The Development of the LV Prasad-Functional Vision Questionnaire: A Measure of Functional Vision Performance of Visually Impaired Children

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PURPOSE. To develop a reliable and valid questionnaire (the LV Prasad-Functional Vision Questionnaire, LVP-FVQ) to assess self-reported functional vision problems of visually impaired school children.

METHODS. The LVP-FVQ consisting of 19 items was administered verbally to 78 visually impaired Indian school children aged 8 to 18 years. Responses for each item were rated on a 5-point scale. A Rasch analysis of the ordinal difficulty ratings was used to estimate interval measures of perceived visual ability for functional vision performance.

RESULTS. Content validity of the LVP-FVQ was shown by the good separation index (3.75) and high reliability scores (0.93) for the item parameters. Construct validity was shown with good model fit statistics. Criterion validity of the LVP-FVQ was shown by good discrimination among subjects who answered "seeing much worse" versus "as well as"; "seeing much worse" versus "as well as/a little worse" and "seeing much worse" versus "a little worse," compared with their normal-sighted friends. The task that required the least visual ability was "walking alone in the corridor at school"; the task that required the most was "reading a textbook at arm's length." The estimated person measures of visual ability were linear with logarithm of the minimum angle of resolution (logMAR) acuity and the binocular high contrast distance visual acuity accounted for 32.6% of the variability in the person measure.

CONCLUSIONS. The LVP-FVQ is a reliable, valid, and simple questionnaire that can be used to measure functional vision in visually impaired children in developing countries such as India. (*Invest Ophthalmol Vis Sci.* 2003;44:4131–4139) DOI: 10.1167/iovs.02-1238

Vision loss early in life has profound functional and psychological implications.[1] Visually impaired children have reduced educational experiences and, later, employment opportunities. Early referral and intervention for a vision problem is critical to maintaining and maximizing the use of functional vision. Functional vision is defined as vision that can be used to perform a task(s) requiring vision—that is, how a person uses vision.[2] There are a number of tools for assessing functional vision[2–11] but most are inappropriate for use with children, especially those from developing countries, because many of the items in these tools pertain to maintaining a home and finances and reading the newspaper, for example. Questionnaires are useful for collecting data on functional vision because they can be applied to general population groups, they do not require attendance at a clinic, and they are quick and inexpensive to administer. Development of a questionnaire for the assessment of functional vision in children would be valuable because unlike adults, children with visual impairment often cannot or do not express their problems. This may be for a variety of reasons, such as lack of awareness (an assumption that all people have vision similar to theirs), fear of being taken to an eyecare practitioner, fear of use of glasses (considered as a cosmetic blemish), fear of being teased by their friends or relatives, fear of losing friends (because of the need to sit closer to the front of the class and away from their normally sighted friends), or fear of exclusion from sports-related activities.

Measurements in young children pose a special challenge. Clinicians often have to rely on parents' completing questionnaires on behalf of their children (proxy responses), although questionnaires have been used with children providing the responses.[12] A functional vision questionnaire consists of a list of questions related to the use of vision. The activities of children vary with age, and so it is difficult to develop a single instrument that can serve as a measure of children's functional problems. Several internationally applicable instruments for adults have been developed[13–18] and shown to be reliable and valid across countries.[19] However, such an effort has been lacking for the pediatric age group.

In traditional ophthalmology practice, especially in developing countries, where eyecare practitioners are overloaded with patients, there is often very little time to explore the wide array of problems faced by patients. Visually impaired children are no exception to this. In addition, children have limited attention and some may not cooperate during an ocular examination or may get easily bored or fatigued. Distance visual acuity is often taken as the sole measure of a child's overall visual performance. Various studies have shown visual acuity to be inadequate for assessing problems with daily activities in adults.[20–22] The same is probably true for children. All other measures of visual performance need an amount of patient cooperation that may not be possible with children, and the eyecare practitioner has to base his or her judgment on visual acuity or the ocular diagnosis to get a feel for the child's visual problems. Activities of school children range from self-care to being able to copy from the blackboard in class. Different activities involve different aspects of vision. Interventions targeted toward the specific needs of visually impaired children would enhance the quality of care offered to them. Use of a questionnaire to get self-reports on important daily activities that require vision may be one method of assessing functional problems of visually impaired children. In addition, it may be of

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Supported in part by the Hyderabad Eye Research Foundation of the LV Prasad Eye Institute.

Submitted for publication December 4, 2002; revised April 18, 2003; accepted April 29, 2003.

Disclosure: **V.K. Gothwal**, None; **J.E. Lovie-Kitchin**, None; **R. Nutheti**, None

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value to assess children's perceptions of their own difficulties compared with their normal-sighted peer group.

We developed a questionnaire to assess the self-reported functional abilities of visually impaired children: the LV Prasad-Functional Vision Questionnaire (LVP-FVQ). Because perceived ability is a latent trait, a latent variable analysis is indicated to measure the variable underlying the trait. We used the Rasch analysis for this purpose in the present study. Earlier, Turano et al.[23] reported the use of the Rasch analysis to develop a questionnaire to assess the different levels of perceived ability for independent mobility in 35 situations in patients with retinitis pigmentosa. Similarly, Haymes et al.[11] reported the use of the Rasch analysis for the development of the Melbourne low-vision activities of daily living (ADL) index, and recently Turano et al.[24] used the Rasch analysis to estimate the interval measures of perceived visual ability for independent mobility in patients with glaucoma. In the present study, we describe the development and analysis of the psychometric properties of the LVP-FVQ, which was intended for use as a screening tool in developing countries.

Methods

LV Prasad-Functional Vision Questionnaire (LVP-FVQ)

An extensive literature review was performed to construct a list of vision-related tasks performed by children with minimal to severe visual impairment. In addition, we conducted focus group discussions[25] (groups included pediatric ophthalmologists, visually impaired children, parents of visually impaired children, and low-vision therapists) and semistructured interviews that together yielded 26 descriptions of problems with various day-to-day activities. From this pool of potential items, the selection criteria were further refined to cover impairments ranging from mild to severe, with consideration given to the impairment's effect on daily living. Through a process of refinement, the final LVP-FVQ was reduced to 19 items (questions) designed to cover four domains: distance vision (six questions), near vision (six questions), color vision (two questions), and visual field (five questions). These 19 items related to difficulties in performing a variety of tasks. An additional item (question 20) was related to the global self-assessment of a subject's vision in comparison to his or her normal-sighted friends. Henceforth, this is referred to as the last question. Its inclusion was considered important because of the lack of any existing questionnaires for assessment of functional vision problems in children with low vision; this item could act as a surrogate measure of a subject's vision. Similar questions relating to global measures of vision have been included in questionnaires for adults with visual impairment.[13,19,26] The 20 items included in the final LVP-FVQ are shown in the Appendix.

A 5-point scale (0–4) was used for the 19 items. A "Yes" or "No" response was first requested for each question. If the answer was "No," the response was recorded as "No difficulty," and the score for that particular question was zero. If the answer was in the affirmative, then the subjects were instructed to rate on a scale of 1 to 4 the level of difficulty they experienced in performing each task. They were told that 1 meant "a little difficulty" and 4 meant "unable to do the activity due to visual reasons." All items were scored in the same direction and in the same units. An additional response of "not applicable" was used, because some items such as threading a needle and lacing shoes tended to be gender specific. The "not applicable" data were treated as missing data for the Rasch analysis.

For the purposes of the Rasch analysis, however, we reversed the rating scale (0 was taken to be 4, 1 as 3, 4 as 0, and there was no change for 2) so that the measure and logit would have the same sign. We did not use the raw scores for statistical analyses, because they are not measures.[27]

Each subject had the nature of the study explained to him or her and was provided with standard instructions. The questionnaire was administered face to face by the first author to all subjects, away from their parents. The time taken to administer the questionnaire was 10 to 15 minutes. After administration of the questionnaire, the parents were invited to join the subject for the vision assessment.

Subjects

Seventy-eight visually impaired subjects were recruited for the study. All subjects were referred from the outpatient services of the L. V. Prasad Eye Institute (LVPEI) to the Center for Sight Enhancement for low vision management. The criteria for inclusion were: school-going child in any grade from 3 to 10, ability to perform standard clinical vision tests, visual impairment from any cause, and an ability to respond to the questions on the questionnaire. All the subjects could perform standard clinical vision tests. However, during the initial phase of the study, we had to raise the lower age limit to 8 years because we observed that subjects ($n = 8$) between the ages of 5 and 7 years had difficulty comprehending the questions; those children were not included in the study. Subjects with other impairments (such as hearing loss or intellectual impairment) were excluded from the study. Informed consent to participate was obtained from both the children and their parents, and the research was approved by the Queensland University of Technology Human Research Ethics Committee and the Ethics Committee for Human Research at LVPEI. The study was conducted in accordance with the tenets of the Declaration of Helsinki.

The mean (±SD) age of the subjects was 12.8 ± 2.5 years (range, 8–18). The 78 subjects comprised 43 males (mean age, 13.4 ± 2.3 years) and 35 females (mean age, 12.0 ± 2.5 years). At presentation, using the World Health Organization (WHO) classification of vision loss,[28] 7 (9%) subjects were blind (<20/400 in the better eye), 22 (28.2%) were severely visually impaired (<20/200 to 20/400 in the better eye), 44 (56.4%) were moderately visually impaired (<20/60 to 20/200 in the better eye), and 5 (6.4%) were near normal or had no visual acuity impairment (≥20/60 in the better eye). Fourteen (17.9%) subjects were sighted in one eye, but no subject was totally blind (no light perception in both eyes). Binocular high-contrast distance visual acuity for the subjects ranged from 0.12 logarithm of the minimum angle of resolution (logMAR; $20/25^{-1}$) to light perception. The mean ± SD binocular high-contrast distance visual acuity was 0.92 ± 0.32 logMAR ($20/160^{-1}$). There was twice the number of children (56.4%) with moderate visual impairment compared with those with severe visual impairment (28.2%). Only 9% were blind (visual acuity <20/400 in the better eye). These results compare favorably with earlier reports on pediatric low vision in India and Australia in other clinic-based studies.[29,30] Thus, the demographics of the population in the present study are similar to that seen in most low-vision clinics.

The major causes of vision loss in the present study were retinal disorders (55%) that mostly included heredomacular degeneration and retinitis pigmentosa; whole globe disorders (15%) such as microphthalmos, uveal coloboma, congenital glaucoma, and oculocutaneous albinism; and lens disorders (12%), including amblyopia secondary to aphakia. These causes are similar to results of a recently published hospital-based study of a pediatric low-vision population by Gothwal and Herse.[29]

A convenience sample of 25 subjects was asked to return to complete a repeat questionnaire after a minimum period of 1 day (mean, 21.5 ± 16.6 days; range, 1–46). The mean age of these 25 subjects was 12.8 ± 2.7 years (range, 9–18), and the mean binocular high-contrast distance visual acuity was 0.84 ± 0.30 logMAR ($20/120^{-2}$), comparable with that of the whole sample.

Demographics and Vision Measures

The following demographics were recorded: age, gender, and cause of visual impairment as ascertained from the clinical records. Habitual (presenting) distance visual acuity was measured under monocular and

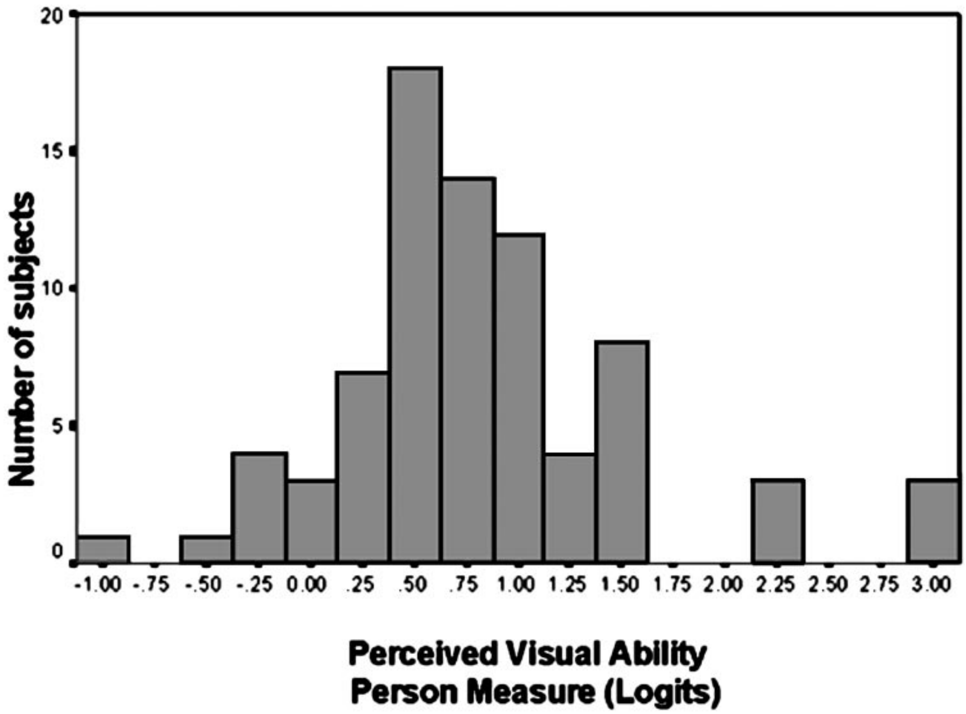

Figure 1. Distribution of person measures of perceived visual ability for functional vision performance (α), estimated from the application of Wright and Masters[33] model to subjects' ratings of the difficulty of 19 items. Person measures are expressed as logits, where a person logit = $\alpha_n - \bar{\rho}$.

binocular viewing conditions using a Bailey-Lovie letter chart and was scored as logMARs, using the per-letter method.[31] Arbitrary logMARs of 2.50 were assigned for light perception and 3.0 for no light perception. Binocular near-vision acuity was measured using the Bailey-Lovie logMAR near word chart[32] at 30 cm. A test distance of 30 cm was used because it was thought to represent a typical reading distance used by children with normal vision. Near acuity was recorded as the smallest print size at which at least three of the six words were read correctly and was scored in logMAR to the nearest whole line. As a part of the clinical assessments, other visual function tests were conducted, including color vision, stereopsis, and visual fields, but these were not used in any analyses.

Results

Rasch Analysis

The total raw score for the items on the LVP-FVQ ranged from 51 to 298. The mean (± SD) total raw score on the items was 210.5 ± 74.9 of 298 and the average rating was 3.7 ± 0.29. Interval measures of perceived visual ability for functional vision performance were estimated from the ordinal ratings of difficulty by performing a Rasch analysis (Wright and Masters[33]) on the matrix of ratings by the 78 subjects for the 19 items. We used an unconditional maximum-likelihood estimation routine (student version of Winsteps, ver. 3.33; Mesa Press, Chicago, IL) to perform the Rasch analyses. Winsteps provides estimates of the three model parameters and tables of estimation errors, reliability coefficients, and fit statistics.

If a person's perceived visual ability for functional vision performance is less than the required ability for that particular task, the probability of the person's rating the task in the "severe difficulty" category (rating 4) is high. In contrast, if a person's perception far exceeds the visual ability required for functional vision performance for a particular task, the probability of the person's rating the task in the "no difficulty" category (rating 0) is high. Hence, it is expected that the probability of using any particular rating category will increase monotonically with the difference between the person's perceived visual ability for functional vision performance and the visual ability required for the particular task.

Subjects rate the difficulty in performing the day-to-day activities, and in doing so they are actually judging their functional reserve. The Rasch model assumes that the probability that person n will assign response x to item i depends only on functional reserve. Functional reserve is the difference between the person's perceived visual ability α_n and the ability required by the item ρ_i—that is, $\alpha_n - \rho_i$.[34,35] The Rasch model is a model of the probability of using a particular rating category as a function of functional reserve. Rasch analysis allows us to estimate each patient's visual ability α_n, the required ability of each item ρ_i, and the step measure (i.e., functional reserve threshold) for each response category, and it enables us to test the validity (accuracy) and reliability (precision) of the measurement of the construct (see Massof[35] for a detailed description of the application of the Rasch model in measuring vision disabilities).

The person logit refers to the difference between each person's perceived visual ability α_n and the mean item measure ($\bar{\rho}$). If the person logit is positive, the person's perceived visual ability is higher than the average required visual ability for 19 items. If the person logit is negative, the person's perceived visual ability is less than the required visual ability. Figure 1 is a histogram of the person-ability logits. In our sample, estimates of the perceived visual ability (logits) for functional vision performance were not significantly different from a normal distribution ($P = 0.059$, Kolmogorov-Smirnov Z test). The mean ± SD of the distribution was 0.72 ± 0.60 logits, indicating that the perceived visual ability of our subjects was higher than the mean required visual ability of the 19 items.

Table 1 summarizes the analysis of the five response categories for the difficulty ratings. For each difficulty rating, the "Count" column shows how many times the rating was used across all items and subjects. Rating categories 1, 2, and 3 were used rarely, compared with 0 and 4. The step measure is the person measure minus the item measure at which the probability of responding with category x equals the probability of responding with category $x - 1$. There is no step measure for

Table 1. Summary of the Analysis of the Response Categories for Difficulty of the 19 Items

Difficulty Rating	Count	Step Measure	Infit	Outfit	Expected Score Measure*
0	309	None	0.92	1.13	(−0.85)
1	29	2.10	1.64	2.94	−0.34
2	29	0.06	0.84	0.97	−0.01
3	88	−0.70	1.28	0.58	0.32
4	912	−1.46	0.97	1.68	(0.87)

* Data in parantheses are unbound on one side and are estimates of the category boundaries.

category 0 because there is no lower category (Table 1). The expected measure at each category is the average functional reserve for the extreme categories, and the functional reserve for the peak of the probability function. In our sample, the expected measure showed a consistent increase with the order of the ratings.

Reliability is the ratio of the adjusted SD to the observed SD of the person or item measure distribution. The adjusted SD is the square root of the difference between the observed variance and the square of the SE (SE^2). Hence the reliability coefficient is the fraction of variability in the observed measurement distribution that can be attributed to the true variance of the person or item measure. The closer the reliability value is to 1.0, the less the variability in the measurement distribution can be attributed to measurement error. The reliability estimates produced by the Rasch analysis were 0.65 for the person-ability parameters and 0.93 for item-difficulty parameters (Table 2).

Content validity is tested with the separation index (Table 2), which is a measure of how broadly the parameters are distributed across the visual ability dimension and is simply the ratio of the estimated true SD to the SE of the estimate. We had separation indices of 1.38 for the person measures and 3.75 for the item measures. Using these indices with the formula of Wright and Masters,[33] we determined that our sample had two statistically distinct levels of person measures and six statistically distinct levels of item measures.

Figure 2 presents a scatterplot of visual acuity (logMAR) against the person measure. It demonstrates that there is a strong linear relationship between visual acuity and person measure ($r = -0.57$). Thus binocular high-contrast distance visual acuity could explain 32.6% of the variance in the visual ability person measure. However, there is very little variability in visual acuity among the subjects and the variance that exists in our subjects appears to be mainly measurement related and random. Hence, the test–retest reliability on the person measures would be expected to be low. A close look at the scatterplot also reveals that LVP-FVQ is able to properly discriminate people of different (such as the extreme cases) abilities despite a poor separation index (Fig. 2).

To evaluate the construct validity (this refers to the interaction of the subject with the instrument (i.e., the subject must have a measurable trait, and the instrument must be able to measure that trait), we calculated the infit and outfit statistics (Table 3). The fit statistics are indices of measurement accuracy. The outfit statistic is sensitive to unexpected behavior by subjects on items far from the subject's ability level. The mean-square (MNSQ) outfit statistic is expected to be 1.0. Values substantially less than 1.0 indicate dependency in the data; values substantially more than 1.0 indicate the presence of unexpected outliers. The infit is an information-weighted fit statistic that is more sensitive to unexpected behavior that affects ratings of items near the subject's level. As with the outfit statistic, the MNSQ infit statistic is expected to be 1.0. Values substantially below 1.0 indicate dependency in the data, and values substantially above 1.0 indicate noise. For both the outfit and infit statistics, the Z_{STD} is the MNSQ normalized to approximate a theoretical mean 0.0 and 1.0 SD. A Z_{STD} greater than ±2.0 indicates that the MNSQ exceeds the model's expectation by more than 2 SD. From Table 3, it is evident that the infit statistic for each item measure fell within ±2 SD of the expected value, suggesting that there were no misfitting items. The corresponding outfit statistics for all but two of the items (numbers 7 and 14) exceeded the model's expectations by more than 2 SD, suggesting that the misfit of these two items can be attributed more to noise than to extreme anomalous responses by a subset of subjects. Such noise may be attributable to the subjects in their interpretation of these questions with respect to the dependence on vision to perform these activities successfully.

Figure 3 plots the person measures against the *z*-transformation infit values for the 78 subjects. Data points for the persons with the most visual ability for functional vision performance are located at the top of the graph and those for persons with the least visual ability are located at the bottom. Data points for persons that are in shaded regions of the box show response patterns that are inconsistent with the expectations of the model. Data points that fall inside the right-hand (shaded) box indicate that the persons have response patterns that are more than the expected value by 2 SD or more, and data points that fall in the left-hand (shaded) box represent response patterns that are less than the expected value by 2 SD or more. In our sample, three (3.8%) subjects did not fit the model. A retrospective review of the history of one subject revealed that the subject was sighted in one eye with advanced congenital glaucoma, had a high-contrast acuity of 20/480 with low contrast acuity of 20/800, and had a small central island of vision. This subject reported difficulty with most of the tasks including those of daily living (self-care). However, this was in contrast to other subjects who had severe visual impairment but did not report difficulty with simple tasks of daily living, such as applying paste to the toothbrush. The subject was probably never trained by his or her parents to use substitution skills. Two subjects had nothing in their histories to suggest

Table 2. Summary of the Global Fit Statistics for Person Ability and Item Difficulty Parameters

Parameter	Separation Index	Reliability	Average Infit	Average Outfit	Model Measurement Error	SD
Person ability	1.38	0.65	0.97	1.24	0.24	0.60
Item difficulty	3.75	0.93	1.01	1.23	0.15	0.78

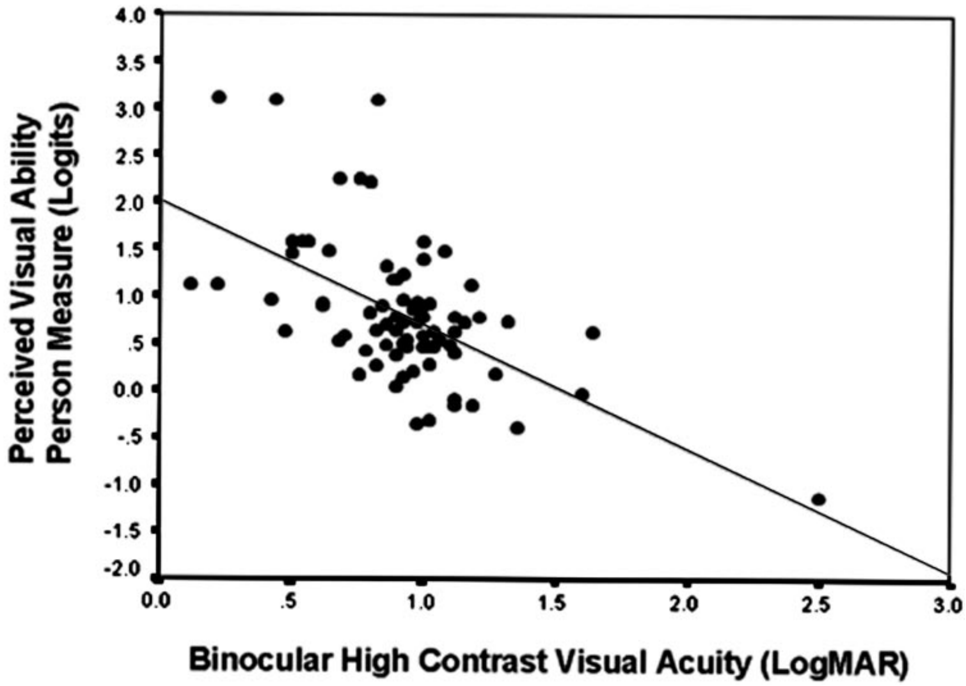

FIGURE 2. Scatterplot of person measure estimates based on subject responses to 19 items that required difficulty ratings versus presenting binocular visual acuity. Visual acuity is expressed as the logMAR. A logMAR of 0 corresponds to Snellen acuity of 20/20, and a logMAR of 1 corresponds to 20/200. The regression line (*solid line*) has a slope of −1.31 and an intercept of 2.01. The Pearson correlation coefficient is −0.57.

anomalous response to the items. Elimination of these three misfitting subjects does not influence the estimation of item or person measures.

Table 3 shows the 19 items, listed in order from the most to the least visual ability required to perform that task according to our subjects' difficulty ratings. The values in the table are item logits that indicate the difference between the mean item measure for 19 items ($\bar{\rho}$) and, the item measure for each item (ρ_i). The item measure ρ_i corresponds to the visual ability required for that task and has the same sign as that of the item logit (because we reversed the rating scale). If the item logit is positive, the required visual ability for that item is higher than the mean required visual ability of all the items, and if the item logit is negative, the required visual ability for that item is less than the mean required visual ability. Thus, the most difficult item was reading a textbook at arm's length, and the easiest item was walking alone in a corridor at school.

Relationship between the Person Measure and Global Rating of Vision

For an instrument to possess criterion validity, the instrument must be able to discriminate or predict against some gold standard. If our questionnaire is to be a measure of perceived visual difficulty, then the person measure should be able to differentiate subjects on the basis of their global rating of vision. One analytical tool for testing criterion validity is the receiver operating characteristic (ROC).[36] We performed an

TABLE 3. Results of Rasch Analysis of Item Difficulty

					Infit		Outfit	
Item	***n****	**Description**	**Item Logit**	**Error**	**MNSQ**	**Z_{STD}**	**MNSQ**	**Z_{STD}**
8	75	Reading a textbook at arm's length	1.47	0.11	1.04	0.2	0.64	−0.7
12	69	Threading a needle	1.11	0.09	1.19	1.00	1.99	1.9
7	71	Reading destination of the bus	0.87	0.08	0.92	−0.6	2.4	2.8
5	74	Copying from the blackboard	0.76	0.08	0.78	−1.8	1.26	0.7
2	75	Seeing a waving hand across the road	0.66	0.08	1.12	0.9	1.59	1.5
16	56	Locating a ball	0.58	0.09	1.01	0.1	0.8	−0.6
6	74	Reading bus numbers	0.54	0.08	1.01	0.1	1.26	0.7
10	75	Locating the next line while reading	0.21	0.09	0.86	−0.8	1.51	1.0
11	75	Locating dropped objects	0.11	0.10	0.99	−0.1	1.21	0.4
13	75	Differentiating between coins	0.17	0.12	0.86	−0.6	0.44	−1.2
1	75	Differentiating between gender	−0.19	0.12	0.7	−1.2	0.47	−1.1
19	75	Differentiating between colors	−0.23	0.12	1.32	1.00	1.55	0.8
9	75	Writing along a straight line	−0.35	0.14	0.86	−0.5	1.18	0.3
14	75	Climbing stairs	−0.41	0.15	1.12	0.3	3.38	2.2
4	74	Walking back home at night	−0.46	0.16	1.16	0.4	0.43	−1.0
15	50	Lacing shoes	−0.52	0.19	0.76	−0.6	0.45	−0.8
18	75	Locating food on a plate	−0.91	0.24	0.87	−0.2	0.62	−0.5
17	74	Applying paste on a brush	−1.19	0.31	1.99	1.1	1.42	0.4
3	75	Walking in the corridor at school	−1.87	0.6	0.73	−0.2	0.77	−0.2

* Number of subjects to whom the item was applicable.

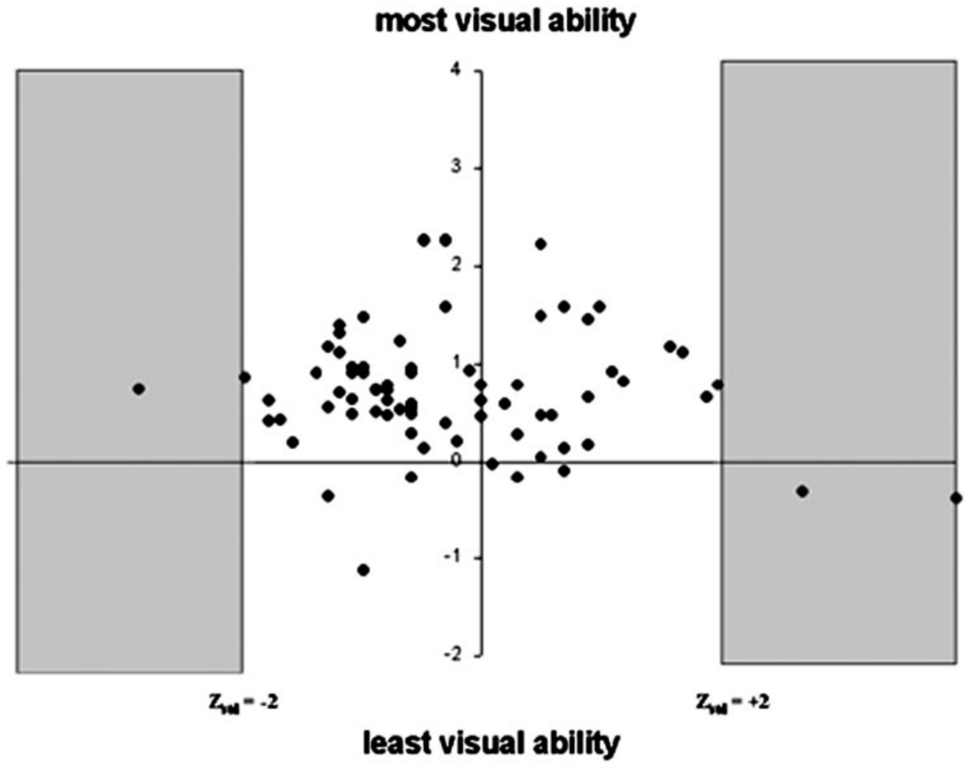

Figure 3. Person measures of perceived visual ability for functional vision performance (α) versus the z-transformed infit mean squares (Z_{std}). Data points for the subjects with the most visual ability for the functional vision are located at the top of the graph and those for persons with the least visual ability are located at the bottom. Normalized infit values that exceed ± 2 (located in the shaded regions of the graph) indicate that the mean square exceeded the model's expectations by more than 2 SDs.

ROC analysis[37] on the person measures to determine the instrument's discrimination ability based on the responses to question 20 (global rating of vision). Question 20 was not included in Rasch analysis. We computed the area (A) of the ROC curve for each group and then compared these values with chance performance ($A = 0.5$) to test for significance. The person measure discriminated all categories ($A = 0.79$–0.90, $P < 0.05$) except for those who answered "a little worse" versus "as well as" ($A = 0.70$, $P = 0.25$) which may be attributable to the small sample of subjects who answered "as well as" ($n = 3$).

Discussion

As expected, subjects most frequently reported difficulty with common but visually demanding tasks such as reading and copying from the blackboard. Questions relating to self-care activities revealed little difficulty, suggesting that these physical activities were less dependent on vision than other tasks. However, they were included in the final questionnaire because they represented one area of questioning suggested for inclusion by Van Dijk et al.,[8] and they also increased the range of measurement scale of the LVP-FVQ.

The purpose of this study was to determine whether the LVP-FVQ could be used to determine perceived visual ability for functional vision performance in children with different levels of visual impairment. To accomplish this goal, we developed a patient-based assessment that, together with the Rasch analysis, allowed us to infer an underlying trait—perceived visual ability. We determined a person score of perceived visual ability for each subject. The LVP-FVQ showed adequate content validity as demonstrated by separation indices (1.38 for person measure and 3.75 for item measure). The poor separation reliability for person measures could be attributable to the homogeneity of visual acuity in our sample (Fig. 2). Construct validity of the LVP-FVQ was demonstrated by good MNSQ fit statistics. Despite poor separation reliability for person measures, the criterion validity of the LVP-FVQ was demonstrated by its ability to discriminate between subjects of different abilities (i.e., those who responded "seeing as well as their normally sighted friends," "seeing a little worse than their friends," and "seeing much worse" than their friends). The LVP-FVQ could be improved further by adding other questions such as those related to mobility in unfamiliar areas. The addition of items related to mobility would make the results of the LVP-FVQ more generalizable and would be useful to detect subjects with reasonable acuity but advanced peripheral field loss, such as those with retinitis pigmentosa and glaucoma. Further investigation of the new set of items using factor analysis to check for unidimensionality[38] would be needed before these new items could be added.

Rasch analysis demonstrated higher reliability for item difficulty parameters (0.93) than for person ability (0.65). We speculate that the poor person measure reliability is related to the rating scale used in the present study. Our subjects tended to use the extreme categories of the rating scale (0 and 4) more often than the intermediate categories (1, 2, and 3; explained in detail later).

The results of the present study are similar to those reported by Massof and Fletcher[14] in their evaluation of the NEI Visual Functioning Questionnaire as an interval measure of visual ability in low vision. They reported a high linear correlation (0.52) between visual acuity and person measure and demonstrated that items in part 2 of the NEI-VFQ could be used to estimate an interval scale of visual ability for patients with low vision. In the present study, the correlation between visual acuity and person measure was −0.57. This strong correlation between visual acuity and visual ability suggests that visual acuity is a major factor for the visually impaired children in their responses to the 19 items on the LVP-FVQ. A comparison between the two studies also reveals that the LVP-FVQ appears to be measuring an aspect (difficulty performing everyday activities) similar to that of part 2 of the NEI-FVQ.

Daily Tasks of School-Going Children Requiring the Most and Least Visual Ability

The hierarchy of required visual ability for the 19 items (Table 3) shows that the 4 most difficult tasks were all related to activities that require high resolution: reading a textbook at arm's length, threading a needle, reading destination details of a bus, and copying from the blackboard despite sitting in the front row. All these are significant activities in schoolchildren.

At the easiest extreme of our difficulty hierarchy (those items that required least visual ability) were tasks of daily living, such as applying paste to a toothbrush, locating food on a plate, walking alone in the corridor at school, and walking back home at night, for which the subjects reported little or no difficulty. This implies that vision may not be as critical when subjects are required to do tasks that can be managed by other cues, such as tactual (locating food on a plate and applying paste to a toothbrush). Although we used a 5-point rating scale (0–4) in the present study, the subjects tended to dichotomize their responses. Response category 0 was used 22% of the time and category 4 was used 64% of the time with categories 1, 2, and 3 being used only 2%, 2%, and 6% of the time, respectively. The probability of subjects using categories 1, 2, or 3, was near zero for all values of person-item measure. These response categories were rarely used by our subjects and conveyed no information. Approximately half of our subjects (56.4%) were moderately visually impaired and we expected most of them to respond with "moderate to a great deal of difficulty" in performing the tasks, but they tended to dichotomize the responses (i.e., they answered with the most extreme categories). We speculate that it was difficult for the children to remember the four response categories. In addition, they may not have not been able to make judgments of scale (i.e., they either could perform the task or they could not, and if they could, they did not have any basis for deciding whether they had mild, moderate, or a great deal of difficulty, because they always performed the task that way). All these factors could have led to an infrequent use of the intermediate rating categories. Based on our experience we suggest that the rating scale of the LVP-FVQ could be modified to make it dichotomous and to further shorten the administration time. However, another study with a more heterogeneous (in visual acuity) and larger sample size is needed before such a recommendation can be made.

Role of the LVP-FVQ

There are several potential applications for the LVP-FVQ, the first being that it could be used by optometry and paraoptometry professionals with no low vision experience to identify children with visual impairment and either refer them to low-vision specialists or advise them on appropriate assistance. A second application for the LVP-FVQ is that it provides eye care professionals with a structured format for recording vision problems of children with visual impairment. Several investigators[39,40] have expressed similar views in their review of visual function assessment questionnaires in adults. Third, it could guide planning of appropriate interventions. For example, in situations in which parents cannot afford to take their child to specialist centers for improved care, the primary eye care provider could make a recommendation to the child's teachers and school authorities for appropriate environmental modifications in the classroom. This would develop a rapport between the eye care provider and the teachers of children with visual impairment, thus helping to reduce functional difficulties. If the child is unable to cope with the visual requirements in the classroom or at home, the primary eye care provider could then refer the child to a low-vision specialist. Results from the LVP-FVQ could help to advise parents and teachers on simple interventions to improve the functioning of children with low vision. For example, in this study, 78.2% of subjects reported that they were unable to read their textbooks at arm's length. However, only 39% of subjects reported being unable to read the blackboard from the first row. Simple and inexpensive interventions in the form of environmental modification, such as being seated closer to the blackboard in class, enabled a large proportion of subjects to perform well at board work. If children were encouraged to hold their books closer to their faces, they should be able to read because of the availability of ample accommodation in this age group. Such interventions to assist children with low vision can be achieved through parental counseling and providing recommendations to teachers to dispel myths with regard to the use of residual vision.

The LVP-FVQ also could be used as an adjunct to clinical measures in assessing self-reported functional vision. However, as has been demonstrated by Wright et al.,[41] children may under- or overestimate their level of difficulty. One way of overcoming this problem could be to have subjects actually perform the required tasks in the presence of the clinical practitioner or investigator.[2] That approach was not used in the present study because of the difficulty of simulating classroom conditions, such as light levels, and seating distance, among others. A questionnaire has greater general application among eyecare practitioners and educators than a more complex functional assessment of vision.

Although the LVP-FVQ is valid and reliable, it has a few limitations. All the subjects included were of school age and were under the care of the LVPEI. Their visual acuities were spread over a relatively small range (mean 0.92 ± 0.30 logMAR). They may not be representative of all children with visual impairment in the community, and selection bias could have occurred. However, the causes of visual impairment in the present study were similar to those in a population-based study conducted in the same part of the country.[42] Little is known about self-reported problems with daily tasks in children. As in all studies that rely on self-report measures of disability, the possibility of reporting bias must be considered. The setting in which the questionnaire was developed may have had some influence on its content. Although the generalizability of LVP-FVQ items may be sufficient to allow cross-cultural use, this can only be confirmed by appropriate cross-cultural development work.

Conclusions

In conclusion, the LVP-FVQ can serve as a useful and valid measure of self-reported functional vision performance for visually impaired children. The LVP-FVQ may supplement clinical vision measures, because it may be a useful indicator of functional vision performance.

Acknowledgments

The authors thank Robert W. Massof, PhD, for valuable assistance with the Rasch analysis and also thank the subjects who participated in this study.

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APPENDIX

LV Prasad-Functional Vision Questionnaire

1. Do you have any difficulty in making out whether the person you are seeing across the read is a boy or a girl, during the day?
   _______ Yes _______ No _______ Not applicable

   If yes, how much difficulty do you have?

   - little
   - A moderate amount
   - A great deal
   - Unable to do the activity (Note: the same response options were used for questions 1–19.)
2. Do you have any difficulty in seeing whether somebody is calling you by waving his or her hand from across the road?
3. Do you have difficulty in walking alone in the corridor at school without bumping into objects or people?
4. Do you have any difficulty in walking home at night (from tuition or a friend's house) without assistance when there are streetlights?
5. Do you have any difficulty in copying from the blackboard while sitting on the first bench in your class?

6. Do you have difficulty in reading the bus numbers?
7. Do you have any difficulty in reading the other details on the bus (such as its destination?)
8. Do you have any difficulty in reading your textbooks at an arm's length?
9. Do you have any difficulty in writing along a straight line?
10. Do you have any difficulty in finding the next line while reading when you take a break and then resume reading?
11. Do you have any difficulty in locating dropped objects (pen, pencil, eraser) within the classroom?
12. Do you have any difficulty in threading a needle?
13. How much difficulty do you have in distinguishing between 1 rupee and 2 rupee coins (without touching)?
14. Do you have difficulty in climbing up or down stairs?
15. Do you have difficulty in lacing your shoes?
16. Do have difficulty in locating a ball while playing in the daylight?
17. Do you have difficulty in applying paste on your toothbrush?
18. Do you have difficulty in locating food on your plate while eating?
19. Do you difficulty in identifying colors (e.g., while coloring)?
20. How do you think your vision is compared with that of your normal-sighted friend? Do you think your vision is

    - As good as your friend's
    - A little bit worse than your friend's
    - Much worse than your friend's