

Teacher Characteristics and the Degree to which Teachers Incorporate Features of English in Their Sign Communication with Hearing Impaired Students

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This paper examines teacher responses to questionnaire probes into specific aspects of their sign communication with hearing impaired students. Specifically, a Rasch scaling procedure was performed on a series of 16 questionnaire items designed to assess the degree to which teachers incorporated grammatical features of English in their sign communication with their hearing impaired students. Resulting Rasch scaled scores were examined with respect to the following teacher characteristics: hearing status of teacher, years of experience teaching hearing impaired students, and educational placement level of students in the classroom. Using ANOVA, significant main effects were shown for all three independent measures. Deaf teachers reported incorporating fewer English features in their sign communication than hearing or hard-of-hearing teachers; teachers with less than six years' experience teaching hearing impaired students reported incorporating fewer English features than those with more experience; and teachers of pre-primary and elementary hearing impaired students reported incorporating a greater number of English features in their signs than did teachers at the junior high or high school levels.

Controversies among groups advocating the use of various approaches to manual communication in instructional settings have been every bit as spirited as those between groups advocating oral versus manual education for hearing impaired students. For example, proponents of the use of American Sign Language (ASL) in the classroom propose requiring fluency in ASL of all teachers acquiring certification from deaf education programs (Clements & Prickett, 1986). They point to the success of bilingual programs with hearing students and contend that English language development may be enhanced when hearing impaired students are taught first in their native language.

Alternatively, proponents of the various systems of English signing, which use some ASL signs and add

affixes and markers to signal different word forms in order to parallel English, claim that hearing impaired students can better master the grammatical complexities of English when the manual system they use approximates it semantically and syntactically (Bornstein, 1979).

Whatever the merits of each theoretical approach, recent survey research has clearly suggested that the sign communication used by the overwhelming majority of teachers who sign to their students is predominantly English-like (Crittendon, 1986; Woodward, Allen, & Schildroth, 1985). In fact, Woodward, Allen, & Schildroth (1985), drawing inferences from questionnaire probes into teachers' signing behaviors, concluded that less than 1 per cent of teachers who signed to their students were using ASL in the classroom. This conclusion was based on a study conducted by the Center for Assessment and Demographic Studies (CADS) of a national sample of 1,762 teachers of hearing impaired students randomly selected from programs which supply data to the Annual Survey of Hearing Impaired Children and Youth (CADS, 1985). The current paper, using the same

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data base, explores the teachers' responses to these communication questions in more depth.

The fact that teachers do not employ ASL as their instructional language does not imply they are paralleling English in their signs. Woodward (1973) proposed that ASL and manually-coded English could be conceived as a continuum along which the specific signing practices of individuals could be categorized. Therefore, forms of sign communication which incorporate features of both English and ASL could be studied if the English-ASL continuum were adequately described. Such an analysis would lead to a better understanding of the English language experiences of children in the instructional setting.

Woodward & Allen (in press), using data from the communication survey cited above, evaluated two methods for studying the degree to which teachers incorporated features of English in their signing: a scalogram analysis (Bickerton, 1971), which is a traditional tool employed by linguists to evaluate language variation, and a Rasch analysis (Wright & Stone, 1979), which is a tool employed by psychometricians in designing tests to analyze the quality of test items. Woodward & Allen concluded that Rasch analysis of questionnaire data holds promise as a linguistic tool to assess variation in sign language from large samples.

In their study, Woodward & Allen performed a Rasch analysis for the teachers in the CADS communication data base who reported signing to their students during instruction. As a result, these teachers were assigned scaled scores representing the degree to which they incorporated features of English in their signing. The current paper studies variations in the resulting scaled score distributions. Using the Rasch scaled score as a dependent measure, the current analysis considers the effects of three independent measures: the hearing status of the teacher, the number of years of experience the teacher has teaching hearing impaired students, and the placement level of the students.

METHOD

Sample

Data for this study were collected in the spring of 1985 by the Gallaudet Research Institute's Center for Assessment and Demographic Studies. The sample for the study was drawn from those programs which supply data to the Annual Survey of Hearing Impaired Children and Youth, a yearly survey that collects demographic and educationally relevant data on approximately 50,000 hearing impaired students.

From the 1983-84 Annual Survey data base, 4,500 students were randomly selected and assigned to one of three subject area stratification groups: reading, mathematics and social studies. Students were stratified in this way to ensure that teachers in a variety of academic contexts were represented in the sample. The programs enrolling these students were sent questionnaires with instructions that they be distributed to the appropriate reading, mathematics or social studies teachers. Since Annual Survey sampling is carried out on an individual

student basis, some teachers received more than one questionnaire. Because the primary aim of this analysis was to describe the communication patterns of teachers, duplicate responses for these teachers were eliminated from the data base. Also, for the current paper, the data set was limited to teachers who signed directly with their students. The resulting file contains information on 1,135 teachers; complete data for all independent and dependent measures included in the analysis are available for 888 of those 1,135 teachers. The current analysis is based on these 888 teachers.

Dependent Measures

The questionnaire for this national study was constructed to describe the communication patterns used in classrooms with hearing impaired students. Teachers were asked if they signed, spoke or signed and spoke during their instruction of individual students in the targeted subject area (reading, mathematics or social studies). Teachers who signed were asked several additional questions to determine the degree to which they incorporated English features in their signs. In particular, the following were asked:

Read the following two English sentences:

- 1) He is looking at me.
- 2) I am looking for him.

A. When communicating the meaning of the two English sentences above to the named student in the classroom, indicate how you would communicate each of the following:
(a. Would fingerspell; b. Would use separate sign or gesture; c. Would include as part of another sign; d. Would omit)

He	(a,b,c, or d?)	I	(a,b,c, or d?)
is	(a,b,c, or d?)	am	(a,b,c, or d?)
look	(a,b,c, or d?)	look.	(a,b,c, or d?)
-ing	(a,b,c, or d?)	-ing	(a,b,c, or d?)
at	(a,b,c, or d?)	for	(a,b,c, or d?)
me	(a,b,c, or d?)	him	(a,b,c, or d?)

B. When communicating the meaning of the two English sentences above to this student in the classroom, indicate how you would normally sign the following words:
(a. Would use the same sign for each; b. Would use a different sign for each; c. Would not sign one or both of these words)

He and Him	(a,b,or c?)
I and Me	(a,b,or c?)
Am and Is	(a,b,or c?)
Look in both sentences	(a,b,or c?)

The data were coded as follows: For Section A, all "fingerspelled" or "signed with a separate sign" responses ("a" or "b") were considered to be English-like. For Section B, all "different sign" responses ("b") for He and Him, I and Me, and Am and Is were considered to be English-like. For Look in both sentences, "use the

same sign" ("a") was considered to be English-like. All other responses were considered to be less English-like. This coding scheme resulted in an item vector containing 16 dichotomous elements.

Rasch Analysis. The data were analyzed with MICROSCALE, a Rasch scaling program (Wright & Linacre, 1984). In a Rasch analysis, the responses (the sign elements) and the respondents (the signers) are placed on the same numerical scale. For signers, the scale represents the level of English in their signing; for the sign elements, the scale represents the level of English necessary from a signer for the sign to be signed in an English-like fashion. For example, *-ing* is assigned a higher scaled score than I because, while most signers use a separate sign for I, only signers who incorporate more English features in their signing use a separate sign for *-ing*.

The unit of measure in a Rasch analysis is a logit; the logit scale is constructed in such a way that if the scale value assigned to a signer equals the scale value assigned to a sign element, the signer is expected to emit the English response 50 per cent of the time. The relationship between the sign element scale and the signer scale is fixed so that the probability of an English response can be easily calculated from the difference between the scale value assigned to any signer and the scale value assigned to any sign element (Wright & Stone, 1979). As an example, signers receiving a logit scale value of 4.0 should emit English responses 95 per cent of the time to sign elements assigned logit values of 1.0. This 95 per cent relationship exists all along the scale whenever the difference between the English signing level of the signer and the English level required by the sign equals 3 logits. Given any logit difference, probabilities are easily calculated using algebra.

Assessing the fit of the actual data to the Rasch model is an important component of Rasch analysis (Wright & Stone, 1979). The goal of the analysis was to derive a scale in which the probability of an English response to a given sign element by a signer high on the scale is *always* greater than the probability of an English response to that sign element by a person low on the scale. When the sign element and signer scale values are computed, the computer picks a set of values that constitute a "best fit" of the real data to the Rasch model. Then, each person's actual signing pattern is evaluated to assess the accuracy of the scale values in predicting individual signing responses and a fit statistic is computed.

A fit statistic equal to 0 indicates a perfect fit of a signer to the scale—the pattern of English responses actually emitted can be perfectly predicted by the logit scale value assigned to the signer. When the fit statistic for a given signer deviates from 0, lack of fit can be noted. Two kinds of fit problems can be described: high positive values and high negative values. High positive values occur either when a signer with a high logit score has emitted non-English responses to elements that are low on the English scale or when a signer with a low scale value has emitted an English response to an ele-

ment that is high on the scale. That is, signers with high positive fit statistics show inconsistent patterns which render their logit scores of somewhat dubious value. In the current data, a teacher who reported signing *-ing* as a separate sign (which is high on the English logit scale for signing) but who reported omitting I (which is low on the scale) would show a high positive fit statistic because the pattern is inconsistent and unlikely.

High negative fit statistics are a bit more difficult to interpret. They designate signers whose assigned Rasch scale values are too discriminating. For example, a signer with a high negative fit statistic and an assigned logit scale value of 1.0 would actually emit English responses to signs rated slightly below 1.0 with a probability much greater than 50 percent and would respond to signs rated slightly higher than 1.0 with a probability much less than 50 per cent. That is, their rating actually discriminates *too well* the sign elements to which they are likely to emit an English response. In the current context, high negative fit statistics for signers are not of particular concern.

Independent measures and ANOVA design

Separate questions on the communication questionnaire pertained to the three independent variables which are analyzed in the present paper. Teachers were asked to classify themselves as hearing, hard-of-hearing or deaf. They were also asked to report how many years they had taught hearing impaired students. (These responses were recoded into two categories: 0-5 years and 6 years or more.) Finally, they were asked to categorize the placement level of the targeted student for whom they were responding into one of five categories: pre-primary, elementary, junior high, high school or ungraded. For the current analysis, pre-primary and elementary were combined into one category and ungraded students were eliminated. The resulting analysis of variance therefore had a 3 x 2 x 3 design. Since cells had unequal Ns and random assignment could not be assumed, a hierarchical regression approach was prescribed for the calculation of the main effects sum of squares and their appropriate error terms. Hearing status, as a trait of the teachers, was evaluated first; years of experience was evaluated second, controlling only for hearing status; placement level was evaluated third, controlling for the other two independent variables; interactions were evaluated after the main effects in the same hierarchical manner.

RESULTS

Distribution of teachers along the English features scale

Of the 1,762 teachers in the survey data base, 1,135 reported signing to their students and responded to the continuum questions described above. Of the 1,135, 181 gave the English response to all 16 items. In a Rasch analysis, it is not possible to estimate logit scores for these respondents. Therefore, they were excluded from

further analysis. It should be noted, however, that these teachers showed the highest level of English signing of all teachers in the data base. However, because they could not be scaled, they require separate analysis.

Table 1 shows the number of signers at each of the logit scale levels. Half of the teachers (50 per cent) gave the English-like response to 14 or more of the items on the scale, and less than 12 per cent gave the English response to fewer than 8 of the items on the scale. The distribution reveals that, using self-reported data, teachers are predominantly English-like in their use of signs; however, considerable variation remains in the distribution.

Table 1
Frequency Distribution of English Logit Scaled Scores for Teachers Who Reported Signing to Their Students

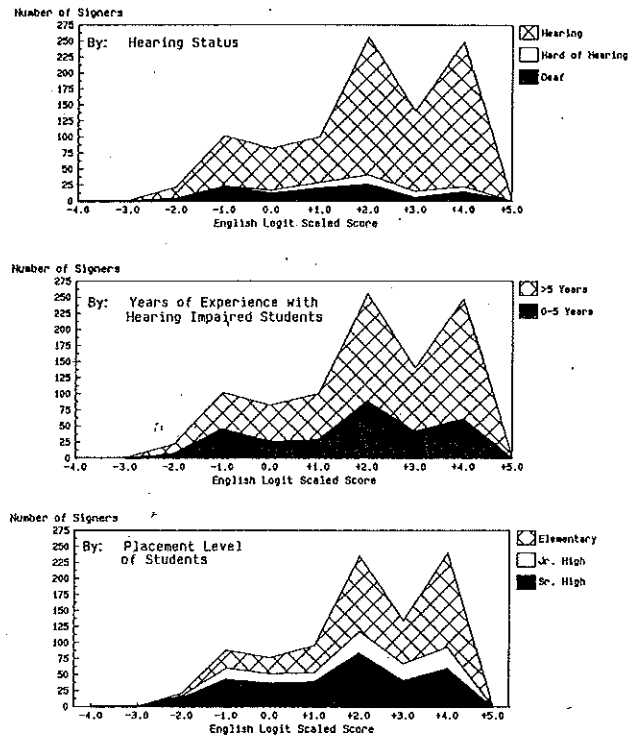
Number of Sign Elements Signed in an English-like Fashion	Logit Value	Number of Signers	Percent of Signers
16 (All English-Like)		181	15.9%
15	4.27	249	21.9%
14	3.24	140	12.3%
13	2.44	158	13.9%
12	1.77	99	8.7%
11	1.21	63	5.5%
10	0.72	37	3.3%
9	0.29	40	3.5%
8	-0.13	42	3.7%
7	-0.54	53	4.7%
6	-0.95	29	2.6%
5	-1.39	20	1.8%
4	-1.86	11	1.0%
3	-2.39	11	1.0%
2	-3.02	1	0.1%
1	-3.90	1	0.1%
	Total	1,135	100.0%

Figure 1 shows the shape of the logit distribution, subdivided by each of the independent variables considered in the current paper. Whole numbers have been represented along the X-axis of these plots. Frequencies plotted against these whole numbers represent the number of teachers assigned logit scores within the range of X plus or minus 0.5. Teachers who gave English-like responses to all 16 sign elements are not represented.

The plots depicted in Figure 1 show that the distributions of English logit scaled scores for deaf and hard-of-hearing teachers are flatter than those for hearing teachers, indicating greater variability and a higher proportion of teachers with lower scores. The same is true for teachers with five years or less experience teaching hearing impaired students: their scores are more

dispersed and there is a greater prevalence of teachers at the lower end of the scale. The distribution of logit scores for pre-primary and elementary teachers is more negatively skewed than for their junior high and senior high counterparts, indicating a greater prevalence of teachers with higher levels of English in their signs among this group.

Figure 1
Frequency Polygons:
Number of Signers at Each Level of English Logit Scaled Score



ANOVA of English logit scaled scores and Rasch fit statistic

Table 2 presents the results of the ANOVA for the English logit scaled scores, and Table 3 presents the ANOVA for the Rasch fit statistic. Hearing status, years of experience with hearing impaired students, and placement level of the students are all significant main effects relating to variation in the English features scale. Also there was a significant 2-way interaction between hearing status and placement level of the students. Hearing status was the only significant effect on the Rasch fit statistic.

Table 4 shows the means and standard deviations of the logit scaled scores for each relevant subgroup of the sample. Hearing teachers reported incorporating the highest number of English features in their signs and deaf teachers the lowest. Teachers with 6 or more years of experience reported higher incorporation of English features in their signing. Finally, incorporation of English features was inversely related to placement level of the students; teachers of pre-primary and elementary students had the highest mean logit scale score of any of the subgroups studied, and senior high teachers had the lowest.

Table 2
ANOVA, English Logit Scaled Scores by
Hearing Status of Teacher, Years of Experience
with Hearing Impaired Students, And Placement Level

Source of Variation	Sum of Squares	DF	Mean Square	F	Significance of F
Main Effects	252.22	5	50.44	16.52	.000
Hearing Status (HRSTA)	119.13	2	59.57	19.50	.000
Years of Experience with HI Students (YRSHI)	33.17	1	33.17	10.86	.001
Placement Level (LEVEL)	99.92	2	49.96	16.36	.000
2-way Interactions	39.77	8	4.97	1.63	.113
HRSTA YRSHI	.29	2	.14	.05	.954
HRSTA LEVEL	29.56	4	7.39	2.42	.047
YRSHI LEVEL	5.46	2	2.73	.89	.409
Explained	291.98	13	22.46	7.35	.000
Residual	2669.28	874	3.05		
Total	2961.27	887	3.34		

Table 3
ANOVA, Rasch Fit Statistics by
Hearing Status of Teacher, Years of Experience
with Hearing Impaired Students, and Placement Level

Source of Variation	Sum of Squares	DF	Mean Square	F	Significance of F
Main Effects	32.73	5	6.55	5.12	.000
Hearing Status (HRSTA)	29.69	2	14.85	11.61	.000
Years of Experience with HI Students (YRSHI)	.07	1	.07	.05	.818
Placement Level (LEVEL)	2.97	2	1.48	1.16	.314
2-way Interactions	7.14	8	.89	.70	.694
HRSTA YRSHI	2.38	2	1.19	.93	.395
HRSTA LEVEL	4.58	4	1.15	.90	.466
YRSHI LEVEL	.91	2	.46	.36	.700
Explained	39.86	13	3.07	2.40	.004
Residual	1117.38	874	1.28		
Total	1157.24	887	1.31		

Table 4
Means and Standard Deviations of English Logit Scaled Scores for Teachers at Different Levels of Each Independent Variable

	N	Mean	Standard Deviation
For Entire Population	888	2.00	1.74
By Hearing Status			
Hearing	744	2.14	1.71
Hard-of-Hearing	44	1.91	1.48
Deaf	100	1.07	1.79
By Years of Experience with Hearing Impaired Students			
0-5 years	278	1.79	1.75
6 years or more	610	2.10	1.72
By Student's Placement Level			
Pre-primary/Elementary	429	2.37	1.59
Junior High School	140	1.91	1.75
Senior High School	319	1.56	1.81

To interpret the significant two-way interaction between hearing status of teacher and placement level of the students for the English logit scale, Table 5 presents the means and standard deviations for teachers at different levels of hearing status within each placement level. Figure 2 shows a plot of the means for each group. As is evident from Figure 2, the extraordinarily low mean logit score for deaf junior high teachers accounts for the significant interaction. This finding is extremely difficult to interpret. It should be noted that the number of deaf teachers at this placement level (16) is very low. Thus the low mean value obtained and the significance of the interaction may be an artifact of the current data set. With an overall sample size of 888, the ANOVA shows an abundance of statistical power; thus, sample specific fluctuations may in fact be revealed as statistically significant effects. The main effects, which are more significant (each with a probability $< \text{or} = .001$) are more interpretable.

Another comment is in order pertaining to the low number of deaf and hard of hearing teachers at the elementary and junior high levels. It would be tempting to attribute this study's significant main effect for placement level to the correlation between the two independent variables, placement level and hearing status. Since more deaf teachers teach at the secondary

level, we would expect a lower degree of incorporating English features. While this is true, the hierarchical ANOVA approach used in the current analysis ensured the appropriate statistical control and the significance noted for placement level of the students takes into account the differences in the distribution of teacher hearing status within each group.

Figure 2
Means of English Logit Scaled Scores for Hearing, Hard of Hearing and Deaf Signing Teachers at Three Placement Levels

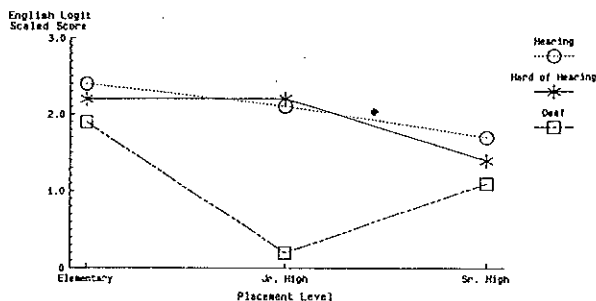


Table 6 shows the means of the Rasch fit statistic for each of the subgroups. The significant main effect for teacher hearing status can be interpreted by looking at the means for each group. Deaf teachers showed a mean fit statistic greater than 0, while hearing and hard-of-hearing teachers showed mean fit statistics less than 0. As described above, a fit statistic greater than 0 indicates inconsistency in the response patterns. Compared to hearing and hard of hearing teachers, deaf teachers had higher levels of inconsistency. This means that they were more likely to give English-like responses to sign elements high in the scale (for example reporting a sepa-

rate sign for *-ing*), while simultaneously reporting a non-English-like response for elements low on the scale (for example, omitting a separate sign or gesture for *I*).

Table 6
Means and Standard Deviations of Rasch Fit Statistics for Teachers at Different Levels of Each Independent Variable

	N	Mean	Standard Deviation
For Entire Population	888	-.13	1.14
By Hearing Status			
Hearing	744	-.20	1.06
Hard-of-Hearing	44	-.02	1.11
Deaf	100	.37	1.55
By Years Experience with Hearing Impaired Students (Not Significant)			
0-5 years	278	-.17	1.16
6 years or more	610	-.11	1.14
By Students' Placement Level			
Pre-primary/Elementary	429	-.23	1.04
Junior High School	140	-.11	1.15
Senior High School	319	-.01	1.26

Table 5

Means and Standard Deviations of English Logit Scaled Scores for Teachers at Different Levels of Hearing Status within Each Placement Level

	N	Mean	Standard Deviation
Pre-primary/Elementary			
Hearing	395	2.39	1.56
Hard-of-Hearing	17	2.23	1.60
Deaf	17	1.94	2.16
Junior High School			
Hearing	115	2.12	1.69
Hard-of-Hearing	9	2.22	1.20
Deaf	16	0.19	1.56
Senior High School			
Hearing	234	1.71	1.86
Hard of Hearing	18	1.44	1.42
Deaf	67	1.06	1.66

DISCUSSION

This paper has explored the utility of using large-scale survey methodology and a sophisticated scaling procedure for studying variations in sign communication among teachers of hearing impaired students. In another paper which reported findings from the same data set, the authors have described the psychometric properties of the scale itself and made recommendations for refining the questions to get a more precise assessment of the degree to which teachers of hearing impaired students incorporate features of English in their sign communication (Woodward & Allen, in press). Nonetheless, the current analysis was undertaken as a first attempt to use the preliminary scale that was developed to describe the variation among the styles of signing which exist among classroom teachers throughout the United States. When the scale becomes more refined and validated against actual classroom observation data, better descriptions will become possible.

The current findings support the conclusion that signed communication in the classroom is predominantly English-like; the majority of teachers studied reported signing in an English-like fashion most of the sign elements included in the scale. Nevertheless, the current study also shows what variation there is among teachers' signing (as it relates to incorporation of English features) is far from random. Incorporation of English features in the signs of teachers of hearing im-

paired students was shown to be related to hearing status, years of experience with hearing impaired students and placement level of the students.

Two important limitations should be mentioned. First, as noted above, the scale has not been validated against actual classroom observational data, thus, the conclusions are tentative. Second, this study has focused on selected teacher characteristics. Student characteristics were not considered. If student and teacher characteristics are correlated, and if teachers modify their use of English features in their signs to meet the needs of in their signs to meet the needs of individual students, then the results of the current analysis may mask important student effects.

These limitations notwithstanding, the findings presented here are important. They suggest that the degree to which English features as employed by teachers of hearing impaired students may vary systematically along the dimensions studied. Students of deaf teachers, of teachers with less experience and of high school teachers may very well be receiving sign communication with fewer English features than others. The fit analysis also suggests that students of deaf teachers may be receiving inconsistent English signing patterns from their teachers.

These results are not prescriptive in any way. Because the scale was designed to assess the incorporation of English features, it does not adequately describe the sign communication of those who scored low on the scale. The results suggest, however, that further large-scale research is possible and desirable to study the relationship between the English language development of hearing impaired students and the sign communication of their teachers. Such research could help assess the impact of teachers' communications on the language abilities of their students.

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