

# Psychometric Behavior of the Short Version of Effort-Reward Imbalance Questionnaire in a Sample of 395 Mexican Teachers<sup>\*</sup>

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This study examined the psychometric properties of the short version of the ERI (Effort-Reward Imbalance) questionnaire with a total of 395 high school teachers (50.1% male, 49.9% female). The reliability of the questionnaire was obtained by an analysis of internal consistency, the validity of the instrument by Exploratory Factor Analysis and construct by CFA (Confirmatory Factor Analysis). Finding Alfa's values greater than 0.60; 0.40. The CFA present good indices of fit ( $X^2 = 173,451(72)$ , GFI = 0.94, RMSEA = 60, and  $\lambda$  weight of 46-99). In conclusion the shorter version of ERI questionnaire has acceptable psychometric properties in this teacher's population.

Keywords: ERI (Effort-Reward Imbalance), teachers, CFA (Confirmatory Factor Analysis), work, stress

# Introduction

At this point in the Americas, the occupational health field faces the challenge to counteract the actual labor trends based in the intensification of the job demands, flexibility of the employment conditions and an alarming increase in the number of workers that develop serious physical and mental diseases. To improve the occupational health conditions, the identification and surveillance of psychosocial risks factors at workplaces is necessary to protect to the employees. Therefore, it's crucial the locally validate instruments to assess the current status of the psychosocial risk factor at work, in this way, the capacities of the occupational health in this area are strengthen (Muñoz et al., 2000). This reflects the need for practical and sensitive tools that focuses on occupational psychosocial risk factors prevention and control (Charria, Sarsosa, & Arenas, 2011).

In regard to the detection and control of psychosocial risks, there are two models that have great relevance the Demand-Control model and ERI (the Effort-Reward Imbalance) model (Aguado, Bátiz, & Quintana, 2013; Charria et al., 2011; Feldman & Blanco, 2012). From these models were developed the most used questionnaires to assess work stressors: the Job Content Questionnaire (JCQ) (Karasek & Theorell, 1990) and the Effort Reward Imbalance Questionnaire (ERI) (Siegrist, 1996).

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The ERI model sees the stress as the product of a socially organized process, related to the imbalance between effort (extrinsic and intrinsic) and the reward at work. Stress exists in conditions of imbalance between the effort and reward, which can produce a state of anxiety and stress, with an adverse health effect (Luceño, García, Rubio, & Díaz, 2004; Siegrist, 1996) (see Figure 1).

Years later, Siegrist (1999) established the intrinsic component as an independent variable, thus combine the information on the demands and rewards at work (extrinsic component) with information on the personal characteristics, determined by a strong commitment and a high need for approval (intrinsic component) that influences the perception of the extrinsic component. In this way, the model contemplates the complexity of individual stressful experiences and those related to employment situation (see Figure 2) (Macias et al., 2003; Siegrist, 2008).



Figure 2. Actual ERI model (Siegrist, 1999, p. 40, as mentioned in Vagchel, de Jonge, Bosma, & Schaufeli, 2005).

The operationalization of the ERI model was carried out through the creation of a self-report questionnaire, the original version contains 22 items that has been translated into different languages. The ERI Spanish version was validated in different studies, Díaz and Feldman (2010), Gómez (2010), Macias et al. (2003), and in Mexico by Arias (2015) and Camacho, García, Noriega, Escobedo, and Juárez (2015), and the version supports the validity and reliability of the questionnaire and model.

Lately, Siegrist developed a 16 items version, this version facilitates the application, and have acceptable alpha scores in all the dimensions, Effort, Reward and Over commitment ( $\alpha = 0.74$ ,  $\alpha = 0.79$ , and  $\alpha = 0.79$ , as listed) (Siegrist, Wage, Pühlhofer, & Wahrendorf, 2009; Siegrist, Li, & Montano, 2014). This shorter version of the ERI questionnaire is considered a useful tool for epidemiological studies regarding the effects of work in health in globalized context. A validation conducted by Leineweber et al. (2010) with a sample of 4,771 workers, obtained acceptable Cronbach's alpha coefficients for the Effort ( $\alpha = 0.80$ ), Reward ( $\alpha = 0.84$ ), and Overcommitment ( $\alpha = 0.85$ ), and its confirmatory analysis showed good fit indices ( $X^2 = 2325.49$ , df = 98,  $X^2/gl = 2174.49$ , GFI = 0.94, AGFI = 0.91, RMSEA = 0.06, CFI = 0.93 and CAIC = 2685.37). A Chinese validation (Li et al., 2012) with a sample of 1,916 workers obtained a Cronbach's alpha coefficients of Effort, Reward and Overcommitment of 0.86, 0.72, and 0.73 respectively, and the confirmatory analysis showed good fit indices ( $X^2 = 739.54$ , GFI = 0.95, AGFI = 0.93, RMSEA = 0.06, CFI = 0.90 and CAIC = 555.55). In Japan, Kurioka, Inoue, and Tsutsumi (2013) contrasted the two versions of the questionnaire, with a sample of 1,489 Japanese workers, the authors concluded that the short version of the ERI is concise and psychometrically valid. However, there was a disagreement in the classification as high-risk individual using the original cut-off point in the original and shorter versions. For this reason, the author suggested for the shorter version a different cut-off point value of ER > 1.4.

The instrument has been tested in several studies and it serves as a powerful predictor of psychosomatic symptoms (de Jonge, Bosma, Peter, & Siegrist, 2000; Tsutsumi & Kawakami, 2004) and shows a significant relationship between Effort-Reward imbalance and the occurrence of cardiovascular diseases (increased heart rate and blood pressure), and the disrupted secretion of stress hormones (cortisol, epinephrine, and norepinephrine) (Fernández, Siegrist, Rödel, & Hernández, 2003; Siegrist, 1996, 2010).

However, to guarantee the quality of measurements, this instrument must be subject to a validation process (Carvajal, Centeno, Watson, Martínez, & Sanz, 2011). This study aim was to analyze the psychometric properties of the shorter version of the ERI in a group of Mexican teachers.

#### Methods

#### **Sampling and Data Collection**

The questionnaire was distributed by e-mail to 4,000 teachers, obtaining a response rate close to 10%. Participants were informed about the research project, their participation was voluntary, they signed and informed consent letter, and the confidentiality of their data was guaranteed.

The participants in this study was a non-random sample of 395 teachers, 198 men (50.1%) and 197 women (49.9%) from ten different schools from a Mexican university. The teachers had a mean age of 46.58 years old, (SD = 10.57, Range 23-75 years old), a mean seniority of 18.69 years (SD = 11.63, range 1-50 years), and 63.5% have a couple. Most of them had a bachelor degree (58.2%), followed by a master degree (36.5%), and a Ph.D. (5.3%). Regarding their type of contract, 76.5% were part-time and 23.5% of full time teachers. A 58.8% of them were in a productivity program.

#### **Instruments and Procedures**

The Spanish version of the ERI short version used in this study was from the official ERI webpage (Siegrist, 2012):

(1) To get the information the following questionnaires were applied;

# PSYCHOMETRIC BEHAVIOR OF THE SHORT VERSION OF EFFORT-REWARD

(2) A questionnaire to get demographic and work environment information.

The ERI short version questionnaire:

(1) To evaluate the extrinsic component of the model, there are 10 items, to get information from the worker's perspective on Effort (3 items, 1-3; range, 3-12 points) and professional Reward (7 items, 4-10; range 7-28 points);

(2) To explore the "intrinsic component", there are 6 items, to know the degree of involvement experienced by the worker in his job, represented by a unique factor called "Overcommitment" (6 items, range 6-24 points).

The imbalance between Effort and Reward (ER) can be calculated with the logarithm of  $ER = k \frac{E}{p}$ , where:

(1) *E* is the score obtained in Effort;

(2) *R* is the score in Reward; and

(3) k is a correction factor to adjust an unequal number of elements between Effort and Reward. If an Effort Item is equivalent to one from Reward, then k is:

$$k = \frac{Number of reward items}{Number of effort items} (k = \frac{7}{3}).$$

The result can be interpreted as follows: if ER = 1 is assumed that the person reports the same level of Effort and Reward; if ER < 1 there is less Efforts than Rewards, and if ER > 1 means that the person reports more Efforts than Rewards (Siegrist, Li, & Montano, 2014).

# **Data Analysis**

212

The SPSS and AMOS software was used for the statistical analysis. Internal consistency analysis was performed for each item with Cronbach's alpha criteria scores ranging between 70-90 as suggested by Oviedo and Camos-Arias (2005).

For the validity of the instrument, a EFA was performed by the method of Main Components using a rotating VARIMAX, requesting three factors as theory commands and three without a minimum number of factors, one general and two other for sex. A Bartlett sphericity test and the index of sampling adequacy Kaiser-Mayer-Olkin (KMO) were carried out, expecting acceptable values p < 0.05 and KMO  $\geq 0.70$  respectively (Pérez & Medrano, 2010).

Subsequently to evaluate the validity of the model a CFA with an assembly of structural equations with a maximum likelihood method, measures of absolute, parsimonious and incremental adjustment were used as suggested by Lévy, Martín, and Román (2006).

# Results

#### **Internal Consistency**

In the analysis of internal consistency by item, the highest measure appeared in item seven "My job security is poor" with 2.84, while item three showed the lowest value with 1.76 "Over the past few years, my job has become more and more demanding" (see Table 1).

All CHI (corrected homogeneity indexes) were greater than 0.40, with the exception of item two within the Effort dimension "I get many interruptions and disturbances while performing my job" (0.35); the highest homogeneity index belonged to "Work rarely lets me go, it is still on my mind when I go to bed" (0.72) and "As soon as I get up in the morning I start thinking about work problems" (0.68).

The results of Cronbach's alpha showed that there is an acceptable reliability in Reward (0.82) and Overcommitment (0.80), but Effort (0.67) scored below the recommended criteria of 0.70 (Oviedo & Campo-Arias, 2005).

For the Effort dimension, almost all the items had reliability indexes above 0.3, and most of them contribute to the internal consistency factor, but the item two "I have many interruptions and disturbances while performing my job" has a low reliability. If item two is removed, the dimension's Cronbach's alpha score increases to an acceptable value of 0.73.

# Table 1

# Analysis of Discrimination ERI Reagents

	Average	SD	Homogeneity corrected	Index from reliability	Alpha without reagent
Effort					
Alpha = 0.675					
ERI1 I have constant time pressure due to a heavy work load.	2.69	0.83	0.578	0.358	0.454
ERI2 I have many interruptions and disturbances while performing my job.	1.76	0.67	0.357	0.128	0.730
ERI3 Over the past few years, my job has become more and more demanding.	2.47	0.86	0.554	0.344	0.489
Reward Alpha = 0.826 Esteem Alfa = 0.745					
ERI4 I receive the respect I deserve from my superior or a respective relevant person.	<sup>1</sup> 2.46	0.86	0.486	0.365	0.815
ERI8 Considering all my efforts and achievements, I receive the respect and prestige I deserve at work.	2.39	0.84	0.652	0.518	0.791
Job security Alpha = $0.754$					
ERI6 I have experienced or I expect to experience an undesirable change in my work situation.	2.58	0.98	0.613	0.485	0.795
ERI7 My job security is poor.	2.84	0.96	0.459	0.373	0.821
Job promotion Alpha = 0.745					
ERI5 My job promotion prospects are poor.	1.87	10.01	0.524	0.302	0.811
ERI9 Considering all my efforts and achievements, my job promotion prospects are adequate.	2.30	0.93	0.606	0.461	0.796
ERI10 Considering all my efforts and achievements, my salary/income is adequate.	2.06	0.94	0.667	0.502	0.786
Overcommitment Alfa = 0.80					
OC1 I get easily overwhelmed by time pressures at work.	. 2.26	0.77	0.511	0.348	0.789
OC2 As soon as I get up in the morning I start thinking about work problems.	2.10	0.84	0.683	0.528	0.749
OC3 When I get home, I can easily relax and "switch off" work.	2.64	0.77	0.463	0.248	0.799
OC4 People close to me say I sacrifice too much for my job.	2.58	0.85	0.448	0.229	0.804
OC5 Work rarely lets me go, it is still on my mind when a go to bed.	<sup>[</sup> 2.28	0.82	0.726	0.567	0.740
OC6 If I postpone something that I was supposed to do today I'll have trouble sleeping at night.	2.33	0.85	0.577	0.390	0.775

#### PSYCHOMETRIC BEHAVIOR OF THE SHORT VERSION OF EFFORT-REWARD

Table 2 presents the correlation among the ERI dimensions, the stronger association was observed between Effort and Overcommitment (0.566). There was a significant correlation between all of dimensions. There was a negative significant association among Reward and Effort and Overcommitment.

# Table 2

Pearson Correlations: ERI Model Dimensions

Variables	1	2	
1. Effort			
2. Reward	-0.422**		
3. Overcommitment	0.566**	-0.261**	

Note. \*\* Correlation is significant at the 0.01 level.

Table 3 shows the results of the factorial analysis with the requirement of three factors, according to the theory, as well as three analysis without a fix number of factors, one global and two per gender suggested in Pérez and Medrano (2010), for a sample bigger than 300.

#### Table 3

Factor Analysis o	f Overall c	ınd Sex
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Dimension Items		Fixed number of factors No fixed number of factors													
		Tixed number of factors			Overall			Women			Men				
		1	2	3	1	2	3	4	1	2	3	4	1	2	3
	ERI1	-0.256	0.739	0.178	-0.207	0.746	0.174	-0.162	-0.217	0.177	0.748	-0.128	0.628	-0.359	0.138
Effort	ERI2	-0.211	0.514	0.114	-0.048	0.569	0.028	-0.309	-0.002	-0.089	0.549	-0.551	0.552	-0.236	0.026
	ERI3	-0.157	0.783	0.128	-0.186	0.768	0.171	-0.010	-0.190	0.087	0.777	0.054	0.743	-0.276	0.019
Estaam	ERI4	0.622	-0.178	0.083	0.732	-0.109	-0.018	0.017	0.613	-0.075	-0.132	0.167	-0.108	0.713	0.318
Esteem	ERI8	0.760	-0.166	-0.034	0.830	-0.096	-0.116	0.133	0.779	-0.156	-0.066	0.138	-0.182	0.813	0.112
Job	ERI6	0.666	-0.110	-0.357	0.306	-0.194	-0.159	0.771	0.418	-0.192	-0.040	0.694	-0.272	0.573	-0.497
security	ERI7	0.534	0.005	-0.466	0.123	-0.097	-0.230	0.818	0.230	-0.290	-0.014	0.782	-0.120	0.375	-0.716
	ERI5	0.660	-0.062	-0.038	0.446	-0.109	0.073	0.518	0.505	0.034	-0.052	0.411	0.007	0.651	-0.287
Job	ERI9	0.730	-0.166	0.008	0.764	-0.115	-0.048	0.170	0.804	-0.053	-0.155	0.051	-0.045	0.725	-0.144
promotion	ERI10	0.796	-0.122	0.040	0.741	-0.104	0.042	0.317	0.839	0.070	-0.100	0.101	-0.036	0.767	-0.246
Overcom mitment	OC1	-0.060	0.757	0.267	-0.075	0.744	0.300	-0.018	-0.074	0.317	0.735	-0.038	0.724	-0.146	0.067
	OC2	0.008	0.608	0.569	0.008	0.581	0.595	-0.058	0.018	0.640	0.527	-0.141	0.833	0.004	0.140
	OC3	0.044	0.033	0.716	0.018	-0.023	0.751	-0.038	0.004	0.759	-0.033	0.015	0.402	0.185	0.455
	OC4	-0.186	0.280	0.503	-0.163	0.250	0.514	-0.149	-0.222	0.484	0.245	-0.003	0.465	-0.113	0.459
	OC5	0.000	0.309	0.779	-0.036	0.248	0.829	-0.041	-0.058	0.815	0.301	-0.116	0.655	0.161	0.332
	OC6	-0.009	0.246	0.703	0.016	0.212	0.711	-0.122	-0.001	0.753	0.067	-0.261	0.684	0.098	0.141

The factorial analysis with the requirement of three factors behaves as expected by the model with the exception of the first item of the Overcommitment dimension in the Effort scale.

The analysis without a fix number of factors shows four factors and the Job security scale does not group with the Reward dimension. The first component includes all items of Effort and one from Overcommitment ( $\alpha = 0.75$ ), the second component includes the Esteem and Job Promotion dimensions ( $\alpha = 0.80$ ), the third component Job security ( $\alpha = 0.75$ ) and the last component was integrated by five items of Overcommitment ( $\alpha = 0.78$ ).

In the case of woman, the factors had a similar pattern than the global analysis. For men, the organization and composition and weight of the components changes, the first component includes all Effort and five items of Overcommitment, the second component includes Esteem, Job promotion and one item from Job security and the third component includes items from Overcommitment and Job security.

Most of the items in the factorial analysis results were properly organized with acceptable scores. KMO = 0.858 and  $X^2 = 2360.445$ ; p < 0.000, that said the factorization of the correlation matrix is feasible.

When performing the CFA with the method of maximum likelihood, the results of the "a priori" model proposed by Siegrist (2009) presents in the dimension of Effort an inadmissible commonality (case "Heywood") (McDonald, 1985). The same analysis was performed by the generalized least squares method and the weighted least squares method that according to Lloret-Segura, Ferreres-Traver, Hernández-Baeza, and Tomás-Marco (2014) reduces the probability to find "Heywood" cases.

At present, the same problem decided accommodate the dimensions according to EFA, for this analysis the questionnaire was purged removing those items with the highest rates of change in the regressions, located in the OC2 and OC4 reagents. When suppressing the analysis reagents by the method of maximum likelihood, the results were favorable (see Table 4). The adjustment index chi-square ( $X^2$ ) it was significant, although this result was expected given the size of the sample. However the GFI and RMSEA were acceptable values, indicating a good degree of accuracy in the model. The incremental adjustment NFI and CFI gain acceptable value above 0.90 in both cases. Finally, the fit indices PGFI and normalized Chi-square  $X^2/gl$ , shows a low parsimony in the model.

Finally, in the second order model (see Figure 4), the lowest weight standardized regression started off item 2 "I have many interruptions and disturbances in the performance of my job",  $\lambda = 0.46$  and the highest point is found between construct ERI and Effort  $\lambda = 0.99$ .

Absolute fit indices			Incren	nental fit indices	Parsi	mony fit indices	Weight from regressions Standardized	
X <sup>2</sup>	GFI	RMSEA	NFI	CFI	PGFI	$X^2/gl$	Weight $(\lambda)$	
173.451(72) <i>p</i> < 0.001	0.941	0.60	0.910	0.944	0.65	2.4090	0.46-0.99	

Table 4Adjustment Indices



Figure 4. Second order structural model.

#### **Conclusions and Discussion**

According to the analysis, the reliability of the instrument was found to have a good internal consistency similar to that reported by other countries (Díaz & Feldman, 2010; Gómez, 2010; Macías et al., 2003; Siegrist, Li, & Montano, 2014). In contrast to other validations of the short version, the values reported in Effort do not fit within the acceptable limits, just like those reported in the Chinese validation (0.67), contrasting with the Swiss and German validations, where alpha values stood 0.80 and 0.74 respectively (Li et al., 2012; Leineweber et al., 2010; Siegrist, Wage, Pühlhofer, & Wahrendorf, 2009, respectively). It is important to point out that item 2 "I have many interruptions and disturbances while performing my job" contributed to inconsistencies by not backing the Alfa in the "Effort" dimension, its elimination resulted in an increase alpha of 0.73, and this would result in an acceptable Alfa, similar to the German validation.

On the other hand, the EFA values of interrelation are greater than 0.40 which shows good consistency in size, although the item "I get easily overwhelmed by time pressures at work" loaded of Effort rather than the Overcommitment factor in all EFA. Similar to that found on petrochemical industry workers in Korea (Eum et al., 2006) and in Chinese health care workers (Li, Yang, & Cheng, 2005). The results confirmed the hypothesis of Li et al. (2005) who point out that there are cultural variations in the perception of stressful experience in the work. Yet, it may also be due to specific conditions of the teaching profession.

The gender differences found, shows the necessity of analysis, considering the work culture and the differences between women and men. In this study the men have a configuration of the first ERI model.

Reward dimension in its original version is made up of three components (Esteem, Job security and Job promotion) (Li et al., 2012; Leineweber et al., 2010; Siegrist et al., 2009; Siegrist et al., 2014). That contrasts with the two dimensions found, one composed of Esteem and Job promotion and the other formed by the dimension of Job Security. This distinction confirms the statement by Zurlo, Pes and Siegrist (2010), who in a sample of 673 Italian teachers found that the ERI model has a different configuration of the Reward dimension, in one hand, the immaterial component "Esteem reward" and in the other hand, a material component, where salary and career reward, originating a whole reward factor "Job security prospects reward" this findings reflect some aspects specific of the application in teaching profession. However, in the Mexican population the reward scale, was built by two factors, the first one consider the reward in the work without differences between material or immaterial components in a single dimension name "Job Promotion and Esteem", and second consider keeping the job itself "Job security". Taking into consideration the unemployment conditions in Mexico, keeping the job is considered a reward; it is also a factor of great relevance in the worker population (Juárez, 2008).

CFA was necessary for the relocation and removal of items subsequent to the case "Heywood" which according to McDonald (1985) can be reduced by having a minimum of 4 items by size, suggesting that the original ERI has lower probability that this phenomenon occurs.

# **Limitations and Further Research**

The ERI short version questionnaire showed acceptable psychometric qualities in the studied population of Mexican teachers, although as a transactional study can't be generalizable, so the application is recommended in another worker's populations.

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#### PSYCHOMETRIC BEHAVIOR OF THE SHORT VERSION OF EFFORT-REWARD

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