Reliability Testing and Validating a Persian Translation of the Low Vision Quality of Life Questionnaire

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Abstract

Objective: Low vision quality of life (LVQOL) questionnaire was translated to Persian. Its model fit and construct validity was assessed by exploratory and confirmatory analysis for adults with visual impairment, before. In this study we aimed to test the reliability of the Persian LVQOL questionnaire based on rasch analysis.

Methods: 100 low vision patients and 100 demographic statue- matched control subjects participated for evaluating reliability aspects. All the participants were asked to complete the Persian LVQOL questionnaire. The low vision group were asked to fill out the LVQOL, three months after rehabilitation to determine how rehabilitation change quality of life. Rasch analyses of the survey items were conducted using WINSTEPS.

Results: All items fit the Rasch model. Point-measure correlations values varied from .13 to .70, providing a preliminary indication of adequate construct validity. All factor loadings were found more than .4. infit values for all other participants were in the acceptable range. All items obtained infit and outfit MSQ values of <2.0. Patients' abilities relative to the items difficulty were analyzed. Item difficulty was estimated and item characteristic curves were included. Sufficient unidimensionality, hierarchical order, and equal interval scaring was obtained.

Conclusions: The Persian LVQOL questionnaire was reliable enough and it will be valuable in both clinical practice and research.

Introduction

Quality of life is defined as a person's satisfaction in life about his aims, expectations and concerns according to the culture in which he lives (WHOQoL Group, 1993). The evaluation and analyses of quality of life will enhance the health services (Yingyong, 2007)

The population of people with visual impairment have grown up since the last decade as the number of aged people and diseases affect the eye are increased (Raasch et al, 1997). A few developed scales are suitable for quality of life and the effect of rehabilitation assessment in patients with very low vision (Testa & Simonson, 1996; Stein, 2004; Terheyden & Finger, 2019). The aim of these questionnaires is to identify the effect of visual impairment on daily life (Abrahamsson et al, 1996).

Low Vision Quality of Life questionnaire (LVQOL) with 25 items (Wolffsohn & Cochrane, 2000) is one of the most used instruments in adult low vision practices that originally developed in English. The LVQOL is widely used by researchers in the field of visual impairment. It was translated and validated in many languages like Chinese, Thai, Turkish, and Spanish (Pérez-Maná et al, 2022). It was recently translated and validated in Persian, too (Heravian Shandiz et al, 2023).

LVQOL was developed in 4 dimensions including 25 items. The questionnaire assesses distance vision, mobility and lighting, adjustment, reading and fine work and activities of daily living. The higher the score obtained from this questionnaire, the higher quality the life is. The aim of this study is to test reliability of the Persian LVQOL questionnaire based on rasch analysis. Rasch modeling is a statistical modeling approach used to analyze test or survey items that are

meant to measure a latent construct. It produces a linear scale from categorical data (Costela et al, 2020).

Methods

This research was reviewed by an independent ethical review board and conforms to the principles and applicable guidelines for the protection of human subjects in biomedical research.

The study was accomplished by 100 patients with visual impairment as the study group and 100 normal vision subjects for the control group in the optometry clinic of Mashhad University of Medical Sciences (MUMS) between December 2020 and May 2021. Guidelines of the declaration of Helsinki was considered in this study. The research ethics committee of MUMS approved the study protocol by the code of 991701 and all patients gave written informed consent to participate in the study. Inclusion criteria were patients with corrected visual acuity of 20/70 or less or visual field less than 20 degrees in the better eye as low vision definition by WHO, age of 18 and older and ability of reading or hearing. Patients who are not Persian native were excluded from the study.

All the participants were asked to complete the Persian LVQOL questionnaire. The low vision group were asked to fill out the LVQOL, three months after rehabilitation to determine how rehabilitation change quality of life. Vision rehabilitation was done based on the patients' visual needs and discomforts. The rehabilitation program extended from telescopes, magnifiers, prisms and colored filters prescription to holding consultation scions and some

advices to help patients use their residual vision in a better way based on their needs. Like the original version, the Persian translation contains 25 items which are graded in an ordinal scale manner between 1 to 5 (1: always, 2: usually, 3: sometimes, 4: rarely and 5: never have problem due to their vision).

Statistical analysis

A study that describes the development of a new instrument or reanalysis of an existing instrument will present some information about the items and also participants to whom it was administered. These include item measures, standard errors and fit statistics, person measures, and indicators of overall scale function such as unidimensionality and precision (Mallinson, 2007). Rasch modeling is a statistical modeling approach used to analyze test or survey items that are meant to measure a latent construct. It produces a linear scale from categorical data (Costela et al, 2020). Our Rasch analysis was performed with Winsteps software (version 3.8.1). The Rasch model has one parameter for the person (ability), and one parameter for each item (difficulty). As a first step, construct validity was examined. Next, fit statistics were inspected in order to insure that persons and items fit the model. We used the outlier-sensitive fit statistic (outfit < 2.0), and the inlier-pattern-sensitive fit statistic (infit < 2.0). A critical question is whether there is a coherent, unidimensional latent variable. Item separation and item reliability assess the item hierarchy, measuring the ability to stratify persons and generate reproducibility of relative item location.

The scores were compared between the study and the control groups by t-test result to show discriminatory aspects. The scores were compared by paired sample t- test, before and after low vision rehabilitation. LVQOL scores were compared between low vision patients with different social statues to find whether these parameters can affect the scores. These statistical analysis were done by SPSS (version 16).

Results

The Persian LVQOL questionnaire was administered in 100 patients with visual impairment with mean age of 45.06 ± 16.38 and 100 normal vision subjects with mean age of 44.55 ± 16.67. The characteristics of the subjects were presented in table 1 [table 1 near here]. 26% of low vision patients had media opacity, 36% had retinopathy, 12% had macular disease and 26% had glaucoma.

Based on measures from the Rasch model, Point-measure correlations values varied from .13 to .70, providing a preliminary indication of adequate construct validity. All factor loadings were found more than .4. The exception was for item no 16 (How well has your eye condition been explained to you) with point measure correlation value of - .8 and factor loading of .25. So, this item was excluded.

According to the fit statistics, Of the 100 participants, just two had outfit and infit values > 2.0 (2.69 and 2.13 infit values), while infit values for all other participants were in the acceptable range. These participants were pruned from the data set and excluded from all subsequent

analyses. By examining item fit statistics all items obtained infit and outfit MSQ values of <2.0. Table 2 shows all the item fit statistics [table 2 near here].

Rasch model showed patient reliability, patient separation, item separation and item reliability were measured for each item, separately. Table 3 shows these assessments [table 3 near here].

The category probability curves, where the probabilities (y axis) are plotted against differences between person and item measures (x axis) (figure 1), provide visualization of response category functioning [figure 1 near here].

As a final step, for viewing the item difficulty estimates of the items, an item person map was generated. Figure 2 presents the person item map for the item bank [figure 2 near here]. Based on visual inspection, very few items were seen at the higher ability levels and a sparse number of items at the lower ability level were observed. Figure 3 shows patients' ability relative to item difficulty [figure 3 near here].

For discriminatory aspects of the questionnaire, t-test results between the study and control group were shown in table 4. P- Value was < .001 for all dimensions [table 4 near here].

Statistical comparison between LVQOL scores, before and after low vision rehabilitation is shown in table 5. All dimensions except the second one, showed significant changes after rehabilitation [table 5 near here].

Discussion

In this study we aimed to assess reliability of the Persian Low Vision Related Quality of Life (LVQOL) questionnaire. A single questionnaire can never include the whole range of quality-of-life features in visual impairment for everyone. However, the LVQOL presents useful clinical information from functional measures of vision, such as visual acuity, contrast sensitivity, and visual field to visual status description of an individual. These information can be used to assess the outcome of low-vision rehabilitation to improve the quality of life of an individual. This instrument evaluates distance vision, mobility, lighting, general adjustment to life, reading and fine work, and activities of daily living of low vision people (Wolffsohn & Cochrane, 2000)

As a first step construct validity was examined. Within the context of tool development, construct validity describes whether items actually measure the underlying construct that they are intended to measure (Bedford & Speklé, 2018). Point-measure correlations are Pearson product-moment correlations based on measures from the Rasch model, which correlate individual item response values and the corresponding person ability estimates. This correlation informs whether the responses to each item align with the ability estimates of the persons. Point measure correlations range from -1 to 1, and in general should be positive (Bond & Fox, 2020). Point measure correlations can be used to identify problematic items that do not appear to map onto the test's latent construct, in this case, visual function and quality of life of low vision patients. Point measure correlations values obtained for the 25 survey items were all positive and varied from .13 to .70, providing a preliminary indication of adequate construct validity. The exception was for item no 16 (How well has your eye

condition been explained to you) with point measure correlation value of - .8. This was occurred because this item possible answers are different from the whole and it was excluded from the analysis. This is like what Pérez-Maná et al (2022) encountered in their study. Point-measure correlations were measured for the 24 items that fit the model to evaluate how closely item scores were correlated with total scores; this is an indicator of unidimensionality. All of the items had point-measure correlations ranging from .33 to .87 indicating that the remaining items showed unidimensionality.

Little discrepancies between results of the original and other translations of the LVQOL questionnaire with Persian translated one may be due to the different culture and life styles. This is what was claimed in other studies (Zou et al, 2005; Idil et al, 2011). For example, most of the persons with visual impairment in Iran, stay at home and their family members care them. Living alone for persons with visual impairment is not formal among Iranians. Reading mails is not common for visually impaired persons and they usually uses their mobile phones for reading massages and using social networks. So we substitute mail by SMS and social networks content in the reading and fine work part.

As Pérez-Maná et.al (2022) concluded, LVQOL is a multidimensional questionnaire, we used Rasch analysis for each dimension separately. The fit statistics of person ability estimates were examined. Outfit is examined first as it is a measure of unexpected outlying observations, and at the person level outfit measures indicate whether a series of responses are inconsistent with the Rasch model. Unexpected patterns of responses or outlying observations are

quantified by the infit measures. Outfit and infit MSQ values > 2.0 are concerning, and indicate when persons should be pruned from the data set (Bond & Fox, 2020). Of the 100 participants, two had outfit values > 2.0 (2.59 and 2.01), while infit values for all other participants were in the acceptable range. Unexpected responses analyses also confirmed that according to the model, these two participants had responses that were unusual and inconsistent based on item difficulty estimates and person ability estimates. These two participants were pruned from the data set and excluded from all subsequent analyses.

Item separation and item reliability assess the item hierarchy, measuring the ability to stratify persons and generate reproducibility of relative item location. Item separation ≥3 and item reliability ≥0.9 were considered acceptable. Person separation and person reliability verify that the instrument was able to classify person ability (e.g. distinguish between high and low ability). Separation ≥2 and reliability ≥0.8 were considered acceptable (Verhavert et al, 2018). Our study showed acceptable ranges of reliability and separation measurement in both items and patients.

With the remaining 24 items, item difficulty estimates were calculated. For an item, the response option “never” is likely to be endorsed by people with higher ability (figure 1). This response option can be considered to be the most difficult category because only the most able participants (i.e., the participants with better visual function) can endorse this category. In a well-functioning rating scale, the thresholds are neither too close nor too far apart.

Generally, accepted values for a threshold step are between 1.4 and 5.0 logits (Bond & Fox, 2020).

The item person map presents a visual display of the range of the latent trait that the instrument measures. The item person map displays the model results along a scale of item difficulty, with both items and persons in the sample. When an item bank is intended for use with a wide range of individuals, the items should be spread across a range of ability levels. When there are no nearby items to a given ability estimate, the item bank has less precision. Figure 2 presents the person item map for the item bank. Based on visual inspection, very few items were seen at the higher ability levels.

Significant difference of the total scores between visually impaired persons as the study group and normal vision persons as the control group indicates a high discrepancy power for the Persian translated LVQOL questionnaire. This is in agreement with Wolffsohn & Cochrane (2000) claim that the LVQOL must differentiate those with low vision from those with normal vision.

We also tested the ability of our version of the LVQOL questionnaire to detect meaningful change over time (responsiveness) in low vision group before and following low vision rehabilitation. Quality of life measurements showed significant improvement for the first, third and fourth dimension after low vision rehabilitation ($P < .001$). Improvement in the second dimension was occurred but not significant ($P = .41$). We think that this difference can be explained due to each item property. The first, third and fourth dimensions assess

functional abilities that can be improved by low vision aids such as magnifiers, telescopes, colored filters and so on. The second dimension investigates emotions and feelings that can be less affected by low vision rehabilitation.

Conclusion

In conclusion, Persian version of LVQOL questionnaire has excellent psychometric properties and it will be valuable in both clinical practice and research. It will help Iranian optometrists and ophthalmologists to assess their low vision patients' quality of life and their improvements during rehabilitation programs.

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Tables

Table 1. socio-demographic characteristics of the subjects

characteristic	Study group	Control group

Gender		
Male	66	69
Female	34	31
Age		
18-39	43	40
40-59	33	35
≥60	24	25
Level of education		
Primary school	2	4
High school	29	30
Graduated	54	50
Post graduated	15	16
Job		
Housewife	20	24
Working	35	37
Unemployed	7	8
Retried	25	21
student	13	10

Table 2. Rasch fit statistics for each item

Survey item	Factor loading	Infit MnSq	Infit ZSTD	Outfit MnSq	Outfit ZSTD	Point-measure correlations
Dimension 1						

How much of a problem do you have: With your vision in general	*.5880*	0.95	-0.24	0.88	-0.66	0.64
With your eyes getting tired	.4569	0.79	-1.34	1.10	0.6	0.47
With your vision at night inside the house	.6647	0.69	-2.20	0.68	-2.21	0.67
Getting the right amount of light to be able to see	.7099	0.88	-0.75	0.96	-0.23	0.65
With glare (e.g. dazzled by car lights or the sun)	.4820	1.15	0.84	1.00	0.09	0.33
Seeing street signs	.5519	0.92	-0.38	0.76	-1.21	0.57
Seeing the television (appreciating the pictures)	.5617	1.01	0.11	1.03	0.28	0.47
Seeing moving objects (e.g. cars on the road)	.5729	0.95	-0.26	0.96	-0.20	0.64
With judging the depth or distance of times	.4073	0.92	-0.38	0.98	-0.04	0.54
Seeing steps or curbs	.4873	1.16	1.04	1.09	0.64	0.62
Getting around outdoors	.6623	0.90	-0.62	0.88	-0.72	0.75
Cross a road with traffic because of your vision	.4095	1.36	2.20	1.27	1.65	0.53
Dimension 2						
Because of your vision, are you: Unhappy at your situation in life	*.5807*	1.10	0.67	1.06	0.42	0.74
Frustrated at not being able to do certain tasks	.7553	0.58	-3.11	0.58	-2.96	0.84
Restricted in visiting friends or family	.4827	1.31	1.80	1.28	1.58	0.75

Dimension 3						
With your reading glasses, if used, how much of a problem do you have Reading large print (e.g. newspaper headlines)	.6607	0.92	-0.38	1.03	0.25	0.87
Reading newspaper text and books	.8663	0.45	-3.54	0.39	-2.91	0.85
Reading labels (e.g. on medicine bottles	.7905	0.94	-0.19	0.56	-0.95	0.68
Reading your letters and mail	.5487	1.39	1.52	1.62	1.17	0.55
Having problems using tools (e.g. threading a needle or cutting)	.4231	1.48	1.45	1.69	1.46	0.37
Dimension 4						
With your reading glasses, how much of a problem do you have: Finding out the time for yourself	.5874	0.97	-0.12	0.98	-0.07	0.72
Writing (e.g. cheques or cards)	.5357	1.06	0.45	1.21	1.30	0.70
Reading your own hand writing	.7064	0.66	-2.36	0.68	-2.18	0.82
With your everyday activities	.6069	1.23	1.35	1.15	0.90	0.72

Table 3. Item and patients separation and reliability

Dimension	**Item output**	**Patient output**

	Separation	Reliability	Separation	Reliability
Dimension 1	7.46	0.98	2.12	0.82
Dimension 2	6.65	0.96	2.41	0.86
Dimension 4	6.76	0.98	2.50	0.89
Dimension 5	8.81	0.99	2.63	0.83

Table 4. discriminatory aspects of the questionnaire

Different dimensions	Scores of the study group	Scores of the control group	Paired t-sample test (*P*-value)
Distance vision, mobility and lighting	32.60 ± 7.135	52.56 ± 6.985	<.001
Adjustment	11.67 ± 2.237	13.40 ± 1.531	<.001
Reading and fine work	7.59 ± 2.782	23.28 ± 1.854	<.001
Activities of daily living	10.06 ± 3.146	17.80 ± 2.586	<.001

Table 5. difference of LVQOL scores before and after rehabilitation

Dimension	Scores before rehabilitation	Scores after rehabilitation	***P*- value**
Distance vision, mobility and lighting	32.60 ± 7.13	37.40 ± 5.50	**<.001**
Adjustment	11.62 ± 2.24	11.89 ± 2.91	**.413**
Reading and fine work	7.59 ± 2.78	14.80 ± 3.00	**<.001**
Activities of daily living	10.06 ± 3.15	12.94 ± 3.5	**<.001**

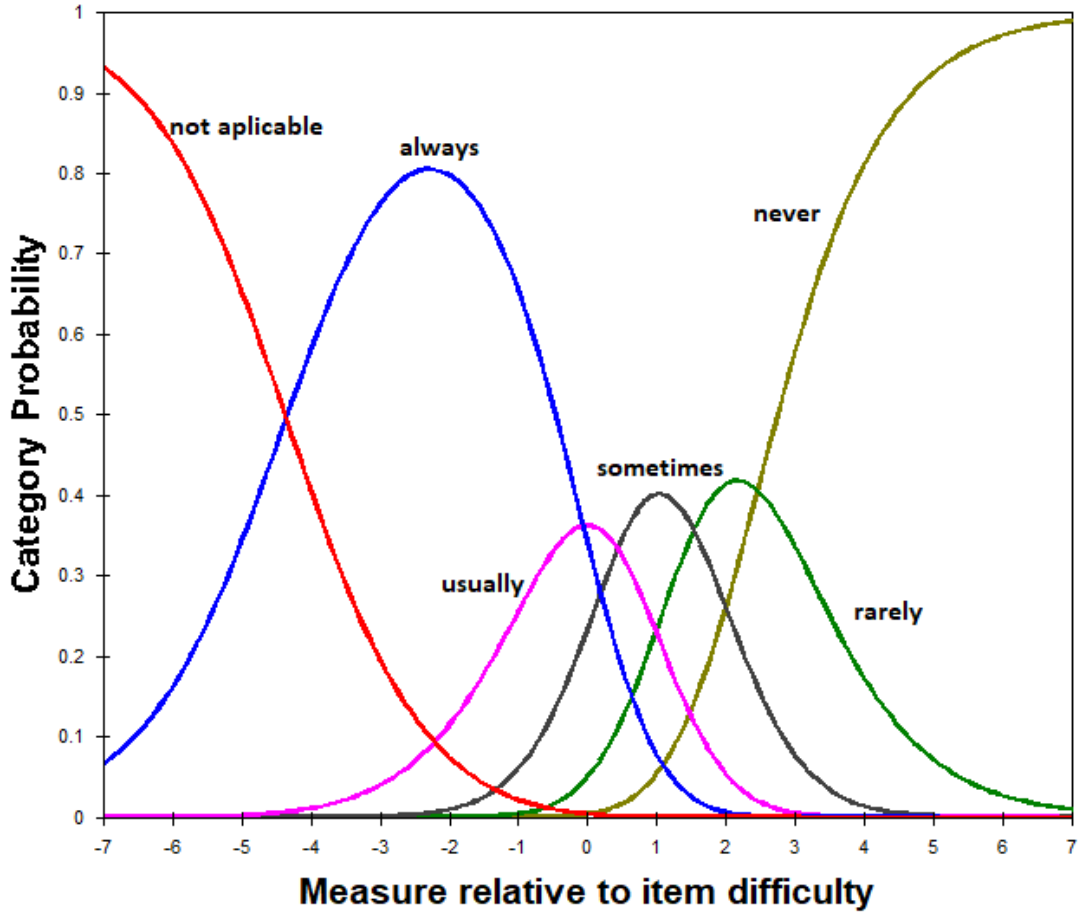

Figure 1. Category probability curves for the LVQOL Questionnaire.

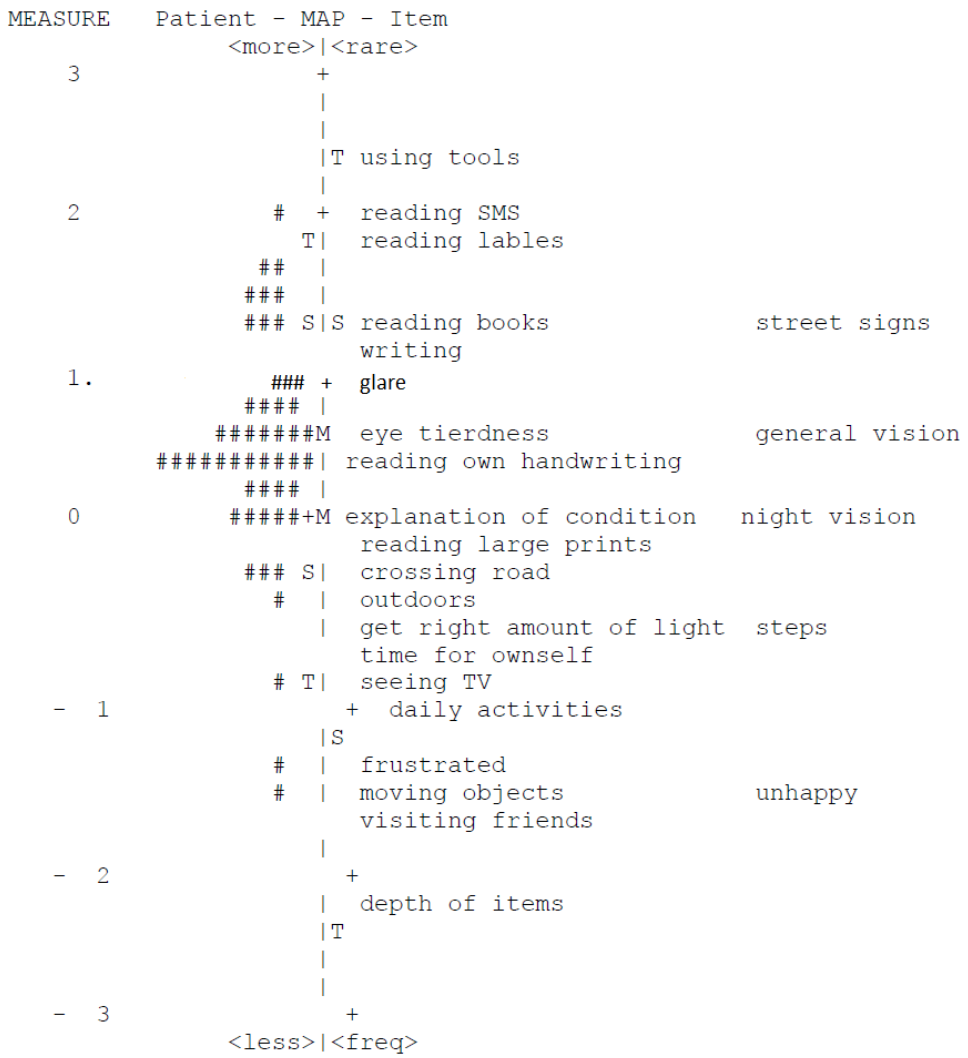

Figure 2. Person item-map for 25 survey items. Note: The items are listed on the right in a hierarchical order, from most difficult (at the top of the map) to those that were least difficult (at the bottom of the map). Patient ability estimates are presented on the left, from the highest ability level at the top to the lowest ability level at the bottom. M = the mean, S = one standard deviation, T = two standard deviations, # = 2 patients.

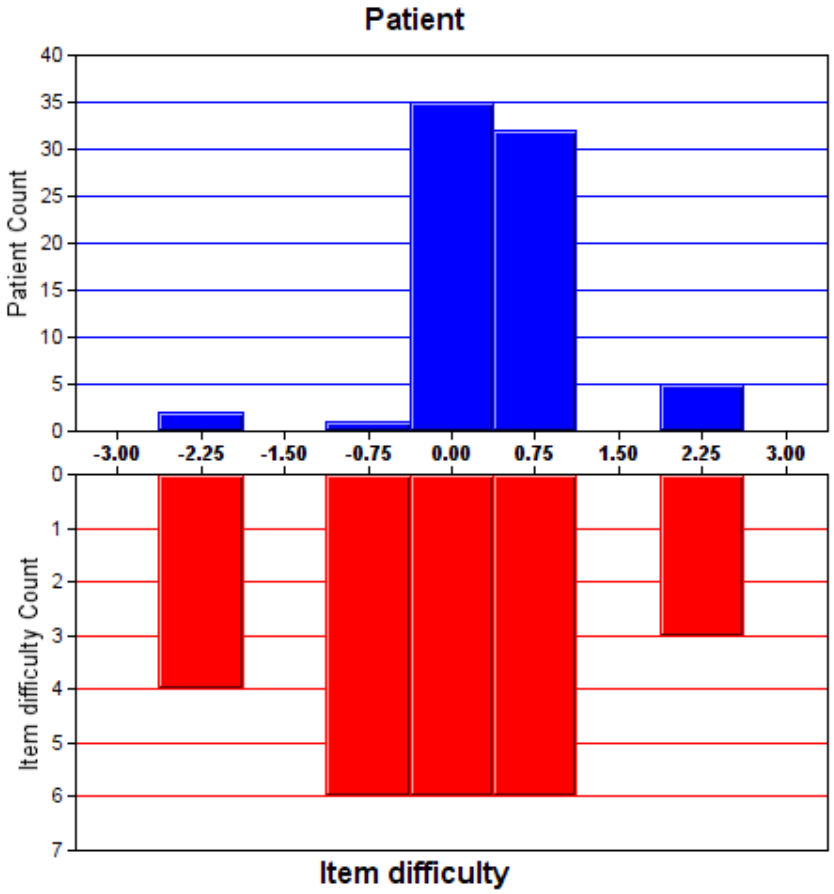

Figure 3. Person-item (Wright) map of the instrument. In the upper map, the participants are shown on the left of the vertical axis, with less able participants located at the bottom. In the lower map, number of difficult Items on the left of the vertical axis, and the horizontal axis shows item difficulty.