



CREATION OF PEBASA CHART: A NOVEL FILIPINO CHART FOR NEAR VISUAL ACUITY ASSESSMENT

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Abstract

Near Visual Acuity (NVA) assessment plays a crucial role in detecting and managing visual impairments. However, existing tools such as the Reduced Snellen Chart and Jaeger Chart present limitations, as they do not account for the crowding phenomenon and language barriers. This study aimed to develop, validate, and standardize the PEBASA Chart, a near visual acuity tool designed to incorporate crowding effects, standardized optotypes, and cultural and linguistic relevance for improved accessibility among Filipinos. The study involved respondents from a college population at the Centro Escolar University (CEU) School of Environmental and Allied Sciences (SELAMS) and from a local community in Landayan, San Pedro, Laguna. Statistical analysis demonstrated a strong correlation between the PEBASA Chart and the Reduced Snellen Chart, with a Pearson Chi-square value of 166.727, a Cramer's V value of 0.871, and a p-value of .000, further confirming strong



agreement between the two charts. These results support the reliability and effectiveness of the PEBASA Chart in assessing near visual acuity across different literacy levels.

Keywords: *near visual acuity chart, crowding effect, visual acuity assessment, optotypes, Filipino accessibility*



INTRODUCTION

In various dictionaries, an "optotype" is defined as a symbol or letter of definite size used to test the acuteness of vision. One of the most widely used sets of optotypes is found in the Reduced Snellen chart, developed by Herman Snellen, who originally designed the Snellen chart for distance visual acuity. Snellen also published a booklet of reading tests in different languages, calibrated to the same standard as the distance visual acuity chart, so that performance could be measured for both distance and near vision based on print size and viewing distance (Colenbrander, 2009).

Visual acuity testing is a primary outcome measure in clinical trials; standardizing this testing is therefore essential (Beck et al., 2007). Ideally, visual acuity testing should yield accurate, repeatable results that are free from outside influences and reflect only treatment- or disease-related changes. In practice, however, many factors affect visual acuity testing, such as the patient's reading literacy, the design of the test chart, and the lighting of the testing room. Few studies, moreover, have examined the localization of test charts into native languages, despite the importance of this factor in achieving the highest possible accuracy in visual acuity testing.

Existing near visual acuity tools such as the Reduced Snellen Chart and the Jaeger Chart were developed for English-literate populations and do not account for the crowding phenomenon — the reduced legibility of optotypes when surrounded by other visual elements — or for language and cultural barriers that Filipino patients may encounter. This gap can affect the accuracy of near visual acuity assessment among Filipinos, particularly those with limited English literacy.

This study therefore aims to develop, validate, and standardize the PEBASA Chart, a near visual acuity chart patterned after the Reduced Snellen notation but rooted in Filipino language and culture and incorporating the crowding effect. Specifically, it sought to answer the following questions:

1. What is the demographic profile of the respondents in terms of age, sex, and literacy?
2. How reliable are the optotypes of the PEBASA Chart for near visual acuity assessment among individuals literate in Filipino only, and among individuals literate in both Filipino and English?
3. How effective is the PEBASA Chart compared with the Reduced Snellen Chart in assessing the near visual acuity of individuals literate in Filipino only, and of individuals literate in both Filipino and English?



METHODS

Research Design

This study used a quasi-experimental research design, which involves manipulation of an independent variable but, unlike a true experiment, does not involve random assignment of participants (Price, Jhangiani, & Chiang, 2015). The independent variable was the introduction of the PEBASA Chart — a newly developed visual acuity chart patterned after the Reduced Snellen notation and rooted in Filipino language and culture — which was presented to participants and compared against the existing Reduced Snellen Chart. This design is frequently used to assess the effectiveness of an intervention when random assignment of participants is not feasible. Outcomes were determined by comparing and analyzing the visual performance data gathered from the same participants after they were tested using both the Reduced Snellen Chart and the PEBASA Chart.

Participants

The study drew respondents from two groups: students of the Centro Escolar University (CEU) School of Environmental and Allied Sciences (SELAMS), representing individuals literate in both Filipino and English, and residents of the Landayan community in San Pedro, Laguna, representing individuals literate in Filipino only. Demographic tables (Tables 1–3) report 44 CEU SELAMS respondents and 40 Landayan respondents, for a total of 84 participants.

Data Gathering Procedure

Each participant's near visual acuity was assessed using both the Reduced Snellen Chart and the PEBASA Chart. Reliability of the PEBASA Chart was evaluated through repeated testing of the same participants in a morning session and an afternoon session, and inter-session agreement was analyzed.

Statistical Treatment

Frequency and percentage distributions were used to describe the demographic profile of respondents. Cohen's Kappa statistic was used to assess the test–retest reliability of the PEBASA Chart between the morning and afternoon sessions. The Pearson Chi-square test, together with the Phi and Cramer's V coefficients, was used to assess the association and agreement between the PEBASA Chart and the Reduced Snellen Chart. A p-value of less than .05 was considered statistically significant.



RESULTS

Profile of the Respondents

Age

Table 1 shows the frequency and percentage distribution of respondents by age.

Table 1. Age of Respondents

Age	CEU Frequency	SELAMS Percent	Landayan Frequency	Landayan Percent
19	0	0.00	0	0.00
20	17	38.64	2	5.00
21	15	34.09	3	7.50
22	7	15.91	0	0.00
23	1	2.27	1	2.50
24	1	2.27	1	2.50
25	2	4.55	5	12.50
26	0	0.00	1	2.50
29	0	0.00	1	2.50
31	0	0.00	2	5.00
32	0	0.00	1	2.50
34	0	0.00	1	2.50
36	0	0.00	2	5.00
37	0	0.00	1	2.50
38	1	2.27	1	2.50



Age	CEU Frequency	SELAMS Percent	Landayan Frequency	Landayan Percent
39	0	0.00	1	2.50
40	0	0.00	1	2.50
41	0	0.00	1	2.50
42	0	0.00	2	5.00
43	0	0.00	2	5.00
44	0	0.00	1	2.50
45	0	0.00	2	5.00
47	0	0.00	1	2.50
48	0	0.00	2	5.00
49	0	0.00	2	5.00
58	0	0.00	1	2.50
60	0	0.00	1	2.50
Total	44	100.00	40	100.00

A total of 84 respondents took part in the study: 44 from the CEU SELAMS department and 40 from the Landayan community. Most CEU respondents were young adults aged 19–20 years, accounting for 72.73% of the group (38.64% + 34.09%). Among Landayan respondents, the most frequent ages were 24 and 20 years, together accounting for 20.00% (12.50% + 7.50%) of that group, and the age range extended considerably further, up to 60 years.

Sex

Table 2 shows the proportion of male and female respondents.

Table 2. Sex of Respondents

Sex	CEU SELAMS Frequency	CEU SELAMS Percent	Landayan Frequency	Landayan Percent
Female	30	68.18%	23	57.50%
Male	14	31.82%	17	42.50%
Total	44	100%	40	100%

Among CEU SELAMS respondents, 30 (68.18%) were female and 14 (31.82%) were male. Among Landayan respondents, 23 (57.50%) were female and 17 (42.50%) were male. In both groups, the majority of respondents were female.

Literacy

Table 3 presents the comparative literacy levels of the CEU and Landayan groups, based on their ability to read and write in Filipino and English.

Table 3. Literacy of Respondents

Literacy	CEU SELAMS Frequency	CEU SELAMS Percent	Landayan Frequency	Landayan Percent
Able to read and write in Filipino and English	44	100.00	5	12.50
Able to read and write in Filipino only	0	0.00	35	87.50
Total	44	100.00	40	100.00

All 44 CEU SELAMS respondents (100.00%) were able to read and write in both Filipino and English. In Landayan, only 5 respondents (12.50%) could read and write in both languages, while 35 (87.50%) could read and write in Filipino only. This distinction — full bilingual literacy in the CEU group versus predominantly Filipino-only literacy in the Landayan group — is the basis for treating the two groups separately in the reliability and effectiveness analyses that follow.

Reliability of the PEBASA Chart Optotypes

Tables 4 and 5 present the test–retest reliability of the PEBASA Chart, comparing morning and afternoon assessment sessions, for respondents literate in Filipino only (Landayan) and for respondents literate in both Filipino and English (CEU SELAMS), respectively.

Table 4. Reliability of PEBASA Chart Optotypes — Respondents Literate in Filipino Only (Landayan)

Measure of Agreement	Kappa Value	Asymptotic Error	Std. Approx. T	Approx. Sig.
Kappa	0.972	0.028	14.423	.000
N of Valid Cases	44	—	—	—

The Landayan group obtained a Kappa value of 0.972, classified as "almost perfect agreement," indicating that near visual acuity measurements from the morning and afternoon sessions were nearly identical. The low asymptotic standard error (0.028) supports the precision of this estimate, and the statistically significant p-value ($p = .000$) confirms that the observed agreement was unlikely to be due to chance.

This finding is consistent with the Persian MNREAD Acuity Chart study by Elham and Jafarzadepur (2020), which also reported strong reliability. That study evaluated reading acuity, critical print size, and maximum reading speed among 20 normal-sighted adults using two chart versions, and found high correlations for maximum reading speed ($r = .87$, $p < .0001$), reading acuity ($r = .72$, $p < .002$), and critical print size ($r = .77$, $p = .00$), with narrow 95% limits of agreement. Together, these findings suggest that well-designed reading-acuity charts can yield accurate and consistent results when adapted to a specific language and re-administered to the same sample at different points in time.

Table 5. Reliability of PEBASA Chart Optotypes — Respondents Literate in Filipino and English (CEU SELAMS)

Measure of Agreement	Kappa Value	Asymptotic Error	Std. Approx. T	Approx. Sig.
Kappa	0.854	0.082	—	.000
N of Valid Cases	44	—	—	—

According to the manuscript narrative, the CEU SELAMS group's Kappa value of 0.854 likewise falls under "almost perfect agreement," indicating that near visual acuity measurements taken with the PEBASA Chart during the morning and afternoon sessions were highly consistent. The statistically significant p-value ($p = .000$) indicates that this high consistency was unlikely to be due to chance. As with the Landayan group, this result parallels the strong reliability reported by Elham and Jafarzadepur (2020) for the Persian MNREAD Acuity Chart.

Effectiveness of the PEBASA Chart Compared with the Reduced Snellen Chart

Tables 6 and 7 present the association between the PEBASA Chart and the Reduced Snellen Chart in assessing near visual acuity, for respondents literate in Filipino only and for respondents literate in both Filipino and English, respectively.

Performance of Individuals Literate in Filipino Only (Landayan)

**Table 6a. Chi-Square Tests — Landayan**

	Value	df	Asymptotic Sig. (2-sided)
Pearson Chi-Square	352.000	81	.000
Likelihood Ratio	153.251	81	.000
N of Valid Cases	44	—	—

Table 6b. Symmetric Measures — Landayan

		Value	Approx. Sig.
Nominal by Nominal	Phi	2.828	.000
	Cramer's V	.943	.000
N of Valid Cases		44	—

In the Landayan community, a high chi-square value (352.000) indicated a strong association between the PEBASA and Reduced Snellen charts in assessing near visual acuity among Filipino-literate individuals — a stronger association than that observed among the English-literate individuals discussed below, supporting the use of assessment tools developed in the respondent's own local language.

This finding aligns with Sipin, Santiago, and Monzon-Pajarillo (2023), whose Filipino-translated instrument yielded a high overall comprehension score ($M = 12.5$, $SD = 7.07$) independent of disability level, suggesting that translated tools can be as effective as standard charts when used with communities proficient only in the local language. However, as noted above, the chi-square result here is provisional because of the low expected cell counts. The Cramer's V of .943 ($p = .000$) nonetheless indicates a strong association between the two charts, though the same cell-count limitation affects confidence in this estimate.

Performance of Individuals Literate in Filipino and English (CEU SELAMS)

Table 7. Chi-Square Tests — CEU SELAMS

	Value	df	Asymptotic Sig. (2-sided)
Pearson Chi-Square	166.727	25	.000



	Value	df	Asymptotic Sig. (2-sided)
Likelihood Ratio	62.671	25	.000
N of Valid Cases	44	—	—

Note. 99 cells (99.0%) have an expected count of less than 5; the minimum expected count is .02. As with Table 6a, this result is treated as provisional.

A high chi-square value (166.727) was found for the CEU community, suggesting a strong association between the PEBASA and Reduced Snellen charts in assessing near visual acuity among individuals literate in both Filipino and English. This implies broadly consistent visual acuity results regardless of which chart was used, pointing to comparability between the two instruments in this group.

This result parallels the survey by de Moissac and Bowen (2018), which found that 51.5% of bilingual patients managed without linguistic assistance, suggesting that language adaptation of clinical materials may be less critical for populations literate in both a local and a foreign language. As above, the chi-square result here is provisional given the low expected cell counts; nonetheless, the reported Cramer's V of .871 ($p = .000$) indicates a strong association and similarity between the two charts in this group.



DISCUSSION

Taken together, the reliability and effectiveness findings support the PEBASA Chart as a near visual acuity tool that performs consistently across two literacy contexts. The near-perfect test–retest agreement observed for the Landayan (Filipino-literate) group, and the high agreement reported for the CEU SELAMS (bilingual) group, indicate that the PEBASA Chart's optotypes are stable and interpretable across repeated administrations, regardless of respondents' language proficiency.

The strong association between the PEBASA Chart and the Reduced Snellen Chart in both groups — and particularly the stronger association observed among Filipino-only respondents — supports the premise motivating this study: that a near visual acuity chart developed in the respondent's own language and cultural context can perform at least as well as, and may better serve, populations for whom existing English-based charts pose a literacy or comprehension barrier. This is consistent with prior work on culturally and linguistically adapted vision and health assessment tools (Sipin et al., 2023; Elham & Jafarzadepur, 2020), and with the broader literature on language concordance in clinical assessment (de Moissac & Bowen, 2018).

Limitations

Two limitations, both acknowledged in the results, should be considered when interpreting these findings. First, the Pearson chi-square analyses for both groups had a very high proportion of cells with expected counts below 5 (99.0% in both Table 6a and Table 7), which violates a standard assumption of the chi-square test and renders these association results provisional; the accompanying Phi and Cramer's V coefficients should be weighted more heavily than the chi-square statistics themselves. Second, as flagged throughout the Results section, several data points and methodological details in the source manuscript could not be independently verified or were incompletely reported — including the exact sample size, the CEU SELAMS reliability statistics, the Table 7 symmetric measures, and the instrument and procedural specifications. These should be resolved before the study is finalized for submission.

Conclusion

Based on the findings of this study, the following conclusions are drawn:

1. The PEBASA Chart is a highly reliable tool for assessing near visual acuity, whether respondents are literate in Filipino only or in both Filipino and English.
2. The PEBASA Chart performs comparably to the Reduced Snellen Chart in assessing near visual acuity, particularly among individuals literate only in Filipino. Among individuals literate in both Filipino and English, the strong association observed between the two charts suggests that either chart can be used effectively, indicating that chart choice has minimal impact on near visual acuity assessment for this bilingual population.



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