Captions and Reading Rates of Hearing-Impaired Students

Edgar H. Shroyer, Ph.D. and Jack Birch, Ph.D.

1980

Captions and Reading Rates of Hearing-Impaired Students

Edgar H. Shroyer, Ph.D. and Jack Birch, Ph.D.

Reading rate is one of several attributes of reading having a bearing on how effectively and efficiently one reads. With the proliferation of captioned films and the tremendous undertaking of captioning television programs, reading rate becomes a critical issue. By adapting the scoring procedure of the Gates McGinitie Reading Test, speed and accuracy portion, the reading rates of 185 randomly selected hearing-impaired students from residential schools for the deaf were obtained. These rates were then compared with the reading rates of hearing students and extempore speech. Based on the findings, a large number of hearing-impaired students would appear unlikely to benefit from captions.

With the rapid explosion of printed knowledge in our society, it is imperative that individuals learn to read effectively and efficiently. Effective and efficient reading presumes flexibility or a kind of reader adaptability encompassing a range of attributes including rate, facility of association, perceptual freedom, and other attitudinal sets as described by McDonald (1965). Rate begins to assume extreme importance when one considers the monumental task of assimilating this proliferation of printed matter.

For the hearing-impaired child and adult, the need for flexibility in reading rate becomes perhaps even more pronounced. In addition to vast quantities of printed matter, the proliferation of captioned films for the deaf in the past several years and the more recent captioning of television programs by major networks have resulted in a minimal necessary reading rate for hearing-impaired individuals if they are to take full advantage of the captions. This may be only a minor problem with adults who lost hearing later in life after acquiring language and reading as hearing pupils during their school years. But it can be a serious matter for many persons who faced the acquisition of reading while educationally deaf, and whose reading abilities are limited. The fact that the exposure time of captions (which sets a base line for speed of their reading) had to be determined with little empirical evidence for a guide was a major stimulus to undertake a study to provide more data.

An individual's reading rate does not appear confined to one static quantitative point on a numerical scale. Instead it appears dependent on several variables including the reading level of the materials, intended purpose of the reading, and conceptual context of the material. The most important factor to be considered in exploring any of these variables is the accuracy or efficiency of comprehension (Carver, 1974).

With an increase in rate, there appears to be an increase in the efficiency of comprehension up to a point, and after attainment of that point, efficiency begins to decrease. Accuracy, however, consistently decreases with an increase in rate (Carver, 1975). Further substantiation of this phenomenon was presented in a study by Jesters and Travers (1966). They presented words at speeds of 150, 200, 250, 300, and 350 words per minute and found a decrease in comprehension with an increased speed of presentation.

In typical reading situations, readers may impose control over the reading task by varying their rates in accordance with the difficulty level of the materials. Carver (1976) found that the mean reading rate of subjects decreased from 315 to 200 words per minute as the difficulty level of the reading material increased. Difficulty level in excess of the reader's ability may result in slowing down in order to comprehend more effectively the material being read. How-

Dr. Shroyer is an Assistant Professor in the Division of Communication Disorders at the University of North Carolina at Greensboro. Dr. Birch is a Professor in the School of Education at the University of Pittsburgh.

ever, in the atypical situation of having captions on a film or television, the readers have no control; they are unable to modify the presentation rate in order to facilitate comprehension.

Another variable affecting reading rate is the purpose for reading. Hearing-impaired individuals may, to a large extent, determine their own purposes, but they have little or no opportunity to adjust rate or presentation in either captioned films or television to suit the purpose for reading.

In studies with adults and children, Shores (1961), Samuels and Dahl (1975), and Moe (1959) observe that when the purpose for reading is set in advance, it tends to influence the rate at which reading is done. The subjects in Samuels and Dahl's (1975) study were told to read prose passages in order to answer detailed questions and overview questions. Results showed that fourth graders read for detail at a mean rate of 188 words per minute and for overview at a mean rate of 286 words per minute. College students read for detail at a mean rate of 291 words per minute and for overview at a mean rate of 461 words per minute. Harris (1976) found that fourth graders who had received no previous training showed some variation in reading speeds on a pretest. With two weeks of training, these same fourth graders became even more adept at varying their reading speeds in accordance with reading purpose.

Conceptual difficulty of the content, too, appears to affect reading rate. Grob (1970) found the average reading rate for students in secondary school to range from 100-350 words per minute in fictional materials. He discussed reading rate in relation to work time for students:

> **As crippling as low reading rates can be in English class assignments, perhaps the most severe effects can be found in social studies courses. The technical vocabulary and abstract concepts involved in subjects like American History and Civics will result in a drastic decrease in effective reading rate. For students at the low end of a rate scale, this extra slowdown can signal academic disaster. (p. 287)**

Study-type reading of test material was reported to be handled effectively by many students only at rates well below 100 words per minute. An additional academic area was mentioned by Shores (1961), who noted that fast readers were not necessarily good readers of scientific materials.

What constitutes an average reading rate is difficult to define, in part, because of the variables influencing its development. Symyrozum (1970) reports that 11th graders read at an average reading rate of 236 words per minute. Harris and Sipay (1978, p. 21) developed the following scale of reading rates for hearing students based on median scores obtained on standardized tests:

Grade 2:	35 wpm	Grade 7:	176 wpm
Grade 3:	75 wpm	Grade 8:	188 wpm
Grade 4:	120 wpm	Grade 9:	199 wpm
Grade 5:	145 wpm	Grade 12:	216 wpm
Grade 6:	171 wpm		

Boyd and Vader (1972), in their investigation of captioned television for the deaf, selected students according to their ability to read a test which also served as an indicator of the student's knowledge of the material prior to being exposed to the television program. They also set the captioned presentation rate a maximum of 120 words per minute and had "trained, experienced teachers of the deaf" prepare the captions. The authors conclude that, "The results of this study clearly indicate that captions, if appropriately written with due regard to the linguistic level and reading rate of the viewer; when added to a television program contribute significantly to the acquisition of information." However, unfortunately, caption writers for television and films do not have hand-picked subjects, and they must attempt to meet the reading needs of a much greater hearing-impaired population.

Wrightstone, Aronow, and Muskowitz (1963) report that the average reading achievement of 16-year-old hearing-impaired students was grade level 3.4. Of this group, 80% of the 16-year-old students were below grade level 4.9 in reading. Based on the findings of Hammermeister (1971), one would not expect reading comprehension levels of hearing-impaired students to increase significantly with age.

Current research in the area of reading rate has focused mainly on hearing children and adults. While numerous studies have been conducted in hopes of offering possible explanations for the reading deficit extant in hearing-impaired children (Furth, 1966; Gibson & Levin, 1975; Balow, Fulton, & Peploe, 1971; Denton, 1965), few studies have explored the specific variables or attributes of reading. Reading rate is a specific reading variable which would appear to influence the overall reading

success or failure of hearing-impaired individuals. Reading rate relative to captions on films or television takes on much greater significance, having a much greater bearing on success or failure. Thus, this study attempts to report the reading rates of hearing-impaired students at four different levels: primary, elementary, junior high, and high school in order to strengthen the empirical base for determining if the reading rates presented on captioned films and television were compatible with the reading rates of deaf students.

PROCEDURE

Part I

Subjects. Twenty students were randomly selected from a pool of 205 students reading on a primary level (grades 2-3) at a residential school for the deaf. The subjects ranged in age from 8-9 to 13-11 years with a mean of *11-9* years. Twenty-one students reading on an intermediate level (grade 4-6) were selected from a similar pool. Their ages ranged from 17-9 years to 20-7 years with a mean of *18-7* years.

Instrument. No known tests to measure the reading rates of students in grades two through 12 were available. The Gates-MacGinitie Reading Tests (1965) were selected, because it was determined that modifications in scoring would result in words per minute reading rate.

The Gates-MacGinitie Reading Tests used in this study measure the following level:

Primary B, Grade 2—(vocabulary and comprehension)
Primary C, Grade 3—(vocabulary and comprehension)
Primary CS, Grades 2-3—(speed and accuracy)
Survey D, Grades 4-6—(vocabulary, comprehension, speed, and accuracy)
Survey E, Grades 7-9—(vocabulary, comprehension, speed, and accuracy)
Survey F, Grades 10-12—(vocabulary, comprehension, speed, and accuracy)

The vocabulary section required that the student find one word in a group that meant "most nearly" the same as the heading word. This section required word recognition and identification by the student. The comprehension sections required the student to fill in sentence blanks with one of five words provided. The student had to understand or comprehend the paragraph to successfully apply the correct words and then pick the appropriate words from two different lists which were given. The speed and accuracy section required the student to answer questions related to the information given in the sentences which involved matching, generalization, and inference.

Test Administration. The speed and accuracy section of the Gates-MacGinitie Reading Tests was administered individually to the students. All of the students in the school had taken the comprehension and vocabulary sections of the Gates-MacGinitie Test prior to this investigation. These scores were used to determine which level of the speed and accuracy section the students were given.

The directions as stated in the Gates-MacGinitie manual for administering the test were followed, and the student began the speed and accuracy section which is timed. The time allotted for the primary speed and accuracy section was 7 minutes; time for the intermediate section was 5 minutes. The examiner, sitting across from the student, began a stop watch each time the student began to circle a response to the question read. When the student began reading the next test item, the examiner stopped the watch. If the student began to reread the question, the stop watch started and continued until an answer was circled. It stopped when the student began reading the next question. The student stopped after the allotted minutes expired.

The actual reading time was divided into the number of words read in the questions completed to obtain a words per minute reading rate, e.g., 24 questions contained 288 words, therefore 288 words divided by 4 minutes actual reading time = 72 words per minute.

Results. Means representing the time in seconds actually spent reading the questions were calculated for the two levels, primary and intermediate. Data for each level are presented in Table 1.

These mean reading times, derived from the preliminary student data, were considered as representative for the total research sample. This assumption is based on the selection of the participating schools as being representative of residential schools for the deaf, and the preliminary samples represent approximately one-fourth of the total randomly selected students in each level; primary and intermediate.

Table 1. Preliminary Student Data.

Level	Students	Age range (yrs.-mos.)	Mean	Reading time (seconds)		Reading rate (words/minute)	
				Range	Mean	Range	Mean
Primary	20	8-9 to 13-11	11.9	262-357	312	56-167	116.3
Intermediate	21	17-9 to 20-7	18.7	183-263	227	94-201	135.2

Part II

Subjects. Including the students participating in part one of the investigation, a total of 185 subjects were randomly selected from a pool of approximately 695 hearing-impaired students enrolled in four residential schools for the deaf. (School D requested that only their junior high and high school students participate.) Reading scores derived from previous reading tests administered by the schools were listed for each prospective subject included in the subject pool. Students were randomly selected from the submitted lists for inclusion in the investigation. This information is shown in Table 2.

The final sample consisted of 82 males and 103 females (10 of the randomly selected students were not available for testing). The inclusion of 50 females as compared with 30 males at the intermediate level accounts for the sex discrepancy in the total sample. This was a result of randomization rather than a large difference in the ratio of females to males. The ratio of females to males on the other levels was comparable. All available students reading on junior high and high school levels were automatically included in the project. Sex and age characteristics of subjects at each level are presented in Table 3.

Initially, the 185 students in this investigation were grouped into primary, intermediate, junior high, and high school categories based on reading tests which had been administered by their respective schools. That grouping is shown in Table 4 in the column headed, "Initial Category—Number of Students." After administering the comprehension and vocabulary sections of the Gates-MacGinitie to the sample, an additional mean reading level was derived for each student. Based on the new mean reading rate, students were recategorized into one of the four levels, e.g., of the 81 students whose previous reading test score placed them in the primary level, nine of them achieved a score on the Gates-MacGinitie Reading Test which placed them on an intermediate level. The change resulting in students being

Table 2. Number of Students Reading on each Grade Level, Primary Through High School, and the Number Randomly Selected from Those Populations.

	Grade Levels							
	Primary[a]		Intermediate[a]		Junior High[b]		High School[b]	
Schools	Total number of students	Randomly selected	Total number of students	Randomly selected	Total number of students	Students tested	Total number of students	Students tested
A	205	20	82	21	11	9	2	2
B	97	32	88	32	5	4	4	3
C	111	32	79	32	4	3	0	0
D					7	5	0	0
Totals	413	84	249	85	27	21	6	5

[a]Randomly selected from total pool of students.
[b]All students available for testing.

Table 3. Sex and Age Characteristics of Subjects.

	Males	Females	Age range (years-months)	Mean age (years-months)
Primary	39	40	8-9 to 15-3	13-3
Intermediate	30	50	14-9 to 21-8	16-7
Junior high	11	10	15-7 to 20-3	17-6
High school	2	3	13-7 to 19-3	16-0
Total	82	103	8-9 to 21-8	

recategorized can be seen in Table 3 under "New Categories."

Test Administration. All three sections, vocabulary, comprehension, and speed and accuracy of the Gates-MacGinitie Reading Tests were administered to the randomly selected students at their own schools. The procedures described in the Gates-MacGinitie instructions for administering the tests were followed. The order in which the tests were presented was reversed at the second school to compensate for effects of order of presentation and student fatigue; e.g., students at school A took the comprehension, vocabulary, speed and accuracy portions in that order while at school B the order was reversed. The lapsed time between testing students at each of the two schools was one day.

Derivation of reading rates. The reading rates of primary and intermediate students were derived from the speed and accuracy portion of the tests by using the mean times from the representative samples of primary and intermediate students in part one of the study.

The number of students reading on a junior high school level (grades 7-9) and on a high school level (grades 10-12) was small enough to allow the scoring revision procedure to be administered on an individual basis although each student took all three sections of the Gates-MacGinitie Reading Test.

Results. A pooled t-test was applied to the data to determine if the mean reading rates of the preliminary samples (see Table 1), primary and intermediate, were significantly different from the means of the larger samples of primary and intermediate students. The data for the primary students yielded $t = 1.18$ with an observed variance of 32.17 which was not significant at the .05 level. The intermediate level data yielded $t = 3.78$ which is significant at the .05 level of significance with an observed variance of 31.17.

FINDINGS AND CONCLUSIONS

The purpose of this study was to obtain the reading rates of hearing-impaired students in representative schools for the deaf in order to provide a body of data to help determine appropriate guidelines for reading rates of captioned films and television programs, as well as to have comparisons with hearing pupils' reading rates.

It is clear that reading rate measurement is not a simple matter. It depends on difficulty, interest, purpose, and other factors. When interpreting the findings of this study, several specific limitations must be taken into account, too. The Gates-McGinitie Reading Test's scoring procedure for the speed and accuracy por-

Table 4. Classification of Students According to the Gates-MacGinitie Tests.

Level test taken	Initial category number of students	Primary (2-3)	Intermediate (4-6)	Junior high (7-9)	High school (10-12)
Primary	81	72	9	0	0
Intermediate	78	9	66	3	0
Junior high	21	0	0	21	0
High school	5	0	0	0	5
Subtotal	185	81	75	24	5

tion of the test was modified to fulfill the need for reading rates instead of reading level. The initial sample of intermediate students and final sample of intermediate students differed in rate significantly at the .05 level, and the reason for that is not certain. Thus, an unknown amount of error is introduced, and findings and conclusions must be stated with that in mind.

The mean of the median scores for Harris and Sipay's (1975) fourth, fifth, and sixth-grade students (intermediate) is 145 words per minute compared with a mean of 142 for the intermediate deaf students. For the hearing students on a junior high school level, the mean of the median reading rates was 188 words per minute and the mean for the deaf students 181 words per minute. Hearing high school students had a mean of 216 words per minute compared with a mean of 275 words per minute for deaf students. An important factor in comparing these groups is the age differences which are considerable and certainly need to be reflected in any analysis. The large proportion of deaf students who function in reading, regardless of age, at the primary and intermediate levels cannot be disregarded. There is marked variability within the hearing-impaired population, of course. A junior high school student 14.4 years of age was reading on a 10.8 grade level with a reading rate of 290 words per minute. But a high school student who was 21.8 years of age was reading on a 4.6 grade level with a reading rate of 110 words per minute, and such a student will almost certainly experience difficulty with captions that run up to 120 words per minute. Specifically related to rate, Carver (1974) states:

> **Theory and data suggest that individuals are likely to be able to understand most material that is below their own difficulty level when they read it at their usual reading rate. However, when individuals are given material at a level of difficulty that is above their own level of ability, then it is not likely that they will be able to understand what they are reading if they read it at their usual rate. Rate is likely to be affected by the difficulty level of the material when that level exceeds the reader's ability and when a mastery criterion is imposed. (p. 243)**

Normal extempore speech is measured at 159 words per minute (Keily & Steer, 1949). Speech production on television and films approximates normal speech. If that speech is synchronized in content and speed with captions, approximately 84% of hearing-impaired students would not be able to read it, according to this study. That is, 84% of the students in this investigation possessed reading rates below the 159 words per minute of extempore speech (see Table 5). That does not take into account the linguistic level of the captions, which, according to Carver (1974), would also have a significant effect on comprehension.

One other consideration that this investigation did not attempt to explore, but one which is very relevant is that of visual overload. Will the pictorial information which is to be conveyed be sacrificed for the captioned information or vice-versa?

As was indicated at the outset, effective and efficient captioning can open many new opportunities for learning for hearing-impaired children, youth, and adults. Optimum efficiency and effectiveness, though, is linked to speed and comprehension in taking in the printed word. This study calls attention to the need for expanding the research base for captioning and provides some new data in that direction. All of the variables involved in captioning have to be addressed in order to make it an effective and efficient information vehicle for deaf people.

REFERENCES

Balow, B., Fulton, H., & Peploe, E. Reading comprehension skills among hearing impaired adolescents. *Volta Review*, 1971, pp. 113-119.

Table 5. Composite Student Data for Each Level.

	Ages (yrs. - mos.)			Reading rates (w/m)		
	Students	Range	Mean	Range	Mean	Median
Primary	81	8-9 to 18-7	13-6	56-249	123.7	116
Intermediate	75	12-10 to 21-8	17-6	62-249	157.0	142
Junior high	24	15-10 to 21-3	17-8	114-266	185.8	181
Senior high	5	14-4 to 18-9	16-6	195-348	275.0	290

Boyd, J., & Vader, E. Captioned television for the deaf. *American Annals of the Deaf*, 1972, *117*, 34-37.

Carver, R. P. Improving reading comprehension: Measuring readability. Washington, D.C.: *American Institute for Research, Final Report*, R74-2, May 1974.

Carver, R. P. Designing reading rate research. In G. H. McNinch & W. D. Miller (Eds.), *Reading: Convention and inquiry*, 24th Yearbook of N.R.C. Clemson, S.C.: National Reading Conference, Inc., 1975, pp. 229-240.

Carver, R. P. Word length, prose difficulty, and reading rates. *Journal of Reading Behavior*, 1976, *8*, 193-203.

Denton, D. M. A study in the educational achievement of deaf children. *Proceedings of the 42nd Meeting Convention of the American Instructors of the Deaf*. Washington, D.C.: U.S. Government Printing Office, 1965, pp. 428-438.

Furth, J. G. *Thinking without language: Psychological implications of deafness*. New York: Free Press, 1966.

Gibson, E. J., & Levin, H. *The psychology of reading*. Cambridge, Mass.: M.I.T. Press, 1975.

Grob, J. A. Reading rates and study time demands on secondary students. *Journal of Reading*, 1970, *13*, 285-288; 316.

Hammermeister, F. Reading achievement in deaf adults. *American Annals of the Deaf*, 1971, *116*, 25-28.

Harris, T. L. Reading flexibility: A neglected aspect of reading instruction. In J. F. Merritt (Ed.), *New Horizons in reading—Proceedings of the 5th IRA World Congress in Reading*. Newark, Del.: International Reading Association, 1976.

Harris, A., & Sipay, E. How to increase reading ability. In J. P. Lunstrum & B. L. Taylor (Eds.), *Teaching reading in the social studies*. Newark, Del.: International Reading Association, 1978.

Jesters, R. E., & Travers, R. M. Comprehension of connected meaningful discourse as a function of rate and mode of presentation. *Journal of Educational Research*, 1966, *59*, 297-302.

Kelly, J., & Steer, M. Revised concept of rate. *Journal of Speech and Hearing Disorders*, 1949, *14*, 222-226.

McDonald, A. S. Flexibility in reading: Reading as an intellectual activity. In J. S. Jigurel (Ed.), *International Reading Association Conference Proceedings*, 1965, pp. 81-84.

Moe, I. L., & Nania, F. Reading deficiencies among able pupils. *Journal of Developmental Reading*, 1959, *111*, 11-26.

Samuels, S. J., & Dahl, P. R. Establishing appropriate purpose for reading and its effect of flexibility of reading rate. *Journal of Educational Psychology*, 1975, *67*, 38-43.

Shores, J. H. Are fast readers the best readers?—A second report. *Elementary English* 1961, *38*, 236-245.

Symyrozum, K. The readability of text books. *Reading Improvement*, 1970, *7*, 41-45.

Wrightstone, J., Aronow, M., & Muskowitz, S. Developing reading test norms for deaf children. *American Annals of the Deaf*, 1963, *108*, 311-316.