG-CFA). In the first step, the model was simultaneously fitted to the specific subsamples (males and females; bachelor and master graduates) to test configural invariance (i.e., the same pattern of fixed and free factor loadings were specified across groups). Subsequently, a series of constrained models were tested and compared to evaluate scalar (i.e., invariance of both factor loadings and item thresholds) and strict invariance (i.e., invariance of factor loadings, item thresholds, and residual variances). The test of change in CFI (ΔCFI) was used to compare nested models. Invariance was indicated by ΔCFI values lower than or equal to |.01| (Cheung & Rensvold, 2002).

3. Results

Table 1 shows the factor loadings of the three models that were run on the 20 items selected by applying the bifactor EFA, whereas Table 2 shows the fit indices of these models. The one-factor model did not fit the data, while the other two models obtained a better fit. In the four-factor model, consistently with theoretical expectations, all items showed meaningful loadings on the intended dimensions (λs from .505 to .887, ps $\leq$ .001), even though correlations between factors were large (rs = from .580 to .985, ps $\leq$ .001). With regard to the bifactor model, all items significantly loaded on the general factor (λs = from .328 to .799, ps $\leq$ .001) and on the relative domain-specific factors (λs from .095 to .705, ps $\leq$ .05). The inspection of ΔAICs indicated that the bifactor model was superior compared with the other two models (ΔAIC between the one-factor and correlated four-factor models = 1892.64; ΔAIC between the one-factor and bifactor models = 2462.13, and ΔAIC between the correlated four-factor and bifactor models = 569.49). Moreover, given the high correlations between the latent factors in the correlated four-factor model, the bifactor solution seems to be the most suitable option to represent the structure of the scale.

In the bifactor model, the ECV of the general factor was .67, indicating that the scale should be intended as multidimensional. However, the value of the ωh coefficient was high (.86), and this suggests that, despite multidimensionality, the general factor could be interpreted as the measure of a single common construct (Reise, Bonifay et al., 2013; Reise, Scheines et al., 2013).

With regard to internal consistency, ω coefficients were satisfactory for both the general and domain-specific factors (ωs = .95, .88, .90, .83, and .81 for general, self-efficacy, optimism, resilience, and hope factors, respectively).

The invariance of the bifactor model was tested across males and females and across bachelor and master graduates. The results are reported in Table 3. All models reached a successful fit in all samples and the value of the ΔCFI supported the considered levels of invariance.

4. Discussion and conclusion

In this work, a 20-item version of the Academic PsyCap was developed adopting a bifactor approach. The resulting scale was found to adequately assess the four dimensions of self-efficacy, resilience, optimism, and hope, as well as to appropriately define a general factor of psychological capital. In the bifactor model, both the domain-specific and the general factors showed adequate internal consistency and factorial validity.

The results of this work are in line with the literature that indicates that PsyCap components often act synergistically as a broader construct that may be more effective than the distinct components in predicting individual's attitudes and performances (Baron et al., 2016; Luthans et al., 2007; see Dawkins et al., 2013; Luthans et al., 2016).

Future studies are advocated to explore the relationships of the Academic PsyCap scales with indicators of students' and fresh graduates' achievements.

Table 1. Factor loadings and correlations between factors

	Items	*Bifactor Model*		*Four-correlated-factor model*	*One-factor model*
		General factor	*Domain-specific factors*		
Self-efficacy	*Usually, when I face a problem, I am able to identify different solutions.*	.588	.437	.696	.632
	I have the resources to handle even unforeseen situations.	.625	.309	.705	.636
	If I were in a difficult situation I would be able to find a way out.	.663	.322	.746	.68
	In difficult situations, I feel effective in finding a way out.	.799	.299	.887	.801
	I believe I am able to analyze a problem and identify a possible solution.	.664	.507	.782	.711
Optimism	*I'm usually optimistic about the future.*	.622	.500	.784	.699
	I always try to believe that behind every cloud there is a blue sky.	.644	.531	.816	.734
	I am convinced that my willpower will prevail over bad luck.	.655	.147	.721	.634
	I always try to see the glass half full.	.642	.632	.839	.761
	Even in difficult situations, I try to take the best opportunities and the bright side.	.724	.391	.853	.757
Resilience	*Until now, my successes have largely depended on the choices I made.*	.472	.520	.587	.548
	I'm proud of everything I have achieved by now.	.636	.326	.698	.658
	My efforts and my skills are the basis of the results I have achieved.	.507	.537	.625	.584
	Usually, in one way or another, I try to overcome difficulties.	.689	.095*	.701	.663
	I always try to give my best in all the things I do without getting discouraged in the face of obstacles.	.698	.150	.722	.678
Hope	*The goals I have achieved so far are due to my planning skills.*	.363	.705	.587	.502
	I think I will be able to achieve my current goals by counting on my determination.	.647	.326	.767	.673
	I have a hard time planning things to do when I have to reach a goal. (R)	.328	.536	.505	.430
	Willpower was key to obtaining an academic degree.	.512	.445	.662	.581
	At present, I think I'm a successful person in carrying out my duties.	.619	.189	.699	.619
	Correlations between latent factors				
	Self-efficacy - Optimism	-.318		.639	
	Self-efficacy - Resilience	.110†		.832	
	Optimism - Resilience	-.240		.686	
	Hope - Self-efficacy	.216**		.737	
	Hope - Optimism	-.228		.580	
	Hope - Resilience	.829		.985	

Note. All parameters were significant at $p \leq .001$, excluding those indicated with *$p \leq .05$ and **$p \leq .01$. The parameter indicated with † was non-significant ($p > .05$).

Table 2. Model fit indices

	χ^2	*df*	*p*	RMSEA	C.I. RMSEA	CFI	SRMR	AIC
One-factor model	4960.981	170	.000	.133	.129, .136	.806	.100	58175.32
Correlated four-factor model	1916.709	164	.000	.082	.078, .085	.929	.062	56282.68
Bifactor model	731.961	144	.000	.050	.047, .054	.976	.034	55713.19

Table 3. Fit indices of multiple-group confirmatory factor analyses for invariance

	Gender invariance						**Bachelor/Master invariance**					
	χ^2	*df*	*p*	RMSEA	CFI	ΔCFI	χ^2	*df*	*p*	RMSEA	CFI	ΔCFI
Configural	896.48	288	.000	.051	.976		843.953	288	.000	.049	.978	
Scalar	880.08	358	.000	.043	.980	-.004	805.032	358	.000	.039	.982	-.004
Strict	824.74	378	.000	.038	.983	-.003	838.677	378	.000	.039	.982	.000

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