9. The Effect of Education on Diagnosis of Aphasia from Writing and Drawing Performance by Mildly Aphasic and Non-Brain-Damaged Adults

Roberta J. Elman, Jan A. Roberts, and Robert T. Wertz

Elman, Roberts, and Wertz (1991) reported that speech-language pathologists were relatively good and relatively reliable at determining the presence of mild aphasia from writing or drawing samples. However, misclassification of subjects did occur.

Keenan (1971) reported that writing sentences to dictation is a good way to detect mild aphasia, but he added that writing by some normal subjects was judged as being aphasic. Keenan and Brassell (1972) compared the writing errors of poorly educated subjects with those of minimally dysphasic subjects. They found that group differences occurred in the distribution of writing errors, but that poorly educated, non-brain-damaged subjects did produce a variety of errors. Additional evidence that normal writing is not "error free" has been supplied by Hansen and McNeil (1986) and Hansen, McNeil, and Vetter (1987).

Benson and Barton (1970) suggest that drawing may also be a good test to detect brain damage. Left-hemisphere brain damage may cause drawings to be simplistic (Arrigoni & DeRenzi, 1964; Kirk & Kertesz, 1989), reduced in fluency (Jones-Gotman & Milner, 1977), or deficient in perspective (Hatfield & Zangwill, 1974). However, Kirk and Kertesz (1989) report: "Our control group's imperfect drawings emphasized the need for controls" (p. 884).

It is certain that factors other than brain damage may cause one to produce writing or drawing errors. The literature suggests that educational level is an important factor to consider when assessing individuals on a variety of psychological measures (Benson & Cummings, 1985; Duffy, Keith, Shane, & Podraza, 1976; Finlayson, Johnson, & Reitan, 1977). Therefore, we sought answers to the following questions:

1. Does educational level affect speech-language pathologists' diagnosis of mild aphasia based on a writing sample?
2. Does educational level affect speech-language pathologists' diagnosis of mild aphasia based on a drawing sample?
3. Can speech-language pathologists determine the educational level of aphasic and normal subjects from a writing sample?
4. Can speech-language pathologists determine the educational level of aphasic and normal subjects from a drawing sample?

METHODS

Twenty aphasic adults participated in the study. All were right-handed native English speakers who had sustained a left-hemisphere cerebral vascular infarct. Ten subjects had 12 years or less of formal education and were placed in the lower-education aphasic group. Ten subjects had 16 years or more of formal education and were placed in the higher-education aphasic group. All subjects were mildly aphasic, with a *Western Aphasia Battery* (*WAB*) (Kertesz, 1982) Aphasia Quotient between 74 and 93.8.

Twenty normal control subjects were matched for education with the aphasic patients. All control subjects were right-handed native English speakers, reported no history of a neurological and/or speech-language disorder, and scored above the normal cutoff (93.8) on the *WAB*. Ten subjects had 12 years or less of education and were placed in the lower-education normal group. Ten subjects had 16 years or more of formal education and were placed in the higher-education normal group. Descriptive data for all groups are summarized in Table 9.1.

Eight speech-language pathologists with at least 2 years of postgraduate experience working with neurogenic communicative disorders served as judges. They were asked to classify the aphasic and normal subjects' written language samples and drawings. Forty randomized writing samples (10 lower-education aphasic, 10 higher-education aphasic, 10 lower-education normal, and 10 higher-education normal) and 40 randomized drawing samples (as above) were judged.

Written Picture Description

A typed transcript of the *WAB* written picture description was prepared for each aphasic and control subject. Point-to-point agreement for the typed transcripts was 99% and was calculated by comparing typewritten to handwritten characters for 20% of the transcriptions. Transcripts

TABLE 9.1. DEMOGRAPHIC INFORMATION FOR THE FOUR GROUPS

	Lower Education		*Higher Education*	
	$\bar{X}$	*SD*	$\bar{X}$	*SD*
Age (in years)				
Aphasic	64.70	9.64	62.20	9.40
Controls	72.60	8.40	60.70	6.55
Education (in years)				
Aphasic	9.60	1.65	17.00	1.70
Controls	10.90	1.20	16.40	0.84
Aphasia Quotient *(WAB)*				
Aphasic	86.99	5.35	86.27	6.19
Controls	97.74	1.16	99.63	0.40

reflected spelling, punctuation, and the number of words per line. Judges were asked to determine from the writing sample whether each subject was aphasic or normal and whether each subject had received lower education (12 years or less) or higher education (16 years or more).

Drawing Performance

Seven drawings from the *WAB* (circle, cube, square, clock, tree, house, and person) were obtained from each aphasic and control subject. Judges were asked to determine from the drawing whether each subject was aphasic or normal and whether each subject had received lower education or higher education.

RESULTS

Intrajudge Reliability

Intrajudge reliability was obtained by having two of the judges reclassify the writing and drawing samples. Point-to-point agreement averaged 93% for aphasic versus normal classifications in the writing samples and 79% in the drawing samples. Agreement averaged 80% for education classifications in the writing samples and 74% in the drawing samples.

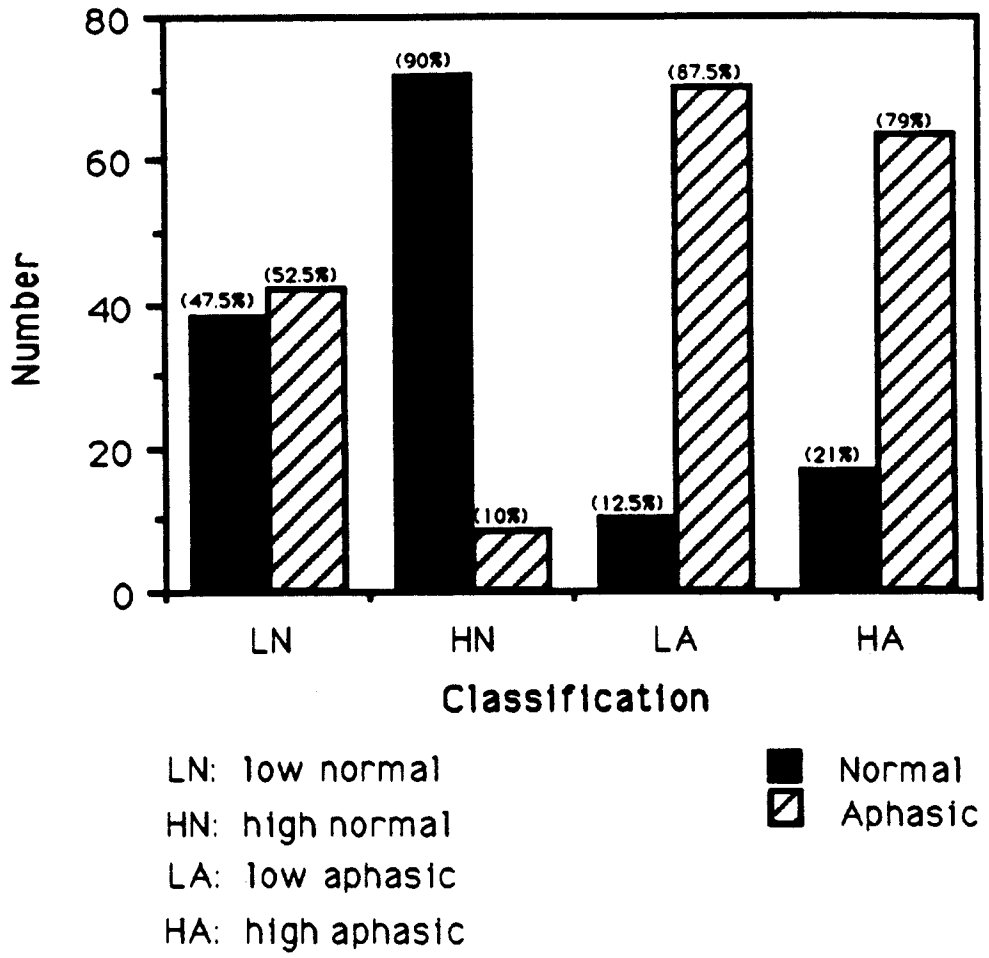

Figure 9.1. Judges' classifications of aphasic and normal subjects on writing performance.

Classification Results

Writing Performance. There were 320 aphasia versus normal judgments based on writing samples (8 judges, 40 subjects). One hundred sixty of these could have been correct by chance. One hundred ten of 160 judgments for aphasic subjects and 133 of 160 judgments for normal subjects were correct. This is significantly better than chance (chi-square = 100.56, $df = 1$, $p < .001$) (Siegel & Castellan, 1988). Figure 9.1 shows the breakdown of correct classifications and misclassifications by group membership and educational level. These data indicate that misclassifications occurred primarily for the lower-educated normal group. Lower-educated normal subjects were classified as aphasic 52.5% of the time.

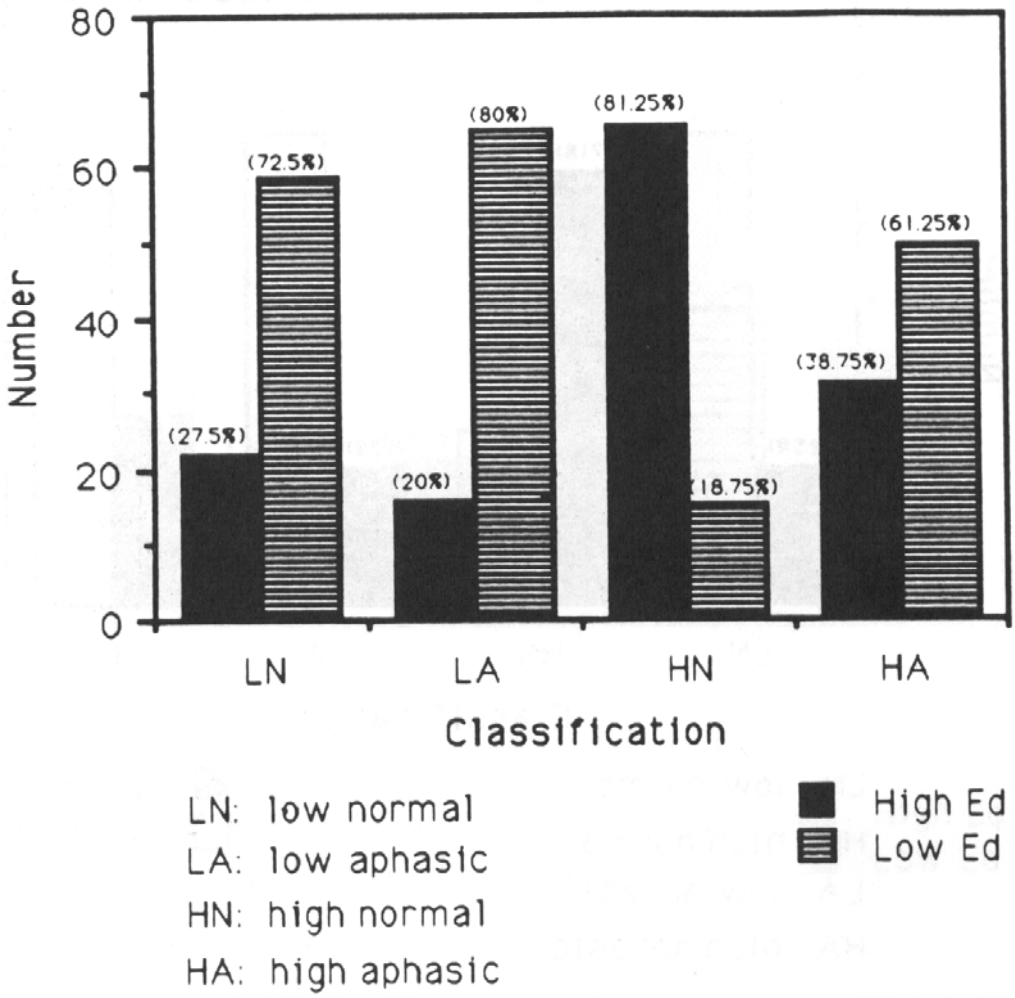

Figure 9.2. Judges' classifications of educational level of subjects based on writing performance.

There were also 320 educational judgments based on writing performance. Ninety-six of 160 judgments for higher-educated subjects and 122 of 160 judgments for lower-educated subjects were correct. This is significantly better than chance (chi-square = 70.38, $df = 1$, $p < .001$). Figure 9.2 shows the breakdown of correct classifications and misclassifications by group membership and educational level.

Drawing Performance. There were 320 aphasia versus normal judgments based on drawing samples. One hundred seventeen of 160 judgments for aphasic subjects and 75 of 160 judgments for normal subjects were correct. This is significantly better than chance (chi-square = 15.35, $df = 1$, $p < .001$) (Siegel & Castellan, 1988). Figure 9.3 shows the breakdown of correct classifications and misclassifications by group membership and educational level. Surprisingly, lower-educated normal subjects were classified as aphasic 77.5% of the time.

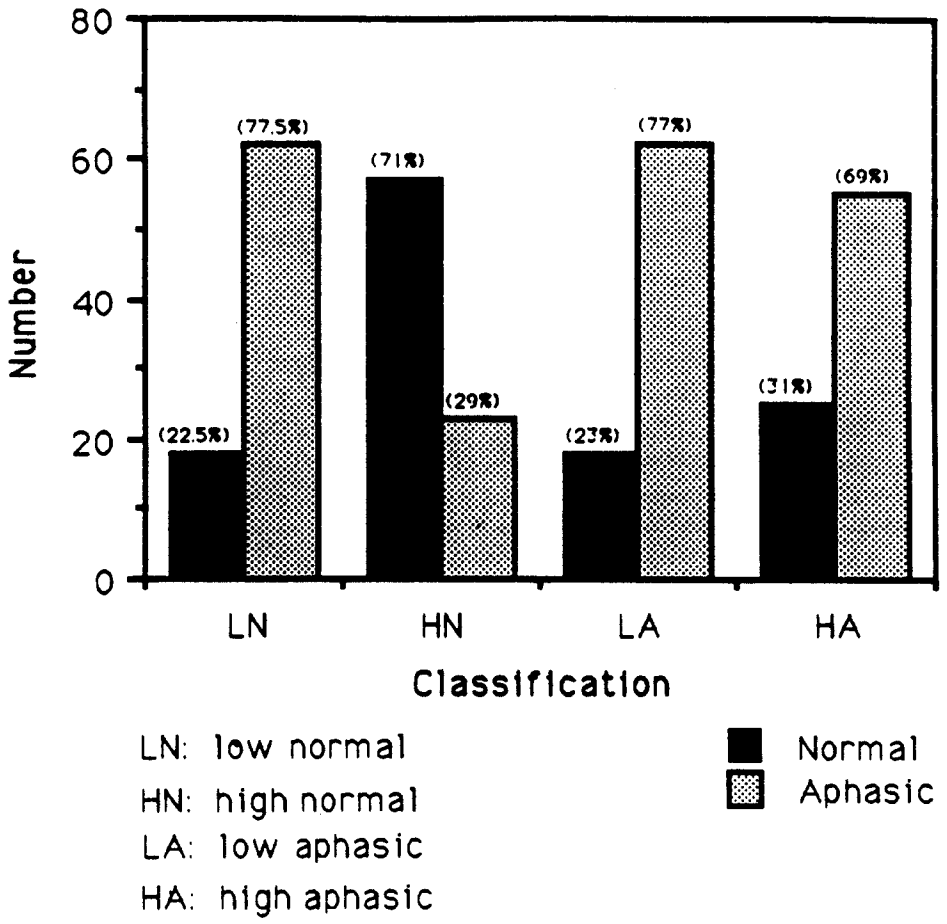

Figure 9.3. Judges' classifications of aphasic and normal subjects on drawing performance.

There were also 320 educational judgments based on drawing performance. Seventy-four of 160 judgments for higher-educated subjects and 116 of 160 judgments for lower-educated subjects were correct. This is significantly better than chance (chi-square = 15.35, $df = 1$, $p < .001$). Figure 9.4 shows the breakdown of correct classifications and misclassifications by group membership and educational level. Judges tended to misclassify highly educated subjects (aphasic and normal) as lower educated.

Overall, misclassifications occurred most frequently for lower-educated normal subjects. Five of the 10 lower-educated normal subjects were consistently misclassified (6 or more judges) as aphasic on the writing sample (see Figure 9.5 for examples), and 7 of the 10 lower-educated normal subjects were consistently misclassified as aphasic on the drawing sample (see Figure 9.6 for examples). Other consistent misclassifications occurred rarely—two highly educated aphasic patients, one lower-edu-

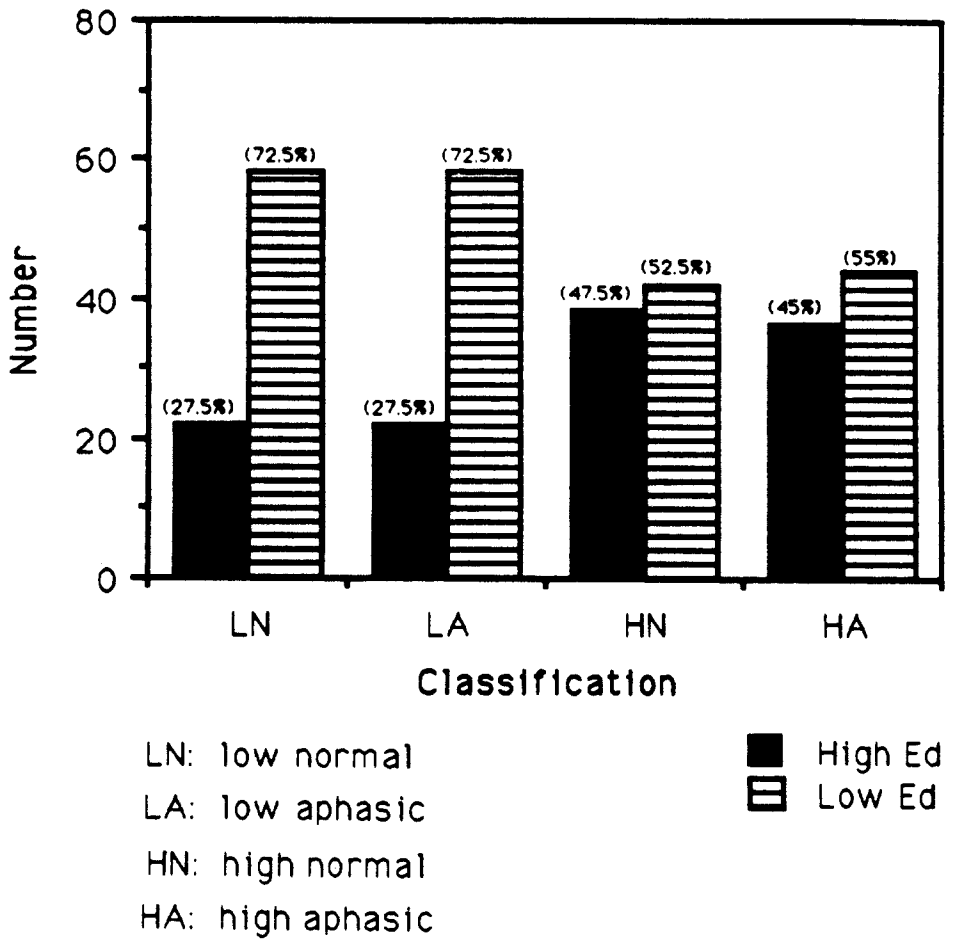

Figure 9.4. Judges' classifications of educational level of subjects based on drawing performance.

cated aphasic patient, and one highly educated normal subject were misclassified.

DISCUSSION

Our results support those of Elman et al. (1991), which state that speech-language pathologists are relatively good at determining the presence of mild aphasia from a writing or drawing sample—with the following exception. Lower-educated normal subjects were frequently misclassified as aphasic on both the writing and drawing samples. We suspect that speech-language pathologists have set too high a criterion for normal performance. This resulted in the large number of false positives in the

WRITTEN PICTURE DESCRIPTION

I see house a tree

drinking Beer

man read book

WRITTEN PICTURE DESCRIPTION

I / see a tree

I see a car

I see a house

a Family having a picnic

I see a sail boat

I see a dog

I see a man flying a kite

I see a flag

Figure 9.5. Examples of judges' misclassifications of writing samples: lower-educated normals classified as aphasic.

present study. It is not surprising that lower-educated normals might make errors on the writing samples. We did not analyze the writing errors qualitatively as Keenan and Brassell (1972) did. This kind of analysis might uncover differences among our groups.

It is more surprising that the majority of our lower-educated normals produced drawings that were classified by our judges as "aphasic." Although we did not conduct a formal analysis, our lower-educated normal subjects produced cubes and houses that lacked proper perspective. A review of the literature indicates that this observation has been made

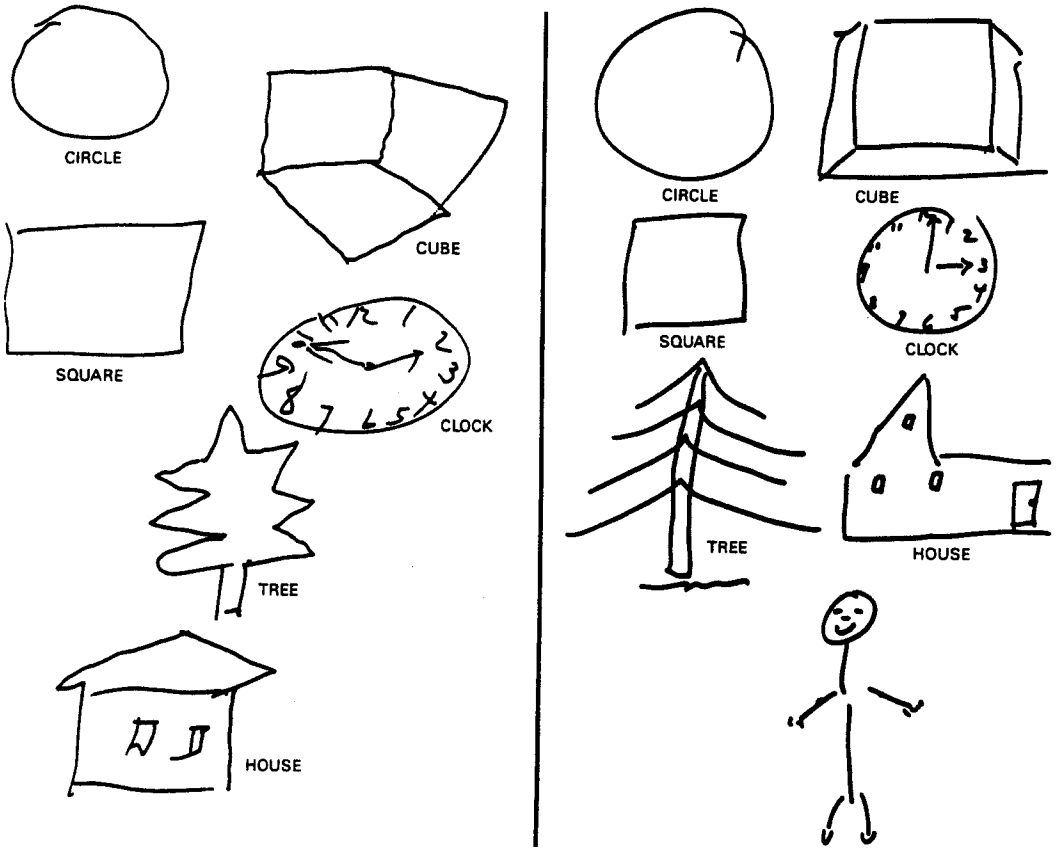

Figure 9.6. Examples of judges' misclassifications of drawing samples: lower-educated normals classified as aphasic.

anecdotally with normal subjects (Arrigoni & DeRenzi, 1964) but has yet to be tested empirically.

Speech-language pathologists are also relatively good at determining educational level from a writing or drawing sample. However, judges often rated highly educated subjects as having less education. This indicates that speech-language pathologists may set too high a criterion when judging educational level.

Our results indicate that education is an important variable to consider when making a diagnosis of mild aphasia based on writing or drawing performance. Further research is needed to determine whether underlying cognitive or experiential factors may help to explain our findings. However, our results indicate that education appears to influence diagnosis even in tasks such as drawing, which, intuitively, would not appear to be influenced by formal education. Finally, our results support the need to establish the range of normal performance for writing and drawing tasks.

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