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Scaling Running Records Passages for Precise Reading Assessment

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**Scaling Running Records Passages
for Precise Reading Assessment**

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**Scaling Running Records Passages
for Precise Reading Assessment**

**A Collaborative Response to the
Second Grade Reading Testing Pilot Program for Washington State**

From:

**Centralia School District
Griffin School District
North Thurston School District
Olympia School District
Pioneer School District
Shelton School District**

Final Report

March 6, 1998

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Scaling Running Records Passages for Precise Reading Assessment

Abstract: A reading Running Records measure (RR Measure) was constructed from the oral reading responses of 1628 second grade students to 18 reading passages from commercially available primary reading assessment materials. Each student read up to four passages to an adult trained in accurately recording running records. Reliability checks indicated high recorder reliability ($r \approx .90$'s). Accuracy and words per minute were combined to form a rate-adjusted accuracy score (A_{Radj}) for each passage. A_{Radj} s were placed into one of five ordered categories. Category scores were analyzed using a Rasch partial credit model. Data from one passage did not fit the measurement model and was dropped from further analysis. Significant differences were noted between the difficulty order of passages based on publisher assignment and difficulty order based on the RR Measure. The correlations between the RR Measure and the CTBS Terra Nova Reading subtests on a sub-sample of 442 students were in the moderate range. While predictions of CTBS performance based on the RR Measure were stable, they were accompanied by rather large standard errors, making predictions at the individual level ill advised. Scoring complexities represent the major challenge to implementation. Spreadsheet software with a simple template could meet the major portion of this challenge.

Problem

Listening to children read orally is a time-honored approach to assessing their reading skills and informing their reading instruction. A teacher skilled in observing, recording, and analyzing oral reading can strategically plan instruction that is appropriate for the child. In view of the instructional value, it is not surprising that the tools developed to assess oral reading (e.g., Analytic Reading Inventory, Developmental Reading Assessment, Qualitative Reading Inventory, and Running Records) are clinically oriented. That is, they emphasize the collection of data that have immediate value to instruction. Use of these data to construct measures of reading with which to draw verifiable inferences or to demonstrate movement on a linear, equal-interval scale is rarely pursued. This is unfortunate. To continue along this path suggests, on one hand, that clinical assessments are sufficient for the purpose they were designed to serve and that other purposes requiring more technical rigor should be served by other tools. Leveraging the information from a single assessment to serve multiple purposes is a distrusted concept. On the other hand, one wonders how identifying a student's position on or movement along an empirically constructed equal-interval scale is not a valid, valued or meaningful part of the clinical process. Certainly, when rigorous measurement options are present they would be a welcome part of any clinical judgement model. This project is based on that very assumption.

Goals

The scaling project was directed toward achieving two goals:

1. To provide sufficient evidence of the measurement characteristics of a common set of reading passages, read and scored according to accepted running records procedures, that will merit including the set as an acceptable measure of second grade reading accuracy and fluency to meet the requirements of Washington's ESHB 2042.
2. To provide a step-by-step guide to the procedures necessary to add new reading passages to the calibrated collection that will result from this project.

Methods

Participants

Students

Grade 2 students (N=1628) in 26 schools from five small to moderate size south Puget Sound school districts participated in the study. No student was excluded ipso facto from the study due to a handicapping condition or enrollment in a remedial categorical program. Only two factors precluded a student from participating; viz., the student: 1) was a non-reader or, 2) could not read the easiest book level (designated as kindergarten level) at greater than 70% accuracy. While some pre-emergent readers read only the easiest book at less than 70% accuracy, their results were not included in the data analysis. Table 1 summarizes the compositions of participant schools in terms of enrollment, free/reduced priced lunch participation, and Title 1 building status.

Table 1. Compositions of Participating Schools

| District | School Name | School | Nov. 1 Enrlmt | % on Free/ Reduced Lunch | Title 1 School? |
|----------------------|-----------------------|---------------|--------------------------|---|----------------------------|
| Griffin | Griffin | A | 63 | 13 | Yes |
| Centralia | Edison | B | 71 | 55 | Yes |
| | Jefferson-Lincoln | C | 97 | 80 | Yes |
| | Fords Prairie | D | 93 | 39 | Yes |
| North Thurston | Lakes Elementary | E | 86 | 40 | Yes |
| | Lacey Elementary | F | 58 | 40 | Yes |
| | South Bay Elementary | G | 93 | 34 | No |
| | Meadows Elementary | H | 90 | 34 | Yes |
| | Woodland Elementary | I | 75 | 32 | No |
| | Seven Oaks Elementary | J | 65 | 3 | No |
| Olympia | Boston Harbor | K | 52 | 3 | No |
| | L.P. Brown Elementary | L | 63 | 23 | No |
| | Centennial Elementary | M | 38 | 6 | No |
| | Garfield Elementary | N | 73 | 34 | Yes |
| | Hansen Elementary | O | 83 | 30 | Yes |
| | Lincoln Elementary | P | 48 | n/a | No |
| | Madison Elementary | Q | 28 | 33 | Yes |
| | McKenny Elementary | R | 54 | 23 | No |
| | McLane Elementary | S | 54 | 31 | Yes |
| | Pioneer Elementary | T | 64 | 5 | No |
| | Rogers Elementary | U | 35 | 25 | No |
| Roosevelt Elementary | V | 58 | 45 | Yes | |
| Shelton | Bordeaux | W | 100 | 61 | Yes |
| | Evergreen | X | 50 | 65 | Yes |
| | Mountain View | Y | 99 | 54 | Yes |
| Pioneer | Pioneer Primary | Z | 110 | 35 | Yes |

Teachers/recorders

In four districts, classroom teachers administered the running records assessment. One district temporarily hired a team of teachers to do so. All teachers on the team had previous training and experience with administering running records. Americorps members, Masters in Teaching students, and several parent volunteers served as the assessment team in one district.

Validation sub-sample

A portion of the study involved validating the newly constructed running records reading measure (RR Measure) against an established reading measure: specifically, the CTBS/5 Terra Nova vocabulary and word analysis subtests. To accomplish this, classrooms from participating schools (except three in one district) were selected at random to administer the CTBS/5 subtests immediately after completing running records. Where possible, steps were taken to limit the classrooms sampled in a single school to one-third of the classrooms available.

Training

All teachers and recorders who had no previous experience with running records were provided a 3_ hour training session. Two *Reading Recovery*-trained teachers conducted the training session. Included in the session were: the rationale behind running records, emphasis on accurate and standardized recording of reading errors, several practice exercises to assess accuracy and reliability, procedures specific to the study, and a question and answer period to clarify understanding and respond to “what if” situations. Since the study did not include a comprehension component, questioning strategies were not addressed.

Materials

The *Assessment Resource Kits, Edition 1* (The Wright Group, 1996) for grades K-1 and grades 2-3 supplied the passages (books) students were asked to read. Two passages were dropped from the K-1 kit to insure that an adequate number of students would have read passages at the lowest level to satisfy the requirements of the scaling model. The final collection consisted of 18 passages, with eight from the K-1 set and 10 from the grade 2-3 set.

For each passage, a recording sheet was constructed from The Wright Group (WG) supplied reproducible material. The constructed sheets were simplified versions of the originals that included only the information essential to the study; namely passage title, number of words and the passage text.

Mark-sensitive scan sheets were developed and pre-printed with each student’s name, school, teacher name, district identification number and passage block (A or B). For each passage read, the recorder was to simply supply three pieces of information: the number of the book read, the number of uncorrected errors and the time it took for the student to complete.

To facilitate accurate recording, several additional materials were used. Inexpensive, digital stop watches were provided to all recorders for time keeping. A “chart of allowable errors per passage” was also provided. This chart allowed the recorder to know, in gross terms, how accurately a student had read a passage. And finally, a flow chart was provided to each recorder to guide them through the levels of reading passages. In effect, the “allowable errors chart” simply gave an indication of how well a student had read a passage. That information was then used in conjunction with the flow chart to determine the next passage the student should read.

Procedures

Passage blocks

To insure that comparable and adequate numbers of students read all passages, two passage blocks were formed. Passages were assigned to blocks of comparable difficulty on the basis of their level as designated by WG. Where there was concern about inadequate numbers of readers for a passage, the passage was assigned to both blocks. The specific passages (one from each book title) assigned to each block are provided in Table 2. Passage blocks were assigned to classrooms on a random basis.

Starting passages

Prior to any running records being administered, all teachers were asked to estimate the student’s gross reading stage (e.g., Beginning Emergent, Emergent, Early Fluency, etc.) from their experience with and observation of the student. This estimate was then used to begin the passage sequence.

Passage sequence

Each student was to read four passages beginning with the one at the level designated by the teacher’s estimate of the student’s gross reading stage. The first passage was considered to be at the student’s *instructional* level. Depending on the student’s performance (accuracy level) on the first passage, a second passage was presented. If the first passage was read at less than 90% accuracy, the second passage was from an easier level, based on WG levels. If the first passage was read at 90% accuracy or greater, a more difficult passage was presented. This process continued until the student had read four passages or had exhausted the available passages at his or her reading level (e.g., an easier passage could not be offered because one did not exist). When the passage sequence proceeded as planned, a student would have read two passages at his/her “instructional level” (90%-94%), one passage at his independent level (95% or higher), and one passage at his/her frustration level (89% or lower). While such a distribution of reading accuracy was desirable, it was not critical to success of the scaling process. Following such a sequence did ensure that students were presented with a fairly full range of passage difficulty without being completely frustrating or completely without challenge.

Running records

Each teacher or running record recorder used the materials described above. Uncorrected reading errors were recorded in a manner consistent with procedures described by Clay (1979). In addition to recording reading errors, recorders were asked to record the time the student needed to complete each passage. These two pieces of data were entered onto the recording form for each passage the student read.

Two to three students from each class (10% of students overall) were selected randomly for recorder reliability checks. For these students, a second trained recorder recorded the student’s reading errors for all passages read. When recorders operated in teams (i.e. four to six), they were instructed to alternate among team members so that recorder pairing would be more evenly distributed across the team. Recorder reliability was estimated using Pearson correlation coefficients of the errors recorded by each recorder.

Preparations for constructing the RR reading measure. Raw scores used to construct the running records (RR) reading measure were the product of two reading ability indicators: rate (WPM) and accuracy (Acc). Both indicators were derived in a traditional fashion. The time (S) needed to read the number of words in the passage (N_p) were used to calculate WPM by:

Accuracy was defined as the proportion of N_p read without errors; that is, after subtracting the proportion of uncorrected errors (E_{uc}). The calculation used was:

$$WPM = \frac{N_p}{S} * 60.$$

$$Acc = 1 - \frac{E_{uc}}{N_p}.$$

The product of these two indicators ($Acc * WPM$) was taken to yield a *Rate-Adjusted Accuracy* (A_{Radj}) score. In both indicators (Acc and WPM), a higher value suggests higher reading ability. Thus, the product of the two carries the same suggestion. Moreover, and obviously, each indicator also moderates or adjusts the other. So, for example, a very high accuracy score of 98% obtained when the student read at a rate of 88 wpm would have the same A_{Radj} score as the student who read the same passage at a rate of 101 wpm but with 85% accuracy.

Each passage the student completed yielded one A_{Radj} score and each student whose performance contributed to the construction of the RR reading measure, had at least two A_{Radj} scores. A A_{Radj} score was only calculated when the value of Acc was $\geq .50$. A categorized version of the A_{Radj} scores was used as the raw scores for final construction of the RR measure.

To formulate a more easily managed raw score from which to construct the RR measure, all A_{Radj} scores were assigned to one of five ordered categories. These categories were established by determining the cut-points used to define quintiles of the distribution of A_{Radj} scores for each passage. The descriptive statistics of common cut-points (20%, 40%, 60% and 80%) across all passages were examined to determine global cut-points for assigning the A_{Radj} scores from any passage to an appropriate ordered level. Table 2 shows the A_{Radj} cut-points for individual passages as well as the global cut-point chosen for all passages. For purposes of constructing the RR measure, it was not necessary to have equal numbers in each score category of each passage. It was only necessary to have sufficient numbers in each score category to allow the measurement model to estimate item parameters and steps within acceptable limits.

Table 2. Cut Points for Five Ordered Categories

| Passage ID | 20% | 40% | 60% | 80% | N per Group | N per Passage |
|-------------------|------|------|------|-------|-------------|---------------|
| 1 | 11.3 | 20.2 | 29.7 | 43.0 | 94 | 470 |
| 3 | 24.4 | 41.5 | 56.5 | 76.0 | 136 | 679 |
| 4 | 13.0 | 19.3 | 27.1 | 35.1 | 34 | 168 |
| 5 | 24.3 | 33.2 | 46.5 | 62.4 | 31 | 153 |
| 6 | 24.9 | 34.1 | 43.0 | 51.4 | 51 | 253 |
| 7 | 23.7 | 31.6 | 40.2 | 53.0 | 58 | 292 |
| 8 | 25.2 | 35.4 | 44.0 | 57.5 | 54 | 269 |
| 9 | 25.2 | 36.6 | 46.6 | 60.8 | 50 | 252 |
| 11 | 30.1 | 44.2 | 57.3 | 75.5 | 65 | 326 |
| 11 | 26.8 | 39.9 | 55.0 | 71.9 | 55 | 273 |
| 12 | 31.0 | 43.8 | 59.8 | 79.4 | 65 | 327 |
| 13 | 31.8 | 47.6 | 64.8 | 87.5 | 62 | 310 |
| 14 | 49.1 | 66.5 | 77.6 | 103.1 | 69 | 343 |
| 15 | 27.4 | 37.7 | 52.4 | 72.9 | 66 | 330 |
| 16 | 37.4 | 48.6 | 62.1 | 81.3 | 66 | 328 |
| 17 | 41.9 | 57.8 | 73.1 | 90.2 | 52 | 260 |
| 18 | 40.9 | 55.2 | 68.9 | 89.7 | 50 | 251 |
| 19 | 40.9 | 50.8 | 62.5 | 80.8 | 55 | 275 |
| Mean | 29.4 | 41.3 | 53.7 | 70.6 | | |
| Median | 27.1 | 40.7 | 55.7 | 74.2 | | |
| Min | 11.3 | 19.3 | 27.1 | 35.1 | | |
| Max | 49.1 | 66.5 | 77.6 | 103.1 | | |
| Range | 37.9 | 47.2 | 50.5 | 68.1 | | |
| Std Dev | 9.8 | 12.2 | 13.9 | 18.0 | | |
| Global Cut-points | 30 | 40 | 55 | 75 | | |

RR Measure Construction and Related Analyses

For final construction of the RR measure, a partial credit Rasch analysis (Masters, 1982) was conducted on the ordered categorical scores. All analyses involved with scale construction were conducted using BIGSTEPS (Linacre & Wright, 1995).

As an estimate of concurrent validity, scale scores yielded from the RR measure were correlated with standard scores from both the vocabulary and word analysis subtests of the CTBS/5 Terra Nova. While the CTBS/5 is not a measure of oral reading, we felt that its content in these two subtests shared enough of the requisite demands of oral reading to serve as a reasonable proxy for validation purposes.

To use scale scores from the RR measure to estimate grade level status in reading, standard scores from the vocabulary and the word analysis subtests were regressed on the RR measure scale scores. Each subtest from the CTBS/5 was treated independently. A double-cross validation procedure (Kerlinger & Pedhazur, 1973) was performed for each analysis to insure the relative stability of the R^2 obtained from each regression equation.

Results

Descriptive

The initial collection of passages (books) used in the study along with pertinent descriptive information for each are provided in Table 3. We see from the table that two passages are assigned to the Beginning Emergent stage, six are at the Emergent stage and so on. Passage 2 was not used in the study. As we would expect, the numbers of words increases as passages increase in difficulty. On average, nearly 300 students read each passage as part of the study, though the numbers per passage ranged from a high of 637 for passage 3 -- *I Have a Home* to a low of 147 for passage 5 -- *Speak Up!*

**Table 3. Descriptive Statistics for Passages:
WG Assigned Level, Size, Student Exposure, Recorder Reliability, and Observed Accuracy-Rate Correlations**

| No. | WG Assigned Stage | Passage (book) Title in WG Assigned Difficulty Order | N words | N of Students Reading Passage | N of Scores Used in Scaling | Recorder Reliability | | Corr. (Acc.WMP) |
|-----|-------------------|--|---------|-------------------------------|-----------------------------|----------------------|-------|-----------------|
| | | | | | | N of Students | Corr. | |
| 1 | Begin. | The Pajama Party | 46 | 392 | -Dropped- | 43 | .99 | .31 |
| 3 | Emergent | I Have a Home | 79 | 608 | 384 | 74 | .99 | .38 |
| 4 | | What Mynah Bird Saw | 90 | 143 | 115 | 18 | .99 | .29 |
| 5 | | Speak Up! | 98 | 135 | 123 | 15 | .99 | .13 |
| 6 | Emergent | Night Noises | 105 | 225 | 200 | 18 | .91 | .39 |
| 7 | | A Fire at the Zoo | 124 | 255 | 232 | 30 | .98 | .37 |
| 8 | | Same but Different | 117 | 233 | 212 | 24 | .95 | .24 |
| 9 | | Lizard's Grandmother | 114 | 227 | 202 | 19 | .99 | .37 |
| 10 | | Emilio and the River | 104 | 291 | 239 | 27 | .98 | .56 |
| 11 | Early Fluency | Trog | 103 | 236 | 205 | 30 | .96 | .56 |
| 12 | | Living in the Sky | 101 | 298 | 247 | 22 | .98 | .44 |
| 13 | | The Little Old Lady Who... | 106 | 266 | 208 | 36 | .97 | .57 |
| 14 | | Camping with Our Dad | 116 | 313 | 189 | 25 | .92 | .41 |
| 15 | Begin. Fluency | The Secret of Cannonball Cove | 182 | 304 | 255 | 19 | .95 | .54 |
| 16 | | Ishmaal and the Glass Horse | 201 | 285 | 229 | 37 | .98 | .48 |
| 17 | | Elliot and the Drainpipe Kids | 210 | 238 | 159 | 16 | .93 | .47 |
| 18 | Fluency | Shambles | 212 | 228 | 155 | 16 | .99 | .37 |
| 19 | | The Adventures of Tutankhamen | 209 | 245 | 192 | 23 | .97 | .29 |

As part of the scaling process, some student records were dropped from the analysis because scores are at the minimum or maximum extreme or records lacked responses. The number of scores that contributed to each passage’s scaled difficulty value also appears in the table. Passage 1 -- *Pajama Party* was dropped from the analysis due to poor infit statistic values. Recorder reliabilities (Pearson r ’s) were quite strong, with passage 6 -- *Night Noises* being the lowest at .91. Finally we see from Table 3 the low to moderate correlations of Acc and WPM. The highest of these correlations (.57 for passage 13 -- *The Little Old Lady Who . . .*) show that at a maximum, accuracy and words per minute share only about 32% of the variance in running records scores. Across all passages average $r^2 = .16$. This suggests that accuracy and rate are tapping two different aspects of the same process. It also serves as the basis for combining these separate scores into a single score; viz., A_{Radj} .

The RR Measure

Results from the initial application of the raw score data to the partial credit model identified one passage, *Pajama Party*, with a high standardized infit value (2.4). Standardized infit values above 2 indicate that responses to the item were unexpected by students whose ability was near the difficulty level of the item. Removing this passage from the analysis and resubmitting the data yielded a measure with 17 available passages. To convert logit units to a more intuitive (0 to 100) scale, the full range of the logit scale (32.3 units) was divided into 100 to produce a scale unit of 3.10. The new scale center was determined by subtracting from the new scale’s minimum (0) the product of the new scale unit and the logit scale minimum (0 - (3.10 * -17.46))=54.06.

The overall analyses are summarized in Table 4 for the 17 passages and for the 1209 students whose scores were not extreme. Examining the model summary for the passages we see a set of passages that conforms very well to the requirements of the partial credit model. Fit statistics, both infit and outfit, are very close to the expectation of 1. Similarly, the root mean square error (RSME) observed in the data (Real) shows almost no departure from model specifications. Coefficient Alpha also points to high internal consistency. Similar characteristics are evident in the student summary.

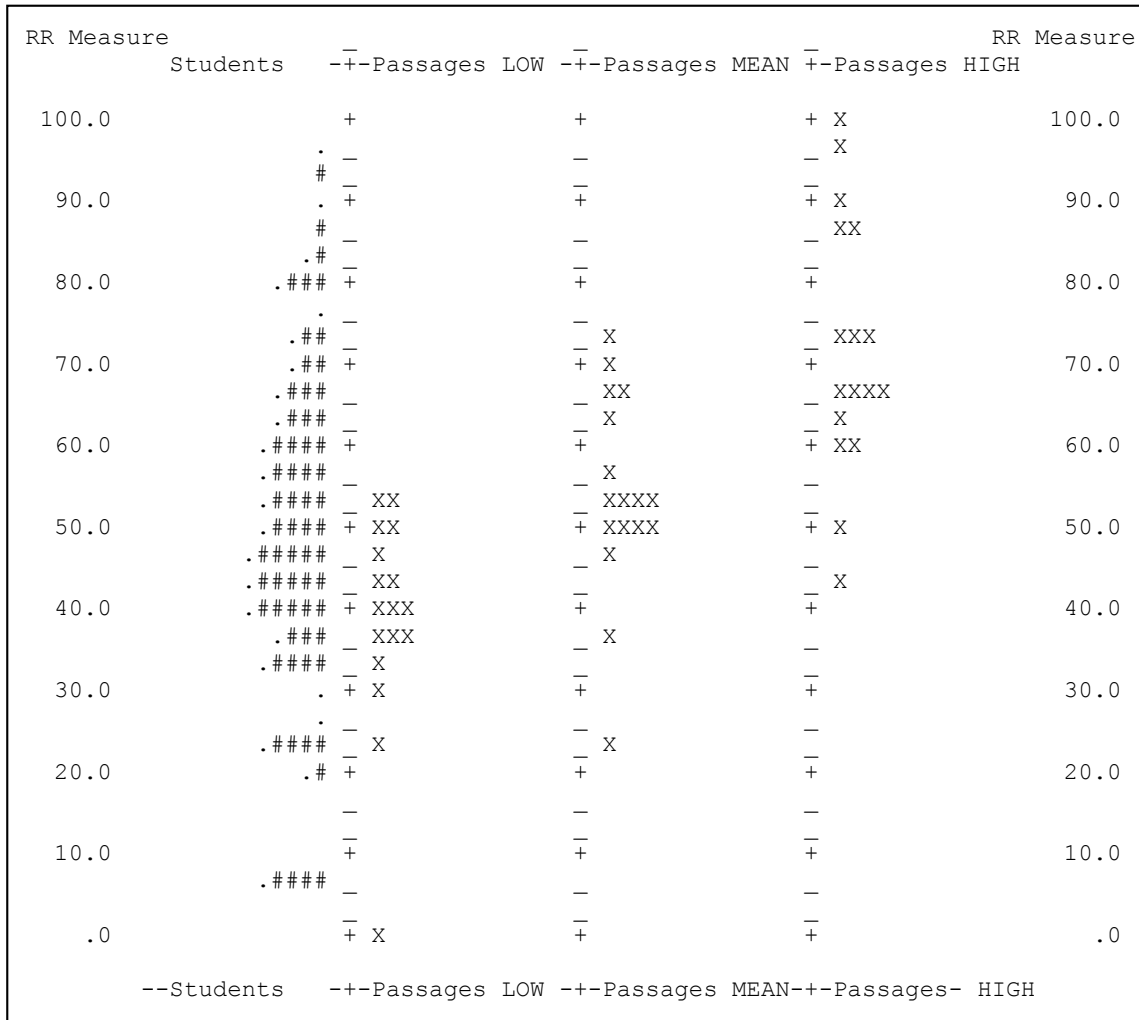
Table 4. Passage and Student Summaries of the Analyses

| Model Summary of 17 Passages | | | | | | |
|-------------------------------------|---------|------------|--------------|------|---------------------|------|
| | Measure | Error | <u>Infit</u> | | <u>Outfit</u> | |
| | | | MnSq | ZStd | MnSq | ZStd |
| Mean | 54.07 | .44 | .93 | -.8 | .85 | -.6 |
| S.D. | 11.98 | .08 | .15 | 1.4 | .19 | .9 |
| Model RMSE | .45 | Separation | 26.48 | | Reliability (Alpha) | 1.00 |
| Real RMSE | .46 | Separation | 25.93 | | Reliability (Alpha) | 1.00 |
| Summary of 1209 Students | | | | | | |
| | Measure | Error | <u>Infit</u> | | <u>Outfit</u> | |
| | | | MnSq | ZStd | MnSq | ZStd |
| Mean | 49.68 | 4.69 | .74 | -.6 | .74 | -.5 |
| S.D. | 20.45 | 2.73 | 1.29 | 1.1 | 1.31 | 1.1 |
| Model RMSE | 5.56 | Separation | 4.84 | | Reliability (Alpha) | .93 |
| Real RMSE | 5.90 | Separation | 4.55 | | Reliability (Alpha) | .92 |

Students with: Maximum extreme scores, 158 | Minimum extreme scores, 208

One distinctive characteristic of the family of Rasch measurement models is that person (student) ability and item (passage) difficulty share a common, equal interval scale. This feature allows performance to be viewed prescriptively rather than merely descriptively. In the partial credit model, each passage has a difficulty value that is added to the measure associated with each step. In the case of the RR Measure, each passage has five steps that correspond to placing each A_{Radj} score into one of five ordered categories.

The useful range of coverage of the 17 passages is illustrated in Figure 1. The student distribution of non-extreme scores on the RR Measure is provided in the left column with higher ability at the top. In the center column each passage is placed at its mean difficulty calibration. In the “Passages LOW” column, each passage is placed at the ability level corresponding with .5 score points onto the 5 point category scale. At the far right, each passage is plotted at the ability level that corresponds with 4.5 score points on the 5 point category scale.



Notes: Each '#' in the Students column is 16 Students.
Each '.' is 1 TO 15 Students.
Extreme student scores are not shown.

Figure 1. Map of Students and Passages

Individual passage statistics reveal the same patterns of fit with the measurement model for all passages. These results appear in Table 5. The right column in Table 5 provides each passage's point biserial correlation with the total test score. These correlations range from .69 to .92 and have a median value of .87.

Passages listed in Table 5 are in order of WG assigned levels. According to WG's Elena Johnson (personal communication, January, 1998) these assignments are based on the number of words, the number of lines of text per page, print size, difficulty of text, and use of and difficulty of proper nouns and multi-syllabic words. Books (passages) included in the assessment kits are selected to reflect the mid to upper range difficulty at each level.

Closer inspection of Table 5 reveals that the order of the passages as assigned by WG is substantially different than the order of passages based on their obtained difficulty value. Not only would re-arranging the passages based on the RR Measure (difficulty value) result in a different order of the passages within WG assigned stage, it would also result in a substantially different passage-stage structure. Figure 2 illustrates these relationships.

Table 5. Passages Statistics

| No. | Passage Title | N | Measure | Error | Infit | | Outfit | | Ptbis |
|-----|--------------------------------|-----------|---------|-------|-------|------|--------|------|-------|
| | | | | | MnSq | ZStd | MnSq | ZStd | |
| 1 | The Pajama Party | -Dropped- | | | | | | | |
| 3 | I Have a Home | 384 | 21.8 | .35 | 1.10 | 1.2 | .93 | -.6 | .88 |
| 4 | What Mynah Bird Saw | 115 | 48.5 | .68 | 1.14 | .8 | .53 | -.4 | .69 |
| 5 | Speak Up! | 123 | 37.2 | .52 | 1.15 | 1.0 | 1.13 | .2 | .87 |
| 6 | Night Noises | 200 | 51.6 | .48 | 1.12 | 1.1 | 1.34 | .3 | .86 |
| 7 | A Fire at the Zoo | 232 | 48.0 | .39 | .93 | -.7 | .75 | -.1 | .83 |
| 8 | Same but Different | 212 | 52.2 | .42 | .99 | -.1 | .94 | 0.0 | .85 |
| 9 | Lizard's Grandmother | 202 | 50.4 | .39 | .91 | -.9 | .82 | -.1 | .83 |
| 10 | Emilio and the River | 239 | 53.4 | .36 | .98 | -.2 | .93 | 0.0 | .85 |
| 11 | Trog | 205 | 58.3 | .42 | .90 | -1.0 | .93 | -.2 | .90 |
| 12 | Living in the Sky | 247 | 53.3 | .36 | 1.00 | 0.0 | .92 | -.3 | .88 |
| 13 | The Little Old Lady Who . . . | 208 | 54.1 | .40 | .88 | -1.3 | .84 | -.1 | .91 |
| 14 | Camping with Our Dad | 189 | 51.0 | .44 | .96 | -.4 | .99 | 0.0 | .86 |
| 15 | The Secret of Cannonball Cove | 255 | 66.8 | .38 | .75 | -2.8 | .68 | -1.6 | .92 |
| 16 | Ishmaal and the Glass Horse | 229 | 63.1 | .43 | .64 | -3.7 | .77 | -1.6 | .90 |
| 17 | Elliot and the Drainpipe Kids | 159 | 68.2 | .51 | .83 | -1.4 | .80 | -1.2 | .89 |
| 18 | Shambles | 155 | 69.0 | .53 | .65 | -3.3 | .55 | -3.2 | .89 |
| 19 | The Adventures of Tutank . . . | 192 | 72.2 | .50 | .83 | -1.5 | .67 | -2.0 | .87 |

For each passage in Figure 2, an arrow is used to point to the passage's difficulty value on the RR Measure. When two passages shared the same WG assigned difficulty level, their arrows' initiating points are joined by a vertical line. Each occurrence of the arrows crossing in Figure 2 represents a reordering of the passages based on the RR Measure. The figure also shows how most passages assigned by WG to the "Emergent" and "Early Fluency" stages, tend to cluster around the center of the RR Measure scale. In fact, seven passages (*Night Noises*, *Same But Different*, *Lizard's Grandmother*, *Emilio and the River*, *Living in the Sky*, *The Little Old Lady Who*, and *Camping With Our Dad*) from three different stages were within less than a 4 point difficulty range.

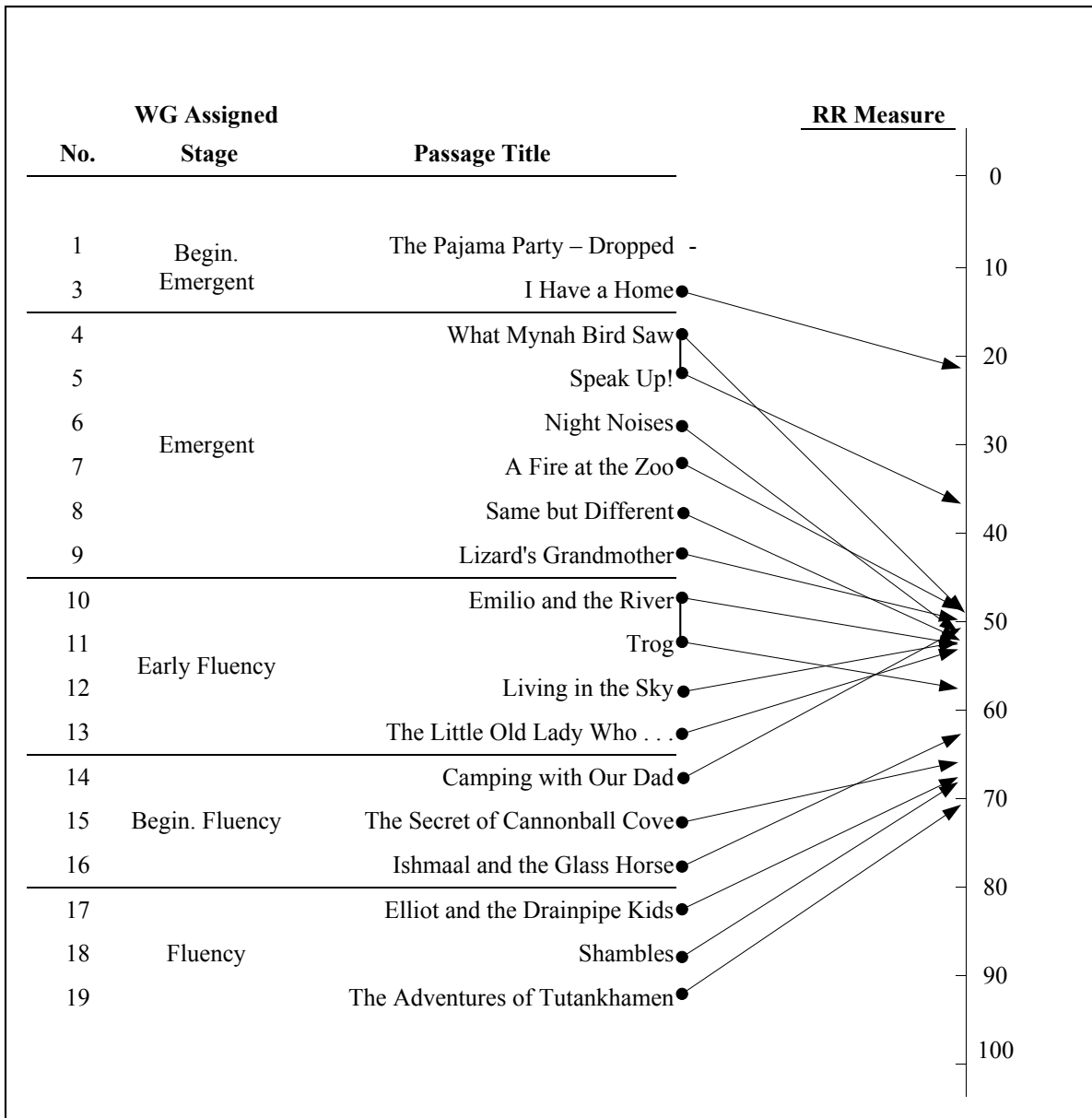


Figure 2. The Relationship Between WG Ordered Passages and the RR Measure.

Still further scrutiny of Figure 2 suggests some possible cut points for the assignment of gross categories such as “below grade level” or “basic proficiency” or “advanced.” Two clear cut clusters of passage difficulties can be observed along with one ‘pseudo’ cluster made up of the two easiest passages (*I Have a Home* and *Speak Up*). For the first full cluster, passages fall in the difficulty range of 45-60. The second cluster contains the five highest WG passages, those with difficulties above 60 on the RR Measure. *What Mynah Bird Saw* is the passage with the lowest RR Measure score of all those passages in the first full cluster. The RR Measure difficulty value of this passage is estimated at 48.51. When all 1575 students who had scores (including extreme scores) are considered, an RR Measure of 48.20 defines the 50th percentile. Table 6 provides a frequency distribution of RR Measure scores for the entire sample of 1575 students.

**Table 6. Frequency Distribution of RR Measure
(extreme scores included)**

| Raw Score | RR Meas. | S.E. | Freq | % | Cum. Freq. | Cum. % | % ile | Raw Score | RR Meas. | S.E. | Freq | % | Cum. Freq. | Cum. % | % ile |
|-----------|----------|-------|------|-----|------------|--------|-------|-----------|-------------|------|------|-----|------------|--------|-------|
| 17 | .02 est. | 6.66 | 151 | 9.6 | 151 | 9.6 | 5 | 51 | 53.37 | 1.33 | 10 | 0.6 | 912 | 57.9 | 58 |
| 18 | 7.03 | 10.72 | 76 | 4.8 | 227 | 14.4 | 12 | 52 | 53.94 | 1.34 | 18 | 1.1 | 930 | 59.0 | 58 |
| 19 | 20.77 | 5.05 | 47 | 3.0 | 274 | 17.4 | 16 | 53 | 54.52 | 1.35 | 8 | 0.5 | 938 | 59.6 | 59 |
| 20 | 26.40 | 3.39 | 68 | 4.3 | 342 | 21.7 | 20 | 54 | 55.11 | 1.36 | 3 | 0.2 | 941 | 59.7 | 60 |
| 21 | 29.35 | 2.73 | 1 | 0.1 | 343 | 21.8 | 22 | 55 | 55.71 | 1.37 | 10 | 0.6 | 951 | 60.4 | 60 |
| 22 | 31.45 | 2.41 | 31 | 2.0 | 374 | 23.7 | 23 | 56 | 56.32 | 1.38 | 13 | 0.8 | 964 | 61.2 | 61 |
| 23 | 33.16 | 2.20 | 43 | 2.7 | 417 | 26.5 | 25 | 57 | 56.94 | 1.40 | 26 | 1.7 | 990 | 62.9 | 62 |
| 24 | 34.61 | 2.04 | 28 | 1.8 | 445 | 28.3 | 27 | 58 | 57.58 | 1.41 | 7 | 0.4 | 997 | 63.3 | 63 |
| 25 | 35.87 | 1.92 | 21 | 1.3 | 466 | 29.6 | 29 | 59 | 58.24 | 1.44 | 13 | 0.8 | 1010 | 64.1 | 64 |
| 26 | 36.99 | 1.81 | 32 | 2.0 | 498 | 31.6 | 31 | 60 | 58.91 | 1.46 | 16 | 1.0 | 1026 | 65.1 | 65 |
| 27 | 38.00 | 1.72 | 32 | 2.0 | 530 | 33.7 | 33 | 61 | 59.62 | 1.49 | 20 | 1.3 | 1046 | 66.4 | 66 |
| 28 | 38.91 | 1.65 | 20 | 1.3 | 550 | 34.9 | 34 | 62 | 60.35 | 1.52 | 19 | 1.2 | 1065 | 67.6 | 67 |
| 29 | 39.76 | 1.59 | 23 | 1.5 | 573 | 36.4 | 36 | 63 | 61.11 | 1.55 | 19 | 1.2 | 1084 | 68.8 | 68 |
| 30 | 40.54 | 1.54 | 18 | 1.1 | 591 | 37.5 | 37 | 64 | 61.91 | 1.59 | 8 | 0.5 | 1092 | 69.3 | 69 |
| 31 | 41.28 | 1.50 | 20 | 1.3 | 611 | 38.8 | 38 | 65 | 62.74 | 1.62 | 21 | 1.3 | 1113 | 70.7 | 70 |
| 32 | 41.99 | 1.46 | 18 | 1.1 | 629 | 39.9 | 39 | 66 | 63.61 | 1.66 | 23 | 1.5 | 1136 | 72.1 | 71 |
| 33 | 42.67 | 1.44 | 32 | 2.0 | 661 | 42.0 | 41 | 67 | 64.51 | 1.68 | 9 | 0.6 | 1145 | 72.7 | 72 |
| 34 | 43.33 | 1.42 | 18 | 1.1 | 679 | 43.1 | 43 | 68 | 65.43 | 1.70 | 13 | 0.8 | 1158 | 73.5 | 73 |
| 35 | 43.97 | 1.40 | 12 | 0.8 | 691 | 43.9 | 43 | 69 | 66.38 | 1.72 | 23 | 1.5 | 1181 | 75.0 | 74 |
| 36 | 44.59 | 1.39 | 17 | 1.1 | 708 | 45.0 | 44 | 70 | 67.34 | 1.74 | 19 | 1.2 | 1200 | 76.2 | 76 |
| 37 | 45.21 | 1.38 | 11 | 0.7 | 719 | 45.7 | 45 | 71 | 68.33 | 1.76 | 10 | 0.6 | 1210 | 76.8 | 77 |
| 38 | 45.82 | 1.37 | 11 | 0.7 | 730 | 46.3 | 46 | 72 | 69.34 | 1.79 | 19 | 1.2 | 1229 | 78.0 | 77 |
| 39 | 46.42 | 1.36 | 13 | 0.8 | 743 | 47.2 | 47 | 73 | 70.41 | 1.84 | 7 | 0.4 | 1236 | 78.5 | 78 |
| 40 | 47.02 | 1.36 | 15 | 1.0 | 758 | 48.1 | 48 | 74 | 71.54 | 1.91 | 25 | 1.6 | 1261 | 80.1 | 79 |
| 41 | 47.61 | 1.35 | 22 | 1.4 | 780 | 49.5 | 49 | 75 | 72.79 | 2.02 | 17 | 1.1 | 1278 | 81.1 | 81 |
| 42 | 48.20 | 1.35 | 16 | 1.0 | 796 | 50.5 | 50 | 76 | 74.21 | 2.18 | 8 | 0.5 | 1286 | 81.7 | 81 |
| 43 | 48.79 | 1.34 | 12 | 0.8 | 808 | 51.3 | 51 | 77 | 75.92 | 2.44 | 4 | 0.3 | 1290 | 81.9 | 82 |
| 44 | 49.37 | 1.34 | 18 | 1.1 | 826 | 52.4 | 52 | 78 | 78.19 | 2.88 | 33 | 2.1 | 1323 | 84.0 | 83 |
| 45 | 49.94 | 1.33 | 16 | 1.0 | 842 | 53.5 | 53 | 79 | 81.44 | 3.42 | 53 | 3.4 | 1376 | 87.4 | 86 |
| 46 | 50.52 | 1.33 | 15 | 1.0 | 857 | 54.4 | 54 | 80 | 85.34 | 3.47 | 21 | 1.3 | 1397 | 88.7 | 88 |
| 47 | 51.09 | 1.33 | 10 | 0.6 | 867 | 55.0 | 55 | 81 | 89.24 | 3.51 | 30 | 1.9 | 1427 | 90.6 | 90 |
| 48 | 51.66 | 1.33 | 10 | 0.6 | 877 | 55.7 | 55 | 82 | 93.33 | 3.63 | 87 | 5.5 | 1514 | 96.1 | 93 |
| 49 | 52.22 | 1.33 | 6 | 0.4 | 883 | 56.1 | 56 | 83 | 98.15 | 4.21 | 61 | 3.9 | 1575 | 100.0 | 98 |
| 50 | 52.79 | 1.33 | 19 | 1.2 | 902 | 57.3 | 57 | 84 | 100.00 est. | 4.63 | 0 | 0.0 | 1575 | 100.0 | 100 |

Validation

Correlations between the RR Measure and the CTBS/5 Terra Nova vocabulary and word analysis subtests were in the moderate range -- .71 and .54 respectively. Between the two CTBS/5 subtests the correlation was .62. These correlations are summarized in Table 7.

With correlations of this magnitude, some consideration may be given to the possibility of using the RR Measure to estimate CTBS/5 subtest scores for purposes of making decisions regarding “grade level” status. To address this purpose, the sample of students who took the CTBS/5 was divided randomly into two equal size groups. For each group, each CTBS/5 subtest NCE score was regressed onto the RR Measure. For each of the four regression analyses (two subtests X two groups), predicted CTBS/5 NCE scores were generated.

Table 7. Correlations Between RR Measure and CTBS/5-Terra Nova Subtests

| | RR Measure | CTBS/5 Vocabulary | CTBS/5 Word Analysis |
|----------------------|------------|-------------------|----------------------|
| RR Measure | | .71 | .54 |
| CTBS/5 Vocabulary | 442 | | .62 |
| CTBS/5 Word Analysis | 442 | 470 | |

Note: Numbers below the diagonal represent the score pairs contributing to the correlations.

To satisfy the requirements of double cross-validation, the regression coefficients from each group solution was applied to the other group. New sets of predicted NCE scores were generated for each group in each subtest. Correlations between predicted and observed NCE scores were computed to examine the degree of shrinkage in explained variance (r^2) that might be expected were these procedures to be used with another group of students. A summary of these analyses is provided in Table 8.

Table 8. Correlations Between Observed and Predicted CTBS/5 Terra Nova Subtest NCE Scores - Based On Weights from Group, Cross-group, and Total Sample Regression Solutions

| CTBS/5 Terra Nova Subtest | Predicted Value of CTBS/5-Terra Nova Subtest NCE Based On: | | | Regression Equation to Predict CTBS/5 Terra Nova Subtest NCE (for Total Sample) |
|---------------------------|--|---------------------------------------|--|---|
| | Group Regression Coefficients | Other Group's Regression Coefficients | Total Sample's Regression Coefficients | |
| Vocabulary | .712 ($r^2=.51$) | .693 ($r^2=.48$) | .709 ($r^2=.50$) | 25.62 + .58(RR Measure) Std Errs: constant = 1.64 RR Measure = .027 |
| Word Analysis | .544 ($r^2=.30$) | .541 ($r^2=.29$) | .543 ($r^2=.29$) | 33.46 + .41(RR Measure) Std Errs: constant = 1.80 RR Measure = .030 |

As Table 8 reveals, the shrinkage in r^2 was minimal for both subtests, thus indicating that predictions of CTBS/5 subtest NCE scores from the RR Measure can be expected to be stable for similar samples of students. However, the confidence in such predictions may not be tolerable when precision is critical. For example, the regression equation for vocabulary would be expected to yield the most precise estimates of CTBS/5 Vocabulary NCE. Yet, for a RR Measure of 48, the 95% confidence band for the estimate of Vocabulary NCE would be 47.64 – 59.28. This range (11.64) represents more than one-half standard deviation in a normally distributed population. Users making such estimates of NCE scores, should take this into account before making important decisions based on their results. More directly, decisions at the individual student level using predicted NCE scores should be avoided; the data simply do not support such use. Decisions at the aggregate level seem more appropriate but only with adequate size groups (e.g., >50) and when decisions can be easily reversed (i.e. low stakes).

Implementation

At the classroom level, implementation would involve having students read passages only from the calibrated collection. The initial passage would be determined by the teacher’s estimate of the passage the student would be able to read with relative success. Taking the running records would be carried out as it was in this study. It would only be necessary to record the number of uncorrected errors. For each passage read, recording the time it required the student to complete would also be essential.

In most instances, two passages read will be sufficient to produce reliable estimates of the RR Measure. The qualifiers to this are that both passages:

1. are read well enough (Accuracy \geq 50%) for each performance to be placed into one of the five categories of the ordered categories raw score scale.
2. not result in leveled category raw scores of 1 and 1 or 5 and 5.

In short, passages should be used that offer the student challenge but not frustration. These should not be problematic requirements; most teachers are able to produce a fairly accurate guess about a student’s general reading ability and hence the student’s likelihood of success with reading a particular passage. From that point, a typical running records data collection routine (a count of uncorrected errors) plus a recording of the amount of time required to read each passage will be adequate to assemble the raw scores and derive an RR Measure. In order to provide a useful measure, it is not necessary to insist on the student reading until an “instructional” level (e.g., 90%-95%) is reached.

Scoring represents *the* challenge to implementation. There are 136 possible two-passage combinations. For each combination there are 10 possible RR Measure scores (one for each possible raw-score total; 2 passages x 5 categories), or a total of 1360 possible RR Measure scores. Determining raw scores requires some basic math computation. This could be done with the aid of a calculator and entered onto a student roster. The basic computations to be completed include:

$$\text{Accuracy} = \frac{\text{Uncorrected Errors}}{\# \text{ Words in Passage}} \quad , \quad \text{Words per Minute} = \frac{\# \text{ Words in Passage}}{\text{Seconds to Complete}} * 60$$

$$\text{Rate Adjusted Accuracy Raw score} = \text{Accuracy} * \text{Words per Minute}.$$

Where Accuracy $>$.50, the rate adjusted accuracy raw scores would have to be converted to an ordered category score according to: <30 = 1; 30-<40 = 2; 40-<55 = 3; 55-<75 = 4; \geq 75 = 5.

The total of the ordered category scores for the pair of passages would have to be looked up to determine the student’s RR Measure. For example, if passage numbers 3 and 7 had ordered category scores of 5 and 3, the total of 8 would be looked up for the 3-7 passage pair to find the student’s RR Measure. An alternative to hand calculations is a set of lookup tables. Accuracy, words per minute, and the categorical values of the rate adjusted accuracy scores are available in Tables 9 through 11.

Table 9. Accuracy Percentages for Number of Uncorrected Errors

| Accuracy | I Have a Home | What Mynah Bird Say | Speak Up! | Night Noises | A Fire at the Zoo | Same but Different | Lizard's Grandmother | Emilio and the River | Trog | Living in the Sky | The Little Old Lady Who | Camping with Our Dad | The Secret of Cannonball | Ishmaal and the Glass Horse | Elliot / Drainpipe Kids | Shambles | The Adventures of Tutank. | Accuracy |
|----------|---------------|---------------------|-----------|--------------|-------------------|--------------------|----------------------|----------------------|------|-------------------|-------------------------|----------------------|--------------------------|-----------------------------|-------------------------|----------|---------------------------|----------|
| 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 |
| 0.99 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 0.99 |
| 0.98 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 0.98 |
| 0.97 | 2 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 5 | 6 | 6 | 6 | 6 | 6 | 0.97 |
| 0.96 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 7 | 8 | 8 | 8 | 8 | 0.96 |
| 0.95 | 4 | 5 | 5 | 5 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 6 | 9 | 10 | 11 | 11 | 10 | 0.95 |
| 0.94 | 5 | 5 | 6 | 6 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 7 | 11 | 12 | 13 | 13 | 13 | 0.94 |
| 0.93 | 6 | 6 | 7 | 7 | 9 | 8 | 8 | 7 | 7 | 7 | 7 | 8 | 13 | 14 | 15 | 15 | 15 | 0.93 |
| 0.92 | 6 | 7 | 8 | 8 | 10 | 9 | 9 | 8 | 8 | 8 | 8 | 9 | 15 | 16 | 17 | 17 | 17 | 0.92 |
| 0.91 | 7 | 8 | 9 | 9 | 11 | 11 | 10 | 9 | 9 | 9 | 10 | 16 | 18 | 19 | 19 | 19 | 19 | 0.91 |
| 0.90 | 8 | 9 | 10 | 11 | 12 | 12 | 11 | 10 | 10 | 10 | 11 | 12 | 18 | 20 | 21 | 21 | 21 | 0.90 |
| 0.89 | 9 | 10 | 11 | 12 | 14 | 13 | 13 | 11 | 11 | 11 | 12 | 13 | 20 | 22 | 23 | 23 | 23 | 0.89 |
| 0.88 | 9 | 11 | 12 | 13 | 15 | 14 | 14 | 12 | 12 | 12 | 13 | 14 | 22 | 24 | 25 | 25 | 25 | 0.88 |
| 0.87 | 10 | 12 | 13 | 14 | 16 | 15 | 15 | 14 | 13 | 13 | 14 | 15 | 24 | 26 | 27 | 28 | 27 | 0.87 |
| 0.86 | 11 | 13 | 14 | 15 | 17 | 16 | 16 | 15 | 14 | 14 | 15 | 16 | 25 | 28 | 29 | 30 | 29 | 0.86 |
| 0.85 | 12 | 14 | 15 | 16 | 19 | 18 | 17 | 16 | 15 | 15 | 16 | 17 | 27 | 30 | 32 | 32 | 31 | 0.85 |
| 0.84 | 13 | 14 | 16 | 17 | 20 | 19 | 18 | 17 | 16 | 16 | 17 | 19 | 29 | 32 | 34 | 34 | 33 | 0.84 |
| 0.83 | 13 | 15 | 17 | 18 | 21 | 20 | 19 | 18 | 18 | 17 | 18 | 20 | 31 | 34 | 36 | 36 | 36 | 0.83 |
| 0.82 | 14 | 16 | 18 | 19 | 22 | 21 | 21 | 19 | 19 | 18 | 19 | 21 | 33 | 36 | 38 | 38 | 38 | 0.82 |
| 0.81 | 15 | 17 | 19 | 20 | 24 | 22 | 22 | 20 | 20 | 19 | 20 | 22 | 35 | 38 | 40 | 40 | 40 | 0.81 |
| 0.80 | 16 | 18 | 20 | 21 | 25 | 23 | 23 | 21 | 21 | 20 | 21 | 23 | 36 | 40 | 42 | 42 | 42 | 0.80 |
| 0.79 | 17 | 19 | 21 | 22 | 26 | 25 | 24 | 22 | 22 | 21 | 22 | 24 | 38 | 42 | 44 | 45 | 44 | 0.79 |
| 0.78 | 17 | 20 | 22 | 23 | 27 | 26 | 25 | 23 | 23 | 22 | 23 | 26 | 40 | 44 | 46 | 47 | 46 | 0.78 |
| 0.77 | 18 | 21 | 23 | 24 | 29 | 27 | 26 | 24 | 24 | 23 | 24 | 27 | 42 | 46 | 48 | 49 | 48 | 0.77 |
| 0.76 | 19 | 22 | 24 | 25 | 30 | 28 | 27 | 25 | 25 | 24 | 25 | 28 | 44 | 48 | 50 | 51 | 50 | 0.76 |
| 0.75 | 20 | 23 | 25 | 26 | 31 | 29 | 29 | 26 | 26 | 25 | 27 | 29 | 46 | 50 | 53 | 53 | 52 | 0.75 |
| 0.74 | 21 | 23 | 25 | 27 | 32 | 30 | 30 | 27 | 27 | 26 | 28 | 30 | 47 | 52 | 55 | 55 | 54 | 0.74 |
| 0.73 | 21 | 24 | 26 | 28 | 33 | 32 | 31 | 28 | 28 | 27 | 29 | 31 | 49 | 54 | 57 | 57 | 56 | 0.73 |
| 0.72 | 22 | 25 | 27 | 29 | 35 | 33 | 32 | 29 | 29 | 28 | 30 | 32 | 51 | 56 | 59 | 59 | 59 | 0.72 |
| 0.71 | 23 | 26 | 28 | 30 | 36 | 34 | 33 | 30 | 30 | 29 | 31 | 34 | 53 | 58 | 61 | 61 | 61 | 0.71 |
| 0.70 | 24 | 27 | 29 | 32 | 37 | 35 | 34 | 31 | 31 | 30 | 32 | 35 | 55 | 60 | 63 | 64 | 63 | 0.70 |
| 0.69 | 24 | 28 | 30 | 33 | 38 | 36 | 35 | 32 | 32 | 31 | 33 | 36 | 56 | 62 | 65 | 66 | 65 | 0.69 |
| 0.68 | 25 | 29 | 31 | 34 | 40 | 37 | 36 | 33 | 33 | 32 | 34 | 37 | 58 | 64 | 67 | 68 | 67 | 0.68 |
| 0.67 | 26 | 30 | 32 | 35 | 41 | 39 | 38 | 34 | 34 | 33 | 35 | 38 | 60 | 66 | 69 | 70 | 69 | 0.67 |
| 0.66 | 27 | 31 | 33 | 36 | 42 | 40 | 39 | 35 | 35 | 34 | 36 | 39 | 62 | 68 | 71 | 72 | 71 | 0.66 |
| 0.65 | 28 | 32 | 34 | 37 | 43 | 41 | 40 | 36 | 36 | 35 | 37 | 41 | 64 | 70 | 74 | 74 | 73 | 0.65 |
| 0.64 | 28 | 32 | 35 | 38 | 45 | 42 | 41 | 37 | 37 | 36 | 38 | 42 | 66 | 72 | 76 | 76 | 75 | 0.64 |
| 0.63 | 29 | 33 | 36 | 39 | 46 | 43 | 42 | 38 | 38 | 37 | 39 | 43 | 67 | 74 | 78 | 78 | 77 | 0.63 |
| 0.62 | 30 | 34 | 37 | 40 | 47 | 44 | 43 | 40 | 39 | 38 | 40 | 44 | 69 | 76 | 80 | 81 | 79 | 0.62 |
| 0.61 | 31 | 35 | 38 | 41 | 48 | 46 | 44 | 41 | 40 | 39 | 41 | 45 | 71 | 78 | 82 | 83 | 82 | 0.61 |
| 0.60 | 32 | 36 | 39 | 42 | 50 | 47 | 46 | 42 | 41 | 40 | 42 | 46 | 73 | 80 | 84 | 85 | 84 | 0.60 |
| 0.59 | 32 | 37 | 40 | 43 | 51 | 48 | 47 | 43 | 42 | 41 | 43 | 48 | 75 | 82 | 86 | 87 | 86 | 0.59 |
| 0.58 | 33 | 38 | 41 | 44 | 52 | 49 | 48 | 44 | 43 | 42 | 45 | 49 | 76 | 84 | 88 | 89 | 88 | 0.58 |
| 0.57 | 34 | 39 | 42 | 45 | 53 | 50 | 49 | 45 | 44 | 43 | 46 | 50 | 78 | 86 | 90 | 91 | 90 | 0.57 |
| 0.56 | 35 | 40 | 43 | 46 | 55 | 51 | 50 | 46 | 45 | 44 | 47 | 51 | 80 | 88 | 92 | 93 | 92 | 0.56 |
| 0.55 | 36 | 41 | 44 | 47 | 56 | 53 | 51 | 47 | 46 | 45 | 48 | 52 | 82 | 90 | 95 | 95 | 94 | 0.55 |
| 0.54 | 36 | 41 | 45 | 48 | 57 | 54 | 52 | 48 | 47 | 46 | 49 | 53 | 84 | 92 | 97 | 98 | 96 | 0.54 |
| 0.53 | 37 | 42 | 46 | 49 | 58 | 55 | 54 | 49 | 48 | 47 | 50 | 55 | 86 | 94 | 99 | 100 | 98 | 0.53 |
| 0.52 | 38 | 43 | 47 | 50 | 60 | 56 | 55 | 50 | 49 | 48 | 51 | 56 | 87 | 96 | 101 | 102 | 100 | 0.52 |
| 0.51 | 39 | 44 | 48 | 51 | 61 | 57 | 56 | 51 | 50 | 49 | 52 | 57 | 89 | 98 | 103 | 104 | 102 | 0.51 |
| 0.50 | 40 | 45 | 49 | 53 | 62 | 59 | 57 | 52 | 52 | 51 | 53 | 58 | 91 | 101 | 105 | 106 | 105 | 0.50 |
| # words | 79 | 90 | 98 | 105 | 124 | 117 | 114 | 104 | 103 | 101 | 106 | 116 | 182 | 201 | 210 | 212 | 209 | # words |

Table 10. Words Per Minute for Number of Seconds to Complete a Passage (Sample Portion of Table)

| WPM | I Have a Home | What Mynah Bird Saw | Speak Up! | Night Noises | A Fire at the Zoo | Same but Different | Lizard's Grandmother | Emilio and the River | Trog | Living in the Sky | The Little Old Lady Who | Camping with Our Dad | The Secret of Cannonball | Ishmaal and the Glass Horse | Elliot / Drainpipe Kids | Shambles | The Adventures of Tutank. | WPM |
|-----|---------------|---------------------|-----------|--------------|-------------------|--------------------|----------------------|----------------------|------|-------------------|-------------------------|----------------------|--------------------------|-----------------------------|-------------------------|----------|---------------------------|-----|
| 10 | 474 | 540 | 588 | 630 | 744 | 702 | 684 | 624 | 618 | 606 | 636 | 696 | 1092 | 1206 | 1260 | 1272 | 1254 | 10 |
| 11 | 431 | 491 | 535 | 573 | 676 | 638 | 622 | 567 | 562 | 551 | 578 | 633 | 993 | 1096 | 1145 | 1156 | 1140 | 11 |
| 12 | 395 | 450 | 490 | 525 | 620 | 585 | 570 | 520 | 515 | 505 | 530 | 580 | 910 | 1005 | 1050 | 1060 | 1045 | 12 |
| 13 | 365 | 415 | 452 | 485 | 572 | 540 | 526 | 480 | 475 | 466 | 489 | 535 | 840 | 928 | 969 | 978 | 965 | 13 |
| 14 | 339 | 386 | 420 | 450 | 531 | 501 | 489 | 446 | 441 | 433 | 454 | 497 | 780 | 861 | 900 | 909 | 896 | 14 |
| 15 | 316 | 360 | 392 | 420 | 496 | 468 | 456 | 416 | 412 | 404 | 424 | 464 | 728 | 804 | 840 | 848 | 836 | 15 |
| 16 | 296 | 338 | 368 | 394 | 465 | 439 | 428 | 390 | 386 | 379 | 398 | 435 | 683 | 754 | 788 | 795 | 784 | 16 |
| 17 | 279 | 318 | 346 | 371 | 438 | 413 | 402 | 367 | 364 | 356 | 374 | 409 | 642 | 709 | 741 | 748 | 738 | 17 |
| 18 | 263 | 300 | 327 | 350 | 413 | 390 | 380 | 347 | 343 | 337 | 353 | 387 | 607 | 670 | 700 | 707 | 697 | 18 |
| 19 | 249 | 284 | 309 | 332 | 392 | 369 | 360 | 328 | 325 | 319 | 335 | 366 | 575 | 635 | 663 | 669 | 660 | 19 |
| 20 | 237 | 270 | 294 | 315 | 372 | 351 | 342 | 312 | 309 | 303 | 318 | 348 | 546 | 603 | 630 | 636 | 627 | 20 |
| 21 | 226 | 257 | 280 | 300 | 354 | 334 | 326 | 297 | 294 | 289 | 303 | 331 | 520 | 574 | 600 | 606 | 597 | 21 |
| 22 | 215 | 245 | 267 | 286 | 338 | 319 | 311 | 284 | 281 | 275 | 289 | 316 | 496 | 548 | 573 | 578 | 570 | 22 |
| 23 | 206 | 235 | 256 | 274 | 323 | 305 | 297 | 271 | 269 | 263 | 277 | 303 | 475 | 524 | 548 | 553 | 545 | 23 |
| 24 | 198 | 225 | 245 | 263 | 310 | 293 | 285 | 260 | 258 | 253 | 265 | 290 | 455 | 503 | 525 | 530 | 523 | 24 |
| 25 | 190 | 216 | 235 | 252 | 298 | 281 | 274 | 250 | 247 | 242 | 254 | 278 | 437 | 482 | 504 | 509 | 502 | 25 |
| 26 | 182 | 208 | 226 | 242 | 286 | 270 | 263 | 240 | 238 | 233 | 245 | 268 | 420 | 464 | 485 | 489 | 482 | 26 |
| 27 | 176 | 200 | 218 | 233 | 276 | 260 | 253 | 231 | 229 | 224 | 236 | 258 | 404 | 447 | 467 | 471 | 464 | 27 |
| 28 | 169 | 193 | 210 | 225 | 266 | 251 | 244 | 223 | 221 | 216 | 227 | 249 | 390 | 431 | 450 | 454 | 448 | 28 |
| 29 | 163 | 186 | 203 | 217 | 257 | 242 | 236 | 215 | 213 | 209 | 219 | 240 | 377 | 416 | 434 | 439 | 432 | 29 |
| 30 | 158 | 180 | 196 | 210 | 248 | 234 | 228 | 208 | 206 | 202 | 212 | 232 | 364 | 402 | 420 | 424 | 418 | 30 |
| 31 | 153 | 174 | 190 | 203 | 240 | 226 | 221 | 201 | 199 | 195 | 205 | 225 | 352 | 389 | 406 | 410 | 405 | 31 |
| 32 | 148 | 169 | 184 | 197 | 233 | 219 | 214 | 195 | 193 | 189 | 199 | 218 | 341 | 377 | 394 | 398 | 392 | 32 |
| 33 | 144 | 164 | 178 | 191 | 225 | 213 | 207 | 189 | 187 | 184 | 193 | 211 | 331 | 365 | 382 | 385 | 380 | 33 |
| 34 | 139 | 159 | 173 | 185 | 219 | 206 | 201 | 184 | 182 | 178 | 187 | 205 | 321 | 355 | 371 | 374 | 369 | 34 |
| 35 | 135 | 154 | 168 | 180 | 213 | 201 | 195 | 178 | 177 | 173 | 182 | 199 | 312 | 345 | 360 | 363 | 358 | 35 |
| 36 | 132 | 150 | 163 | 175 | 207 | 195 | 190 | 173 | 172 | 168 | 177 | 193 | 303 | 335 | 350 | 353 | 348 | 36 |
| 37 | 128 | 146 | 159 | 170 | 201 | 190 | 185 | 169 | 167 | 164 | 172 | 188 | 295 | 326 | 341 | 344 | 339 | 37 |
| 38 | 125 | 142 | 155 | 166 | 196 | 185 | 180 | 164 | 163 | 159 | 167 | 183 | 287 | 317 | 332 | 335 | 330 | 38 |
| 39 | 122 | 138 | 151 | 162 | 191 | 180 | 175 | 160 | 158 | 155 | 163 | 178 | 280 | 309 | 323 | 326 | 322 | 39 |
| 40 | 119 | 135 | 147 | 158 | 186 | 176 | 171 | 156 | 155 | 152 | 159 | 174 | 273 | 302 | 315 | 318 | 314 | 40 |
| 41 | 116 | 132 | 143 | 154 | 181 | 171 | 167 | 152 | 151 | 148 | 155 | 170 | 266 | 294 | 307 | 310 | 306 | 41 |
| 42 | 113 | 129 | 140 | 150 | 177 | 167 | 163 | 149 | 147 | 144 | 151 | 166 | 260 | 287 | 300 | 303 | 299 | 42 |
| 43 | 110 | 126 | 137 | 147 | 173 | 163 | 159 | 145 | 144 | 141 | 148 | 162 | 254 | 280 | 293 | 296 | 292 | 43 |
| 44 | 108 | 123 | 134 | 143 | 169 | 160 | 155 | 142 | 140 | 138 | 145 | 158 | 248 | 274 | 286 | 289 | 285 | 44 |
| 45 | 105 | 120 | 131 | 140 | 165 | 156 | 152 | 139 | 137 | 135 | 141 | 155 | 243 | 268 | 280 | 283 | 279 | 45 |
| 46 | 103 | 117 | 128 | 137 | 162 | 153 | 149 | 136 | 134 | 132 | 138 | 151 | 237 | 262 | 274 | 277 | 273 | 46 |
| 47 | 101 | 115 | 125 | 134 | 158 | 149 | 146 | 133 | 131 | 129 | 135 | 148 | 232 | 257 | 268 | 271 | 267 | 47 |
| 48 | 99 | 113 | 123 | 131 | 155 | 146 | 143 | 130 | 129 | 126 | 133 | 145 | 228 | 251 | 263 | 265 | 261 | 48 |
| 49 | 97 | 110 | 120 | 129 | 152 | 143 | 140 | 127 | 126 | 124 | 130 | 142 | 223 | 246 | 257 | 260 | 256 | 49 |
| 50 | 95 | 108 | 118 | 126 | 149 | 140 | 137 | 125 | 124 | 121 | 127 | 139 | 218 | 241 | 252 | 254 | 251 | 50 |
| 51 | 93 | 106 | 115 | 124 | 146 | 138 | 134 | 122 | 121 | 119 | 125 | 136 | 214 | 236 | 247 | 249 | 246 | 51 |
| 52 | 91 | 104 | 113 | 121 | 143 | 135 | 132 | 120 | 119 | 117 | 122 | 134 | 210 | 232 | 242 | 245 | 241 | 52 |
| 53 | 89 | 102 | 111 | 119 | 140 | 132 | 129 | 118 | 117 | 114 | 120 | 131 | 206 | 228 | 238 | 240 | 237 | 53 |
| 54 | 88 | 100 | 109 | 117 | 138 | 130 | 127 | 116 | 114 | 112 | 118 | 129 | 202 | 223 | 233 | 236 | 232 | 54 |
| 55 | 86 | 98 | 107 | 115 | 135 | 128 | 124 | 113 | 112 | 110 | 116 | 127 | 199 | 219 | 229 | 231 | 228 | 55 |
| 56 | 85 | 96 | 105 | 113 | 133 | 125 | 122 | 111 | 110 | 108 | 114 | 124 | 195 | 215 | 225 | 227 | 224 | 56 |
| 57 | 83 | 95 | 103 | 111 | 131 | 123 | 120 | 109 | 108 | 106 | 112 | 122 | 192 | 212 | 221 | 223 | 220 | 57 |
| 58 | 82 | 93 | 101 | 109 | 128 | 121 | 118 | 108 | 107 | 104 | 110 | 120 | 188 | 208 | 217 | 219 | 216 | 58 |
| 59 | 80 | 92 | 100 | 107 | 126 | 119 | 116 | 106 | 105 | 103 | 108 | 118 | 185 | 204 | 214 | 216 | 213 | 59 |

Table 11. Rate-Adjusted Accuracy Category Scores (Sample Portion of Table)

| WPM --> | <30 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 |
|---------|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Acc. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.00 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.99 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.98 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.97 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.96 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.95 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.94 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.93 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.92 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.91 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.90 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.89 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.88 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.87 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.86 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.85 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.84 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.83 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.82 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0.81 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 0.80 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 0.79 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| 0.78 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| 0.77 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| 0.76 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| 0.75 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 |
| 0.74 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 0.73 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 0.72 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 0.71 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 0.70 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 0.69 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 0.68 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 0.67 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 0.66 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 0.65 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 0.64 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 0.63 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 0.62 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| 0.61 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 |
| 0.60 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 |
| 0.59 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 0.58 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 0.57 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 0.56 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| 0.55 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0.54 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0.53 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0.52 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0.51 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0.50 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

This set of tables (9, 10 and 11) plus a table providing RR Measure scores for total Rate-Adjusted Accuracy scores for pairs of passages read (not provided here), would all be necessary for complete scoring. This scheme is not much different than what would be required when scoring a standardized achievement test manually. The process is cumbersome, to say the least. An alternative to manual computation or a set of lookup tables is to use a simple spreadsheet template.

Figure 3 shows an example of how a spreadsheet might be used to automate the table lookup process. Here, the student's name is entered along with the passages numbers read, the number of uncorrected errors committed on each passage and the time required to complete each passage are entered. The bolded column heading (Accuracy, WPM, Rate Adjusted Accuracy, RR Measure, and Error) are all calculated automatically after the basic data have been entered.

| Student Name | First Passage | | | | | | | Second Passage | | | | | | | RR Meas. Err. | |
|----------------|---------------|-----|-----|-----|------|-----|--------------|----------------|-----|-----|-----|------|-----|--------------|---------------|-----|
| | Pass. No. | Err | Min | Sec | Acc | WPM | Rate Adj Acc | Pass. No. | Err | Min | Sec | Acc | WPM | Rate Adj Acc | | |
| Sam Adams | 5 | 2 | 3 | 2 | 0.98 | 32 | 2 | 8 | 5 | 4 | 44 | 0.96 | 25 | 1 | 43.7 | 3.5 |
| Debbie Brown | 9 | 12 | 2 | 18 | 0.89 | 50 | 3 | 13 | 19 | 3 | 40 | 0.82 | 29 | 1 | 56.6 | 3.8 |
| Ray Charles | 6 | 14 | 2 | 16 | 0.87 | 46 | 3 | 5 | 10 | 2 | 10 | 0.9 | 45 | 3 | 48.1 | 4.2 |
| Bobbi Downey | 8 | 5 | 2 | 25 | 0.96 | 48 | 3 | 11 | 14 | 3 | 36 | 0.86 | 29 | 1 | 54.2 | 4.5 |
| Henry Eli | 8 | 19 | 3 | 1 | 0.84 | 39 | 2 | 6 | 12 | 2 | 24 | 0.89 | 44 | 2 | 46.0 | 4.5 |
| Darlene George | 7 | 24 | 2 | 21 | 0.81 | 53 | 3 | 5 | 12 | 2 | 5 | 0.88 | 47 | 3 | 45.3 | 4.8 |
| Tom Hanks | 5 | 1 | 3 | 4 | 0.99 | 32 | 2 | 6 | 6 | 3 | 47 | 0.94 | 28 | 1 | 42.2 | 3.4 |
| Lois Lane | 11 | 4 | 2 | 13 | 0.96 | 46 | 3 | 14 | 9 | 3 | 17 | 0.92 | 35 | 2 | 60.6 | 3.3 |
| Paul Menhart | 4 | 8 | 2 | 22 | 0.91 | 38 | 2 | 3 | 3 | 2 | 9 | 0.96 | 37 | 2 | 40.4 | 4.6 |

Figure 3. Sample Spreadsheet for Calculating RR Measures (invented data)

The final part of implementation at the classroom level would be re-administering to students in the later part of the school year. Whether this is done for all students or only those students initially considered as “below grade level” or “at risk,” the process would be essentially the same as for the beginning of the year. Because all passages hold a specific point on the RR Measure scale, the RR Measure derived from any two-passage set is comparable to the RR Measure derived from any other two-passage set. *It is not necessary to re-administer the same two passages each time.*

System Level

Beyond the usual maintenance and operations routines involving material availability and security, implementation at the system level will likely require adding passages to the collection. Of course before any passage will be useful in this context, its difficulty (RR Measure scale value) will have to be determined. The procedures for accomplishing this are well known and can be easily summarized.

New passages will have the same general characteristics as those used in this study. That is, they will preferably come from short, primary level books and be about 75 to 230 words in length. It is not necessary that the materials come from WG, though they should be appealing to second graders.

The new passage, along with two passages that are already scaled (have a RR Measure scale value), will need to be read by 200-250 students. Rate adjusted accuracy raw scores would have to be determined for all three passages, just as was done in this study. A Rasch analysis software program (e.g., BIGSTEPS) capable of handling categorical data will be required. Student performance on the two scaled passages would be used to anchor the students' ability on the RR Measure. The set of anchored scale values would be used to estimate the difficulty (RR Measure scale) value of the third passage. Finally, maximum likelihood estimation procedures

would be used to develop total categorical passage-pair to RR Measure conversion tables. Each table would be added to the passage-pair RR Measure matrix.

Conclusion

Accuracy and fluency in oral reading can be used productively to capture the linear progression of at least this aspect of reading ability. To accomplish this, it is imperative that precise, verifiable, and dependable estimates of passage difficulty be established. By doing so, reading ability can be measured and judged based on a student's interaction with reading material of empirically demonstrated difficulty rather than material with difficulty predicated merely on adult judgements. Further, when passage difficulty estimates are made using Rasch methodology, oral reading ability can be measured without reference to the group of students used to make the estimates. Rather, references can be made to the student's position on the underlying scale (RR Measure), to the passages that share proximity on the same scale, and perhaps those component(s) of the rate-adjusted accuracy measure (accuracy or rate or both) which could become a target for instruction.

Focusing on the oral reading accuracy and fluency of grade 2 students clearly meets the surface requirements of Washington State's Second Grade Reading Bill (ESHB 2042). Moreover the RR Measure: a) *must* be individually administered; b) assesses letter-sound recognition, phonemic awareness, word recognition, and reading connected text; and c) has texts (passages) that are ordered in relation to (empirically determined) difficulty. There should be little doubt that the RR Measure scale itself, as well as the procedures used to build it and to estimate a child's reading ability using the scale, meet any reasonable criteria of a sound assessment tool. Adding the RR Measure procedures to the list of Washington State approved second grade reading tests can only enrich the options.

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