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Omani short version of organizational health inventory: Application of item response theory

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Abstract

The current study used item response theory (IRT) to analyze data from (N=323) Omani teachers randomly selected participated in this study to investigate whether a subset of items could be selected to create a short version of the instrument. As a result, the high correlation coefficients between the examinee ability parameter estimated on the easy and difficult test items and did not change between the two versions. This is an indication of the improvement of the unchanging ability estimated invariant. In conclusion, the study concluded a short version of the OHI scale. It contains 30 items distributed on seven Domains.

Keywords: Organizational health inventory, Response theory.

Versión corta omaní del inventario de salud organizacional: Aplicación de la teoría de respuesta a ítems

Resumen

El estudio actual utilizó la teoría de respuesta a ítems (IRT) para analizar los datos de (N = 323). Los maestros omaníes seleccionados al

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azar participaron en este estudio para investigar si se podía seleccionar un subconjunto de ítems para crear una versión corta del instrumento. Como resultado, los altos coeficientes de correlación entre el parámetro de capacidad del examinado estimado en los ítems de prueba fáciles y difíciles y no cambiaron entre las dos versions. Esto es una indicación de la mejora de la capacidad invariable estimada invariante. En conclusión, el estudio concluyó una versión corta de la escala OHI. Contiene 30 elementos distribuidos en siete dominios.

Palabras clave: Inventario de salud organizacional, TEORÍA de la respuesta.

1. INTRODUCTION

The health of organizations is crucial in the establishment of strong relationships among staff, students, and local communities when provided with positive working environments where people feel comfortable, trusted, and empowered. Research studies reveal a strong linkage between school culture and school effectiveness (MACNEIL, PRATER, & BUSCH, 2009). The convergence of theories, knowledge bases and strategies help shape beliefs and expectations of changing school culture. GRUENERT (2008) describes culture as having unwritten rules where members of a group conform to and passed on for years; these developed expectations form the desired culture. Culture can be unique in every school with distinct commonalities in which the organization in each educational institution bonds together. Organizational culture some have defined it as a system held together by shared orientations in which a distinct identity is established.

The health of an organization is known to improve productivity (FAIRMAN & MACLEAN, 2003), and organizations can become agents of change for success. SHABAH (2017) considered teamwork

as one of the best strategies pursued by the institutions to achieve their goals, and work environment is what reflects the level of the organizational health of the institution, where this later must provide a positive, open-minded, organizational environment, and adopt a strategy; that does make realize their goals through the achievement of clear objectives adopted by the enterprise, which can be done via the adoption of the work teams; that provides such an atmosphere, and open the door to self- raising through team's success. ALBELUSHI (2016) study revealed a high degree of practice and direct positive correlation between the degree of principals' transformational leadership and level of organizational health, in basic education schools in Oman, with a total of 504 teachers participated in the study. AL-OMARI (2012) study revealed that the highest mean of dimensions of OHI was for Academic Emphasis dimension at a high level, and the other dimensions (Institutional integrity, Initiating structure, consideration, principal influence, resource support, and morale) were in moderate levels. Female teachers were more perceived in school health than males. Teachers with medium experience in teaching perceived school health more than their colleagues with low and high experience, teachers who work in a school with size less 600 students perceived school health better than teachers in 600 and more. The study was carried out among 406 teachers who worked in secondary schools in Zarqa Governorate-Jordan.

The Item Response Theory (IRT) is an area of psychometrics that focuses on measuring and evaluating potential psychological or educational traits (capabilities) such as levels of intelligence or

competencies. In practice, IRT can be seen as a framework for estimating latent traits through observable variables and statistical Psychometric Models (MAGIC, YAN & VON DAVIER, 2017).

The Graded Response Model (GRM) that introduced by Samejima 1969, to handle the testing situation where item responses are contained in two or more ordered categories on a rating scale (e.g., Likert scale). GRM is considered a generalization of the two-parameter logistic model (2PL), the probability $P^*_{ik}(\theta)$ that a person's response falls at or above a particular ordered category given Ɵ. GRM considers items as a series of K-1 dichotomous items. In which K represent the number of categories in the Likert scale or other ordered category Scale. If a 5-point scale (0, 1, 2, 3, and 4), then the following dichotomous are analyzed for each item: 0 vs. 1, 2, 3, 4; 0, 1 vs. 2, 3, 4; 0, 1, 2 vs. 3, 4; 0, 1, 2, 3 vs 4 (ZANON, HUTZ, YOO & HAMBLETON, 2016). Samejima introduce the operating characteristic of a graded response category as

$$P_{xi}(\theta) = P^*_{xi}(\theta) - P_{(xi+1)}(\theta)$$

$P^*_{x_i}(\theta)$: is the regression of the binary item score on latent ability, it is represents the probability with which an examinee of ability level receives a score of x_i.

In general, IRT models commonly using in recent years to develop Psychometric properties checking of Psychological tests, graded response model especially.

2. METHODOLOGY

The population for the study consisted of schools in Muscat governorate in Oman (7647 teachers: 1808 male, and 5839 female). The schools were all public schools. The sample of this study included teachers who currently worked in the participating schools in the Muscat governorate. 458 Omani teachers randomly selected participated in this study. The Organizational Health Scale (OHS) was used to measure the organizational health of public school in Oman schools, developed by Hoy, Tarter, and Kottkamp. The instrument included seven subtest scores in the following areas: Institutional Integrity (II), Principal Influence (PI), Consideration (C), Initiating Structure (IS), Resource Support (RS), Morale (M), and Academic Emphasis (ALKHAROUSI, 2014).

The researchers followed Brislin's backward translation method for converting the survey from English to Arabic. The original English version was first translated into Arabic by a professional translator. Then the Arabic version was translated back into English by a second native speaker who was unfamiliar with the original version. The two versions were then compared discrepancies identified and discussed, and refinements made to the Arabic version.

To examine the validity of the instruments in this study (face validity evidence) it was presented to six experts in educational administration, research and evaluation and educational measurement. They were asked to check whether the statements in the instrument are

clear and linked appropriately with the problem of study. Based on the experts' comments, some revisions regarding the language were done to the instrument.

Regarding the reliability of the instrument in this study, an internal consistency procedure (to estimate the consistency across the items) was used. A pilot study of 30 participants had been conducted. Those participants did not participate in the final study. The instructions were clear and all of the items of instrument functioning in an appropriate manner. The values of alpha (the internal consistency coefficient) for The Organizational Health Scale dimensions: institutional integrity=0.81, 7 items; initiating structure=0.77, 5 items; Consideration=.86, 5 items; principal influence=.82, 5 items; resource support=.76, 5 items; Morale=0.87, 9 items; and academic emphasis=0.79, 8 items. The previous values can be considered reasonably satisfactory to achieve the objectives of the current study**.**

Slope, Threshold, and Ability parameters were estimated by using MULTILOG software, then used it to estimate the Probability of Correct Response $P_{xi}(\Theta)$ from the graded response model (GRM)**,** it is appropriate for use with scales that have ordered categories such as HOI (not occurred (1), rarely occurred (2), sometimes occurred (3), most occurred (4), and always occurred (5)). One discrimination parameter and five thresholds for each item were estimated. The number of location parameters for any item will thus equal the number of category responses minus one, In the HOI scale each item has four location parameters: 1, vs, 2,3,4,5; 1,2, vs 3,4,5; 1,2,3, vs 4,5; 1,2,3,4, vs, 5.

3. RESULTS

The sample responses submitted to principal component analysis. A prior seven-factor model based on the theoretical structure of the OHI was hypothesized, and the criterion was set to seven factor and Eigen value ≥ 1, and the analysis proceeded to rotate the factor matrix orthogonally with varimax rotation to achieve a simple and theoretically more meaningful solution. 2 items (31, 36) were deleted because they did not loud on any factor, and item 40 was deleted because they loaded highly on multiple factors.

Its main item response theory assumption, which is means examinees performance on an item must not affect, either for better or for worse, his or her responses to any other items in the scale. A Q_3 index used to estimate local independence between OHI items. A Q_3 index descriptive statistic for short version was a sizable decrease (mean= -0.02, SD= 0.1, min=-0.25, max= 0.25) Compared with Original version (44 items) (min= -0.29, max= 0.58, mean= -0.01, SD= 0.11). 9 items (7, 9, 10, 11, 13, 15, 19, 25, and 27) were deleted because $Q_3 > 0.3$.

The item discrimination parameter (a_i) is proportional to the slope of p_i (θ) at the point $\theta = b_i$ (item difficulty), a_i is defined theoretically, on the scale $(-\infty, +\infty)$. The usual range for item discrimination parameter is (0, 2). High value result in item characteristic curve is very steep. In this study 2 items (22, 39) were deleted because its discriminant parameter is low. To examine the

construct validity of the Short version of OHI, a CFA was Conducted by Amos 21 with seven-factor Theoretical structure model, and Compared with Original Version, table 1 Contains Goodness of fit indices

Table 1: CFA goodness of fit indices

index	Original(44)	Short(30)	Criteria
RMSEA	0.08	0.07	Less than
CMN/ DF	3.96	3.66	
AIC	3711.40	1567.73	
CFI	0.79	0.86	Large(Closed to 1)
IFI	0.79	0.86	
NFI	0.73	0.82	
GFI	0.71	0.82	
AGFI	0.68	0.78	

The fit indices showed improvement for the 30 items HOI when compared with the 44 items HOI and; The RMSRE is decreased from 0.08 to 0.07, CFI increased from 0.79 to 0.86, IFI from 0.79 to 0.86. Regarding modification indices also increased for short version; GFI from 0.71 to 0.82, AGFI from 0.68 to 0.78. When Considering the AIC parsimony index, the results showed that the AIC was reduced from 3711.40 to 1567.73, this suggests that the 30-item HOI shows a reasonable and more parsimonious fit to the data than the 44- item HOI.

One important assumption of IRT is unidimensionality. It is assumed that one ability (trait) is necessary to explain examinee test performance. Unidimensional item response theory models assume a single latent trait account examinee performance. This assumption

cannot be met in humanities data, because there are other factors (cognitive, motivation, test anxiety) effects on test performance. In the OHI scale, the unidimensionality has been tested using EFA, the total cumulative variance explained by scale factors 61.45% for the original version and 65.18% for the short version. The first factor explained 40.11% of the total variance for the original version and 41.28 for the short version; this means the HOI is a unidimensional scale (when the percentage of the first factor explains more than 20% of variance) (LEE, 2004). The comparison between the short and long-form of OHI unidimensional index illustrate in Table 2.

Table 2: Eigenvalues and variance for three factors and the ratio

		Factors			
Version		1	2	3	Ratio*
Long (44 item)	Eigenvalue	17.65	2.49	1.85	23.69
	% of variance	40.11	5.66	4.20	
Short (30 item)	Eigenvalue	12.39	1.74	1.38	29.58
	% of variance	41.28	5.79	4.60	

Ratio* = (eigenvalue factor1 - eigenvalue factor2)/ (eigenvalue factor2 - eigenvalue factor3)

It is noticeable from the table 2 that the indicators of the uni dimension assumption were better in the short version than in the original: the first factor accounted for 41.28% of the total variance, while the first factor explained 40.11%. Among the roots of the underlying roots we find that for the abbreviated image was higher.

Internal Consistency Reliability: Internal consistency reliability as measured by Cronbach alpha, Marginal Reliability, and Split-half

for sample scores on short and original HOI scale. The short version's reliability scores seem comparable to those long versions of the HOI scale, and they are acceptable. This suggests that HOI and its factors can be effectively represented by a smaller number of items while keeping the same degree of measurement precision as the 44- item HOI.

Table 3: Internal Consistency of the short and long versions of HOI

Index	Original(44)	Short(30)
Cronbach alpha	0.94	0.93
Marginal Reliability	0.98	0.97
Split-half	0.85	0.85

Parameter invariance is crucial if one wants to carefully assess the degree of inferential generalizability across examinee populations or measurement conditions for a given modeling context, and thus constitutes a fundamental property of measurement for latent variable models. Specifically, for inferences to be equally valid for different populations of examinees or different measurement conditions, parameters in the psychometric models used for data analysis need to be invariant; if parameters are not invariant, the statistical foundation for inferences is not identical across the populations or measurement conditions, and hence the inferences are not generalizable across those to the same degree. In the current study invariant is tested by estimated the correlation between ability on low and high difficulty items (the average of threshold parameters).

Table 4: Correlation Coefficient between abilities parameter on high and low difficulty items in two forms: original, and short

Difficulty Level	Low	High	all
Low	1.00	0.88	0.98
High	0.89	1.00	0.95
All	0.96	0.98	1.00

The results in the 4 table show the high correlation coefficients between the examinee ability parameter estimated on the easy and difficult test items and did not change between the two versions, this is an indication of the improvement of the unchanging ability estimated invariant; the value of the correlation coefficient in the two tests did not vary and was high. As well as between the ability to assess the easy or difficult items with an estimate on the test items as a whole. Table5 contains descriptive statistics for the original version (44) and a short version (30) parameters (θ, a, and b's).

Table 5: Descriptive statistics for Items and person Parameters Estimation

	Original(44)		**Short(30)**	
	mean	**SD**	**mean**	**SD**
Θ	0.50	0.90	0.42	0.89
A	1.79	0.88	1.48	0.83
$\mathbf{b_1}$	-2.63	2.86	-3.01	1.94
$\mathbf{b_2}$	-1.05	0.90	-1.25	0.88
$\mathbf{b_3}$	0.89	2.67	0.40	2.06
$\mathbf{b_4}$	3.05	4.73	2.28	3.48

The results in the 5 table show that the standard deviation of estimates of all parameters in the new short version is lower than the original version, as well as its mean.

4. CONCLUSION

To summaries, the study concluded a short version of OHI scale. It contains 30 items distributed on seven Domains (correspond to the number of Domains of the original scale). Three procedures were conducted in items deleted :

-Exploratory Factorial Analysis: Two items were deleted because they did not loud on any factor, and one was deleted because they loaded highly on multiple factors .

-local independent: 9 items were deleted because they were correlated with another items (Q3> 0.3).

-The Item Discriminant parameter: Two items were deleted due to their low discriminatory capacity.

The psychometric properties of the short version were showed excellent compared to original version:

-Construct validity: Results of CFA showed that the fit indices improvement for the 30 items HOI when compared with the 44

items HOI, and the ratio of eigenvalues confirm the improvement of unidimensionality assumption in short version when compare with the original .

Reliability: reliability estimation indicators (Cronbach alpha, Marginal Reliability, Discrete Half) showed that they were high reliability for the short version, and do not differ from the original version.

-Ability invariant: A feature has been verified in the short version of the scale (high correlation between Respondent's ability on high difficulty items and low).

- The results also indicated the convergence of the parameters descriptive statistics (ability, slandered error of ability estimation, items parameters) between two forms of the scale.

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