Original Article

Reliability and validity of a Kannada rate of reading test

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Purpose: Kannada, one of the Dravidian languages, is the official language of Karnataka state of India. There is a need for a test using Kannada words that can assess visual aspects of reading independently of syntactic and semantic knowledge. **Methods:** A test of reading rate in Kannada was developed following the design principles of the Wilkins rate of reading test (RRT). Fifteen high-frequency bisyllabic Kannada words were selected. Children were recruited from state and private schools that used Kannada or English as the medium of instruction. A total of 799 children from Grade 2 to 9 participated in the study. Reading rate was measured using the English RRT and the Kannada version twice in immediate succession during the first session. In 85 children, measurements using the Kannada RRT were repeated after an interval of 15 days. **Results:** Pearson product moment correlation between the two immediately successive tests was 0.95 for the Kannada RRT and 0.91 for the English RRT. The correlation for the tests separated by an interval of 15 days was 0.83. When Kannada was the medium of instruction, there was little difference between test scores for Kannada and English. When English was the medium of instruction, test scores were greater in English. Scores increased as expected with age ($P < 0.0001$), similarly for Kannada and English tests. **Conclusion:** The newly developed Kannada RRT is both reliable and valid and can be used as a tool for measuring the visual aspects of reading.

Key words: English language, Kannada language, rate of reading test

Reading is a complex task involving vision, phonological decoding, word recognition, and comprehension. In schools, it is typically assessed by asking pupils to read short passages either aloud or silently, perhaps answering questions on the content of the passage. If a pupil underperforms, it is not clear without further testing which of the various component skills, such as vision, is the source of reading difficulty.

Traditionally, vision is measured in an eye care clinic simply by requiring an individual to read small isolated letters. In conventional text, the letters are larger than the acuity limit but in close proximity to one another, crowded into words. Further, the binocular control required for reading text is more complex than that required for the letter chart, involving the reestablishment of appropriate vergence after each saccade. The letter strokes in the text can be similar one to another, impairing this vergence control.[1] The lines of text both from the vertical letter strokes and from the lines of words resemble patterns of stripes that can cause perceptual distortions and discomfort, now collectively referred to as visual stress.[2,3]

The visual stress is sometimes treated using colored sheets of plastic placed on text when reading (colored overlays). The Wilkins rate of reading test (RRT) was developed to measure the effect of overlays in improving reading speed. It assesses the visual aspects of reading independently of the syntactic and semantic knowledge, which would otherwise increase the variance in reading speed. The test consists of a paragraph of randomly ordered common words that are read aloud as quickly as possible, and it is scored in terms of the number of words correctly read in 1 min. The test has proved useful in identifying the individuals who will subsequently continue to use overlays voluntarily in the long term.[4] The test can also assess the effects on reading speed of refractive errors and prisms for decompensated heterophoria.[5,6] The purpose of the present study was to create a version of the test in the Kannada language, used by people in the southwest of India, which has a transparent orthography unlike English. Performance on the Kannada version was compared with performance on an English version in children across different grades with Kannada or English as the medium of instruction. Repeated measures of both the English and Kannada versions were performed to estimate the reliability.

Methods

This study involves the development of a Kannada RRT to assess visual aspects of reading and estimation of its reliability and validity. All participants provided informed consent, and the research was conducted in accordance with the tenets of the Declaration of Helsinki. The study was approved by the Institutional Research and Ethics Committee.

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Development of Kannada reading rate test

A group of 97 Kannada words with a word frequency (frequency of occurrence) ≥90/100,000 words were selected from a repository of words published by the Central Institute of Indian Languages.[7] Only 3 of the 97 words were monosyllabic, 65 were bisyllabic, and the remaining words were either trisyllabic or tetrasyllabic. Owing to the paucity of monosyllabic words, 15 bisyllabic "content and nonpicture" words were selected for the development of the Kannada reading rate test (Kannada RRT), including verbs, nouns, adjectives, or adverbs. The selected words are given in Table 1.

The Kannada RRT was based on the same design principles as the English RRT.[4] Four versions of the Kannada RRT were developed. Each version had 10 lines consisting of the 15 selected Kannada words in a different random order. Each line was checked to ensure that (1) the words did not combine to form meaning; (2) one line did not end with the same word as began the next line, and (3) no consecutive lines had the same words vertically aligned.

"Tunga" font of 8-point size was used, and the reading paragraph was designed using Microsoft Publisher. This size was selected to match the vertical x-height of the English version. All words were single-spaced horizontally. The spacing between the lines was 0.8 point and between words was 0.65 point. The four different versions were printed as black letters on a white background using a 600 dpi laser printer. Fig. 1 shows one of the versions of Kannada RRT.

Participants

Participants were children from Grades 2 to 9 recruited from 9 schools located in Udupi Taluk including 4 private and 5 state schools that had English and Kannada, respectively, as the principal medium of instruction. Both males and females from each grade who were present on the day of examination were considered for the study. Based on the inclusion and exclusion criteria, 430 boys and 369 girls were recruited, ranging in age from 7 to 16 years. Fig. 2 shows the inclusion and exclusion criterion alongside participant

Table 1: Selected high-frequency bisyllabic Kannada words

Kannada word	Pronunciation	Frequency	Meaning
ಈಗ	Ee ga	1347	Now
ಹಗೆ	Ha gae	301	Grudge
ಹೋಗೆ	Hoo ge	202	Go
ಅಲ್ಲೆ	Al lee	188	There
ಹೇಳಿ	Hae le	188	Tell
ಮತ್ತೆ	Math ae	150	Again
ನೋಡಿ	No di	134	See
ಗೊತ್ತು	Goth thu	120	Know
ಇಲ್ಲಿ	El li	118	Here
ಜನ	Ja na	111	People
ದೊಡ್ಡ	Thod da	103	Big
ಅಲ್ಲ	Al laa	99	No
ಸರಿ	Sa ri	98	Correct
ಮುಖ್ಯ	Muk ya	96	Important
ಬೇಕು	Bae ku	95	Want

numbers at each stage of the study. Only three schools provided permission for conducting a repeat test. Based on simple random sampling, 85 children from these schools who were present on the day of testing (15 days after the initial assessment) were included for the repeat test. They included 57 boys and 28 girls, mean (standard deviation [SD]) age of 12 (1.6) years, and range: 9–16 years. The testing rooms were illuminated by daylight to a minimum of 600 lux with a maximum of 900 lux.

Rate of reading

Participants completed the Kannada and English versions of the RRT twice during the first session as part of a study of the effects of a colored overlay to be reported in due course. Each passage was read aloud for 1 min (timed with a stopwatch by KS), and the number of words read correctly was recorded in words per minute (wpm). The English and Kannada versions were alternated. The RRT was administered for all participants at a viewing distance between 0.4 and 0.5 m. During the second session only, the Kannada RRT was repeated.

Statistical analysis

Reliability was assessed using Pearson product moment correlations between the first and second scores on the RRTs. Linear regression analysis was used to analyze the relationship between age and rate of reading.

Results

Reliability

The test was administered twice in immediate succession during the first session in English and Kannada RRT. The Pearson product moment correlation between the two test results performed during the first session was 0.95 ($P < 0.001$) for the Kannada RRT and 0.91 ($P < 0.001$) for the English RRT. For 85 children, the tests were administered a second time after 15 days. The correlation between the first test on the two sessions was 0.83 ($P < 0.001$).

The relation between the two test scores in the first session is shown separately for the Kannada and English tests in Fig. 3a and b.

The Kannada test showed a small practice effect: the second test was read 1% more quickly than the first ($t[798] = 5.32$, $P < 0.001$). In the English version, there was more variation and a weak nonsignificant tendency for the second score to be lower than the first. For both tests, there was a weak but significant tendency for the difference between first and second tests to be smaller for children with high scores ($t[798] = 4.57$,

Figure 1: Kannada reading rate test

P < 0.001, for the Kannada test and *t*[798] = 6.66, *P* < 0.001 for the English version).

The absolute value of the difference between the two scores was expressed as a proportion of their mean. For the Kannada version of the test, the proportional difference averaged 7.7% (SD 7.1%). For the English version, the values were 7.2% (SD 8.3%). Differences of 15% are therefore more than 2 SDs from the mean.

Validity

Table 2 shows the mean and SD for the rate of reading for each age group and each test.

The test scores increased with age as shown in Fig. 4.

The linear regressions on age were all very highly significant (*P* < 0.0001), accounting for a minimum of 61% of the variance. There was no overall effect of gender on reading rate, and so in Figs. 3 and 4, the data for boys and girls have been combined.

Discussion

In the southwest zone of India, Kannada is the official language of Karnataka state, with more than 40% of school children having their medium of education in Kannada. The Kannada RRT was developed for use in this zone. The Kannada RRT had a reliability similar to that previously reported for the English version.[3]

The intraparticipant variation for the Kannada RRT was similar to that for the English version indicating that an increase of >15% in rate of reading is greater than might be expected from chance variation and therefore clinically significant.[4,8]

The progression in reading rate with age indicated that the RRT was a valid measure of reading skill and sensitive to reading development. The rate of development was similar for the English and Kannada versions of the test despite differences in the language of instruction.

In India, most of the state schools have their regional language as the medium of instruction whereas private schools use English. Students from private schools have been shown

Table 2: Mean and standard deviation for the rate of reading (wpm) for each age group and each test

| Medium of instruction	Age (years)	Mean reading rate (SD)	
		Kannada	English
Kannada	9	90.5 (19.5)	87.0 (19.7)
	10	103.8 (18.3)	100.8 (18.9)
	11	108.4 (19.2)	107.7 (20.2)
	12	113.9 (19.9)	108.6 (18.3)
	13	110.2 (21.5)	109.9 (17.2)
	14	117.9 (22.2)	119.5 (20.4)
	15	110.3 (24.5)	112.6 (23.4)
English	9	64.2 (17.4)	90.2 (17.5)
	10	72.1 (21.6)	101.3 (20.4)
	11	77.9 (19.9)	112.1 (23.0)
	12	87.0 (22.1)	116.3 (20.3)
	13	98.6 (24.2)	132.5 (24.4)
	14	103.8 (23.8)	133.1 (23.4)
	15	115.0 (31.5)	148.8 (33.6)

SD: Standard deviation
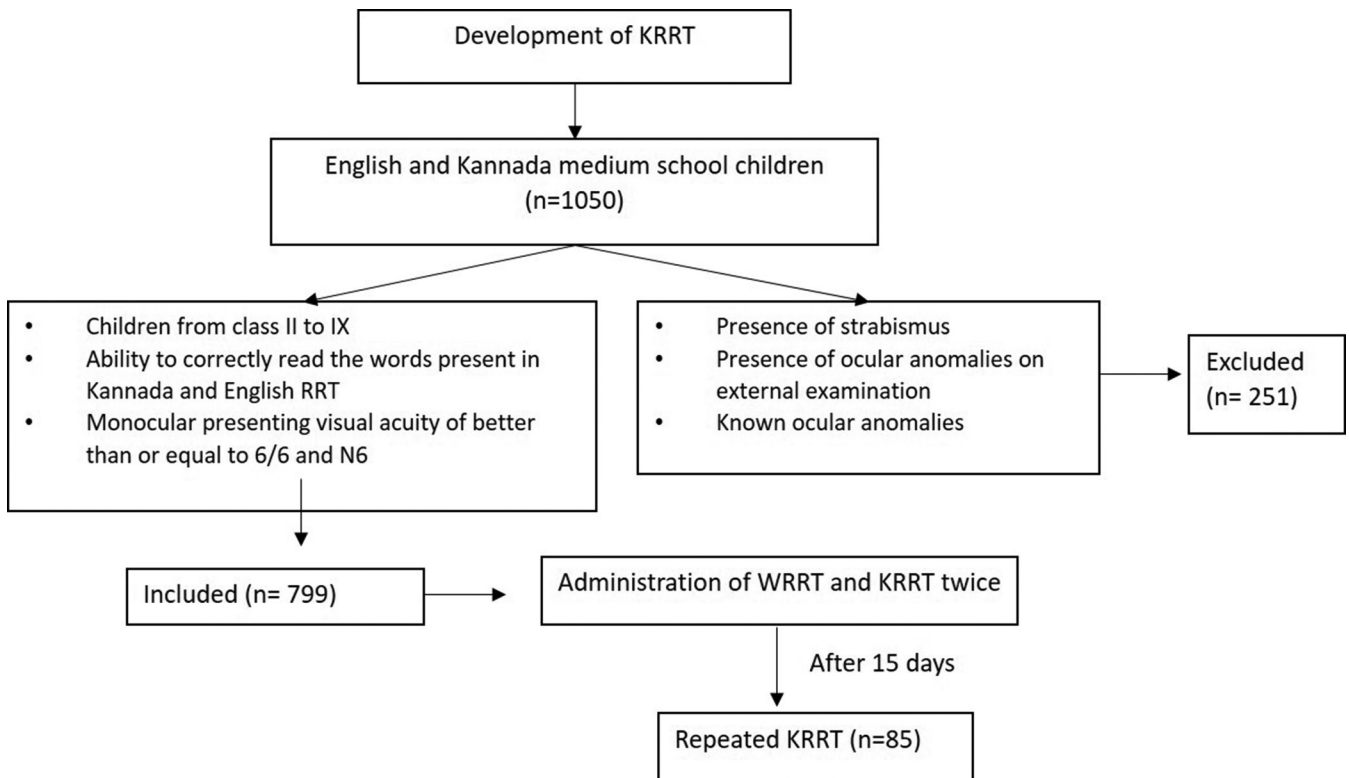
Figure 2: Inclusion and exclusion criterion alongside participant numbers at each stage of the study
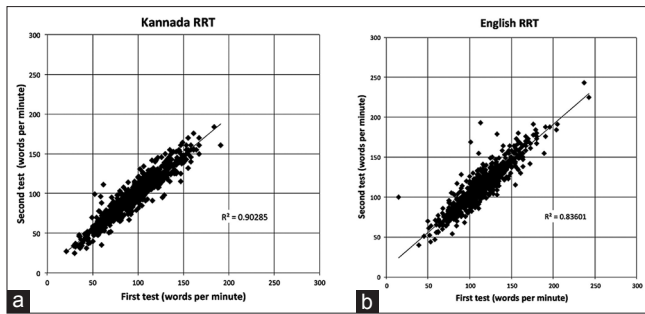
Figure 3: A scatter plot showing the scores in words per minute on the second test as a function of scores on the first test on the (a) Kannada rate of reading test and (b) the English rate of reading test. The R^2 values in the figures show the proportion of variance explained by the relationship between the two scores
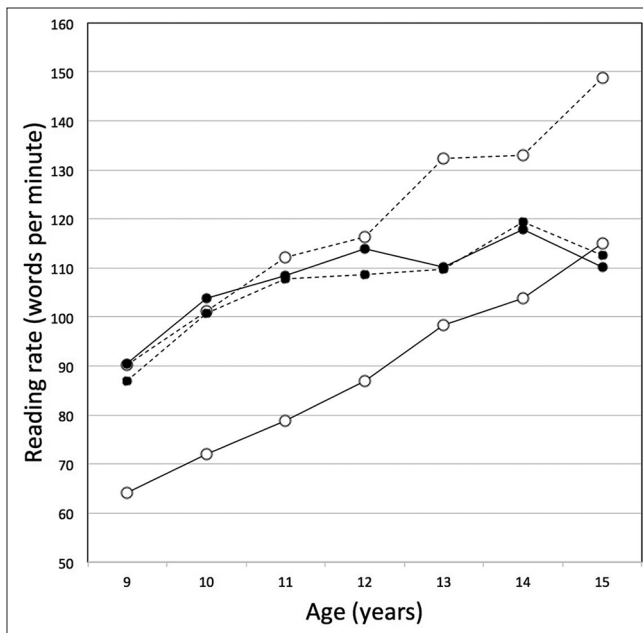

Figure 4: Rate of reading as a function of age on the Kannada rate of reading test (solid lines) and English rate of reading test (broken lines) when the medium of instruction was Kannada (solid symbols) and English (open symbols)

to have generally better language skills.[9,10] The proficiency of teachers in private schools has been estimated to be better than those in state schools.[11] The overall differences in reading rate among children in state and private schools are consistent with these differences and provide a further indication of the validity of the test.

The Kannada RRT is designed to measure the effects on reading of visuoperceptual distortions of text, such as apparent movement or blurring of words and letters. It is therefore proposed to use the test as an adjunct in primary eyecare clinics among children complaining of visuoperceptual difficulties, to assess the immediate effect of any intervention be that refractive, vision therapy, and/or colored overlays. It is worth noting that the Kannada RRT is not a conventional reading test in which the words become progressively more difficult and so does not measure "reading age;" but rather, it assesses reading ability in terms of rate and errors rather than in terms of the difficulty of the words read. Moreover, there is no evidence that individuals who read faster do so because they tolerate a greater number of errors. In general, the conditions that give rise to errors also give rise to slower reading.[4]

Conclusion

There are numerous different reading tests available that assess the educational aspects of reading performance. The RRT is designed to measure the visual aspects of reading and can assess any visual deficits that might affect reading. We have provided a version for use with the Kannada language.

Conflicts of interest

There are no conflicts of interest.

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Author Queries???

AQ1: Please review the sentence.