FACTORIAL INVARIANCE OF ACADEMIC SELF-EFFICACY IN TEAMWORK AND LEADERSHIP SCALE ON MEN AND WOMEN UNIVERSITY STUDENTS

Jose Rene Blanco Ornelas, M.C.
Humberto Blanco Vega, Dr.
Yunuen Rangel Ledezma, M.P.
Maria del Carmen Zueck Enriquez, Dr.
Faculty of Physical Culture Sciences,
Autonomous University of Chihuahua, Mexico

Abstract

The present study analyses the psychometric properties of the Self-efficacy Scale in the Field of Teamwork and Leadership in men and women university students. The overall sample consisted of 2089 participants: 902 women and 1187 men, with a mean age of 18.53 years (SD= 1.52) and 18.99 years (SD= 1.80) respectively. Psychometric analysis showed that a two-factorial structure (Teamwork and Entrepreneurship) was viable and adequate for both populations (men and woman) according to the established psychometric requirements when the informers are the students themselves. In addition, the factor structure, factor loadings and intercepts are considered invariant in the two groups; however, there are differences between groups for the means of Teamwork factor.

Keywords: Self-efficacy, Factor Structure, Measurement Invariance, Multigroup Confirmatory Factor Analysis

Introduction

Motivation and student learning are two of the most important concerns of the majority of teachers, where the beliefs about their abilities to perform their academic tasks are one of the most important variables that influence in academic performance; since people can perform poorly in tasks not necessarily because they lack the ability to succeed, but because they lack confidence in their abilities (Hasheminasab, Ghanbari, Azizi, & Shamsi, 2014; Robbins et al., 2004). One way to conceptualize students' beliefs about their capabilities to carry out their homework that has been used by

researchers of motivation is self-efficacy; it has been shown that high levels of self-efficacy lead to better performance in academic tasks (Bandura, 1997; Javanmard, Hoshmandja, & Ahmadzade, 2012).

Self-efficacy refers to the belief that one can achieve the desired results and is a central construct in Bandura's social cognitive theory (Bandura, 1986, 2012). According to the theory, self- efficacy of an individual is a fundamental factor in the interaction between the environment and the behavior of the individual (Bandura, 2012). Self-efficacy can be specific or general. The specific self-efficacy describes the beliefs of an individual on which he can achieve good results in a defined area of his life, for example their academic performance. While the general self-efficacy is in a sense overall the individual's competence in handling a variety of life challenges. Both types of self-efficacy are relatively stable and can be characterized as traits (Yeo & Neal, 2006).

There is now sufficient evidence about the importance of self-efficacy in professional development. The findings of the studies suggest that efficacy beliefs have a direct influence on decision making and professional performance. A low perceived efficacy may restrict the types of occupations contemplated and influence in the execution and persistence in achieving the chosen profession (Hackett, 1995) and a high perceived self-efficacy typically results in greater motivation to undertake and higher levels of accomplishment (Gibbons & Weingart, 2001).

This instrumental study (Montero & León, 2005) aims to provide empirical support to the factorial division of the Academic Self-Efficacy Scale in the Field of Teamwork and Leadership in Mexican university students; which it is justified by the importance of checking the factorial structure of an instrument and the psychometric equivalence of it in different groups; since in the context of intergroup comparison, it is essential to consider the need to carry out the adaptation of an instrument of psychological measure that fulfills all the criteria of equivalence, but above all consider whether the same factorial structure is applicable to different groups of individuals (Abalo, Lévy, Rial, & Varela, 2006; Arbuckle, 2012).

This paper aims, on one hand, to investigate whether the psychometric results proposed by (Gastélum, Guedea, Viciana, & Peinado, 2012) for the Academic Self-Efficacy Scale in the Field of Teamwork and Leadership are replicated and, secondly, expand them. For this, in the first place it will be checked the degree of congruence of the factorial structure of the scale obtained in this study and the one reported by (Gastélum et al., 2012). Secondly, is calculated the factorial invariance between the samples of the present study.

Method

Participants

The sample of 2089 participants, 902 (43.2%) woman and 1187 (56.8%) men, was obtained by a convenience sample, trying to cover the representation of the different degrees offered at the Autonomous University of Chihuahua. Women ages was ranging between 17 and 25 years, with a mean of 18.53 and a standard deviation of 1.52 years; and men ages was ranging between 17 and 25 years, with a mean of 18.99 and a standard deviation of 1.80 years.

Instrument

Academic Self-Efficacy Scale in the Field of Teamwork and Leadership is a Likert questionnaire, assisted by computer of 16 items (Gastélum et al., 2012) where the respondent answers on a scale of 0-10, how capable he feels, how much interest he has and if he strives to change how capable he could be in each of the domains (items) of the skills (scale factors) Entrepreneur and Teamwork (Figure 1).

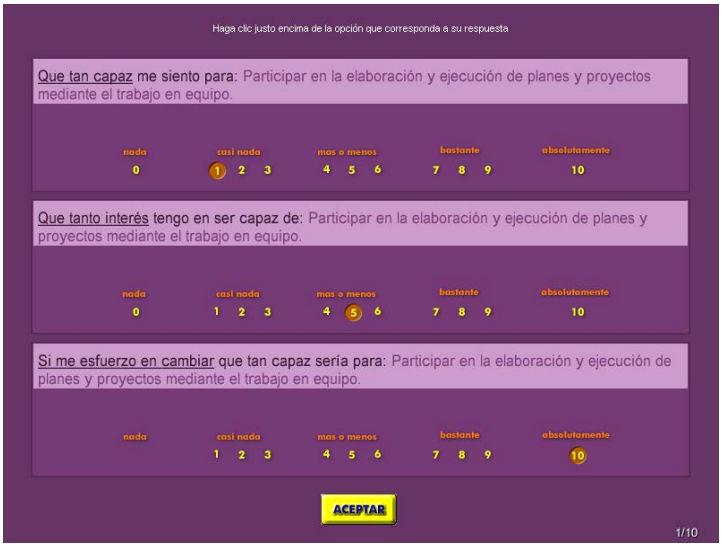

Figure 1. Example Response for each item of the questionnaire.

Although each subject responded to 16 items of the instrument in three different scenarios: Scenario of perceived ability, responding in the context: how capable I feel to... perform in each of the questionnaire items. Scenario of interest in being capable, responding in the context: how much interest I have in being capable of ... perform in each of the questionnaire items. Scenario of change in being capable of, responding in context: if I try to change, how capable would I be to ... perform in each of the questionnaire

items. In the psychometric analysis only the answers to the first scenario were used.

Procedure

Students of all the degrees offered at the Autonomous University of Chihuahua were invited to participate; those who agreed to participate signed a consent letter. Then, the instrument explained above was applied through a computerized application using the instrument administrator module of scales editor, version 2.0 (Blanco et al., 2013) in a session of about 25 minutes in the computer labs correspondent to each participating academic unit. At the beginning of each session students were given a brief introduction on the importance of the study and of how to access to the instrument was explained; instructions of how to answer were on the first computer screens, before the first instrument item. At the end of the session students were thanked for their contribution to the study.

Once the instrument was applied, data was collected by the results generator module of scales editor, version 2.0 (Blanco et al., 2013).

Data Analysis

A psychometrical analysis was applied in two stages: 1) Factorial Confirmatory Analysis and 2) Invariance Factorial Analysis; so that it could obtain evidence that presents the best properties for the scores confirmation of Academic self-efficacy in teamwork and leadership scale on men and women university students.

To conduct the confirmatory factorial analysis for each sample, AMOS 21 software was used (Arbuckle, 2012), variances in terms of error were specified as free parameters, in every variable (factor) a structural coefficient was set associated to one, so that scale was equal to the superficial variables (items). The estimated method used was the maximum credibility; following the recommendation of (Thompson, 2004), so when the confirmatory factorial analysis is used, it is necessary to verify not only the adjustment of the theoretical model but it is recommended to compare the adjustment of some alternative models to select the best.

To evaluate the adjustment model, statistical squared-chi, the Goodness-of-fit index (GFI) adjustment, and the root mean square error of approximation (RMSEA) were used as absolute adjustment measures. Adjusted goodness of fit index (AGFI) the Tucker-Lewis Index (TLI), the comparative fit index (CFI) measures of increasing adjustment. Parsimony normed fit index (PNFI), the Parsimony Goodness-of-fit index (PGFI), the chi-squared fit index divided by degrees of freedom (CMIN/GL) and the Akaike Information Criteria (AIC) as adjusting measures of Parsimony (Gelabert et al., 2011).

Finally, an analysis of the factorial invariance of the models of measurement obtained was made, following the recommendations of (Abalo et al., 2006), and was calculated the reliability of each of the dimensions through Cronbach's alpha and Omega coefficient (Revelle & Zinbarg, 2009).

Results

Confirmatory Factorial Analysis

According to the results obtained in Table1 in the Confirmatory Factorial Analysis of 16 items grouped in two factors in the sample of women is acceptable (GFI .905 y RMSEA .101) and according to the incremental adjustment measures and Parsimony meaningfully superior to the independent model and very similar to the saturated model.

Furthermore, confirmatory factor analysis on the sample of men (table 1) shows again the measuring model of two factors is acceptable (GFI .973 y RMSEA .063) and according to the incremental adjustment measures and Parsimony meaningfully superior to the independent model and very similar to the saturated model.

According to the results of Table 2, in both samples, all items properly saturate in their dimension (factor) provided. High intercorrelations observed between the two factors showing not very adequate discriminant validity.

Table 1. Absolute, incremental and Parsimony fit indices for the generated models. Women and Men Confirmatory factor analysis.

	Absolute indices			**Incremental indices**			**Parsimony indices**	
Model	χ^2	**GFI**	**RMSEA**	**AGFI**	**TLI**	**CFI**	**CMIN/DF**	**AIC**
Factor solution for women								
Independent	9561.267*	.193	.296	.086	.000	.000	79.677	9593.267
Saturated	0.000	1.00			1.000	1.000		272.000
2 factors	407.226*	.945	.058	.926	.961	.967	4.072	479.226
Factor solution for men								
Independent	14330.813*	.169	.316	.059	.000	.000	119.423	14362.813
Saturated	0.000	1.00			1.000	1.000		272.000
2 factors	569.476*	.943	.063	.923	.960	.967	5.695	641.476

Note: * $p < .05$; GFI = goodness of fit index; RMSEA = root mean square error of approximation; AGFI = adjusted goodness of fit index; TLI = Tucker-Lewis index; CFI = comparative fit index; CMIN/DF = chi-squared fit index divided by degrees of freedom; AIC = Akaike information criterion

Invariance of the factorial structure among men and women university students

The fit indices obtained (table 3) allows to accept the equivalence of the base measuring model among the two samples. Although the value of chi-squared exceeds the demanded one to accept the invariance hypothesis, the rest of the indices contradict this conclusion (GFI .938; CFI .962;

RMSEA .046; AIC 1230.115) this allows us to accept the base model of invariance (model without restrictions).

Adding the base model restrictions on factorial charges, metric invariance is characterized. Values obtained from table 3 permit to accept this invariance level. The Goodness of fit index (GFI= .937) and root mean square error of approximation (RMSEA= .045) continue offering convergent information in this direction. Besides Akaike information criteria (AIC= 1222.141) and Bentler comparative fit index (CFI= .962) do not suffer big variations toward the previous model. Using the criteria for the evaluation of the nested models proposed by (Cheung & Rensvold, 2002) who suggest that if the calculation of the difference of the CFI of both nested models diminish in .01 or less, the restricted model is taken for granted therefore the compliance of the factorial invariance. The difference of the CFIs obtained allows to accept the metrical invariance model. We can conclude up to this point that factorial charges are equivalent in the two samples.

Having demonstrated the metric invariance between samples, we evaluate the equivalence between intercepts (strong factorial invariance). The Indices (Table 3) show a good adjustment of this model, evaluated independent as well as analyzed toward nesting with the metric invariance model. The difference between the two comparative indices of Bentler is .002; and the general adjustment index is .933 and the root mean square error of approximation is .044. Accepted then the strong invariance, the two evaluated models are equivalent toward the factorial coefficients and the intercepts.

The factors obtained in the confirmatory factor analysis reached values above 75 of internal consistency in both samples (male and female); demonstrating adequate internal consistency for these subscales, particularly if it is considered the small number of items (Table 4).

Table 2. Standardized solutions for the confirmatory factor analysis in both samples.

	Factorial Weight			
	Factor 1		**Factor 2**	
Item	**Women**	**Men**	**Women**	**Men**
2 Demonstrate ability to generate employment and self-employment.	.80	.80		
4 Optimal use of existing resources.	.75	.78		
6 Using the principles of strategic management in the development of projects.	.78	.80		
8 Apply methods to promote, implement and evaluate the impact of a project.	.85	.86		
10 Linking the academic environment with the work environment.	.77	.78		
12 Create and innovate.	.74	.79		
14 Generate and adapt new technologies in my area.	.78	.77		
16 Procedures used in the operation of basic technology equipment.	.75	.77		
1 Participate in the development and implementation of plans and projects through teamwork.			.66	.76
3 Comply and ensure compliance the rules and laws in a social context.			.68	.71
5 Interact in multidisciplinary groups.			.74	.79
7 Identify leadership skills and potential group development.			.75	.81
9 Develop and encourage a culture of teamwork towards a common goal.			.80	.81
11 Show respect, tolerance, responsibility and openness to confrontation and plurality in group work.			.63	.74
13 Respect tolerance and flexibility toward divergent thinking to reach agreement by consensus.			.70	.74
15 Identify the diversity and contribute to the formation of personal and group development			.83	.83
Correlations between factors				
Factor 1	-		-	
Factor 2	.86	‘	.85	-

Note: Factor 1 = Entrepreneur; Factor 2 = Teamwork

Table 3. Goodness of fit indices of each of the models tested in the factorial invariance.

Model	Fit Indices						
	χ^2	gl	GFI	NFI	CFI	RMSEA	AIC
Model without restrictions	1090.115*	202	.938	.954	.962	.046	1230.115
Metric Invariance	1110.141*	216	.937	.954	.962	.045	1222.141
Strong factor invariance	1187.174*	232	.933	.950	.960	.044	1267.174

Note: * p < .05; GFI = goodness of fit index; NFI = normed fit index; CFI = comparative fit index; RMSEA = root mean square error of approximation; AIC = Akaike information criterion

Table 4. Coefficient omega and alpha for the factors obtained..

	Women		Men	
Factor	**Ω**	□	**Ω**	□
1. Entrepreneur	.925	.900	.932	.923
2. Teamwork	.899	.926	.923	.933

Contrasts of the means of the factors among women and men

Once proved the factorial invariance, the differences among the means of the factors from the two groups were estimated taking as a reference the Men's sample, establishing 0 as the value of the means for this sample, considering freely the value of the means for the sample of women. Restrictions about regression coefficients and intercepts required for the contrast among the means made automatically through the software AMOS 21 (Arbuckle, 2012). The results of the comparisons between means indicated that the mean of the factor Teamwork was meaningfully higher (0.258, p <0.001) in women, and with no difference in the Entrepreneur factor.

Discussion and Conclusion

From the results, analysis and discussion shown, and taking in consideration the main objective of this study which was to examine the factorial structure and the measure of the invariance of this structure in university students, we can conclude the following:

The Confirmatory Factorial Analysis, in both samples, indicated that the adjustment of the data to the theoretical model of 16 grouped items in two factors is acceptable. At the same time that the two factors obtained present in general adequate standardized factorial saturations. Meanwhile the factors correlate among themselves in a positive way and statistically significant, which shows that, as Self-Efficacy perceived increases in some of the factors, the other factor increases as well.

The factors in both samples showed adequate internal consistency, particularly when considering the small number of items in each. Results corresponding to those obtained by (Gastélum et al., 2012).

Along with all the above, the results of the analysis of the factorial invariance between samples; indicate a high congruence between pairs of factors. Suggesting the existence of strong evidence of cross-validation of the measure and therefore the stability of the structure, until the contrary is proved.

The comparisons between the groups reflect significant differences in favor to women, in the mean of Teamwork factor. Suggesting that women perceive themselves a little more self- efficient than men in relation to that factor.

In summary, the analysis of the psychometric properties has shown that a two-factor structure is viable and appropriate in accordance with established psychometric requirements when informants are the students themselves. The structure of two factors, based on statistical and substantive criteria, has shown adequate indicators of adjustment, reliability and validity. However, we believe that further studies are necessary in order to corroborate or refute the data obtained in this investigation

References:

Abalo, J., Lévy, J., Rial, A., & Varela, J. (2006). Invarianza factorial con muestras múltiples. In J. Lévy (Ed.), *Modelización con Estructuras de Covarianzas en Ciencias Sociales* (pp. 259-278). Madrid: Netbiblo.

Arbuckle, J. R. (2012). *AMOS users guide version 21.0*. Chicago, IL: Marketing Department, SPSS Incorporated.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of Control*. New York: Freeman.

Bandura, A. (2012). On the Functional Properties of Perceived Self-Efficacy Revisited. *Journal of Management, 38*(1), 9-44. doi: 10.1177/0149206311410606

Blanco, H., Ornelas, M., Tristán, J. L., Cocca, A., Mayorga-Vega, D., López-Walle, J., & Viciana, J. (2013). Editor for creating and applying computerise surveys. *Procedia Social and Behavioral Sciences, 106*, 935-940. doi: http://dx.doi.org/10.1016/j.sbspro.2013.12.105

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233-255. doi: 10.1207/s15328007SEM0902_5

Gastélum, G., Guedea, J. C., Viciana, J., & Peinado, J. E. (2012). Composición Factorial de una Escala de Autoeficacia en el Ámbito del Trabajo en Equipo y Liderazgo en Universitarios de Ciencias de la Salud. *Formación Universitaria, 5*(4), 49-60. doi: 10.4067/S0718-50062012000400006

Gelabert, E., García-Esteve, L., Martín-Santos, R., Gutiérrez, F., Torres, A., & Subirà, S. (2011). Psychometric properties of the Spanish version of the Frost Multidimensional Perfectionism Scale in women. *Psicothema, 23*(1), 133-139.

Gibbons, D. E., & Weingart, L. R. (2001). Can I Do It? Will I Try? Personal Efficacy, Assigned Goals, and Performance Norms as Motivators of Individual Performance. *Journal of Applied Social Psychology, 31*(3), 624-648.

Hackett, G. (1995). Self-efficacy in career choice and development. In A. Bandura (Ed.), *Self-efficacy in changing societies* (pp. 232-258). New York: Cambridge University Press.

Hasheminasab, M., Ghanbari, Z., Azizi, J., & Shamsi, M. (2014). Investigating the Relationship between Self-Efficacy with Academic Achievement, Discipline, Urban-Rural and Order Birth of High School Students in Rafsanjan. *International Journal of Psychology and Behavioral Research, 3*(4), 258-264.

Javanmard, A., Hoshmandja, M., & Ahmadzade, L. (2012). Investigating the relationship between self-efficacy, Cognitive and metacognitive strategies, and academic self-handicapping with academic achievement in male high school students in the Tribes of Fars Province. *Journal of Iife Science and Biomedicine, 3*(1), 27-34.

Montero, I., & León, O. (2005). Sistema de clasificación del método en los informes de investigación en Psicología. *International Journal of Clinical and Health Psychology, 5*, 115-127.

Revelle, W., & Zinbarg, R. E. (2009). Coefficients alpha, beta, omega and the glb: comments on Sijtsma. *Psychometrika, 74*(1), 145-154. doi: 10.1007/s11336-008-9102-z

Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do psychosocial and study skill factors predict college outcomes? A meta-analysis. *Psychological Bulletin, 130*(2), 261-288. doi: 10.1037/0033-2909.130.2.261

Thompson, B. (2004). *Exploratory and Confirmatory Factor Analysis. Understanding concepts and applications. .* Washington, D C: American Psychological Association.

Yeo, G. B., & Neal, A. (2006). An examination of dynamic relationship between self-efficacy and performance across levels of analysis and levels of specificity. *Journal of Applied Psychology, 91*(5), 1088-1101.