The Written Language of Deaf Adolescents: Patterns of Performance

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A study was conducted of the written language skills of a representative sample of 69 adolescents with severe and profound hearing losses, using both a standardized language sample (TOWL-2) and a letter. The overall results confirmed the generally low levels of performance typically found in this population and the existence of a developmental plateau. Nevertheless, performance levels were not uniformly low. The sample scored relatively high on measures of orthographic conventions and on semantics, but considerably lower on use of grammar. While females scored higher than males, and students in Auditory/Oral (A/O) programs scored higher than those in Total Communication (TC) programs, the profile of scores did not vary by group. In general, the letter elicited higher levels of performance than the standardized sample, although the latter elicited more grammatically complex writing. Factor analysis indicated that the various measures derived from the two samples were associated more strongly by genre than by levels of language form.

The invention of writing is one of the great intellectual achievements in the history of civilization. The “writing revolution” was the first great communication revolution, setting language free from the communicator and providing an independent text that could survive transmission over distance and time (Fagan, 1986). In the context of today’s “information revolution,” society grows increasingly dependent on literacy skills. Without writing, all those activities that depend on a degree of permanence and displacement—such as religion, law, philosophy, grade, and education—are severely limited. Given its critical role, deficiency in written language limits educational, employment, and recreational opportunities (Graham & Harris, 1988; Kelly & Whitehead, 1983). Literacy presents deaf individuals with both an opportunity and a risk—the opportunity of bypassing their generally poor spoken language and finding common ground with hearing society, but the risk of being even further constrained in their social opportunities should they fail to develop functional skills (Sheie, 1985).

Investigations of the written language of deaf students generally reflect the prevailing linguistic model (Marschark, 1993; Quigley & Paul, 1984). Traditionally most studies have concentrated on lexical and syntactic development at the sentence level (e.g., see Yoshinaga-Itano & Snyder, 1985, for a review). The well-known and widely used Test of Syntactic Abilities developed by Quigley and his collaborators (Quigley, Steinkamp, Power, & Jones, 1978) is a familiar example of this approach.

These studies typically reveal that the performance of deaf students is significantly below that of hearing peers (for reviews, see deVilliers, 1991; Quigley & Paul, 1984). In addition to finding that skills initially develop at a slower pace, there is evidence that the rate of acquisition further slows during adolescence (Allen, 1986; Yoshinaga-Itano & Downey, 1996).
This pattern of development, however, may not occur uniformly across components of performance. Yoshinanga-Itano, Snyder, and Mayberry (1996b) found evidence of different developmental trajectories, with semantics developing more rapidly than syntax. They also found that semantic and syntactic variables loaded on different factors, with semantic factors accounting for the larger proportion of the variance. Kluwin and Kelly (1991) also found that semantic and syntactic measures loaded on different factors.

Investigations of orthographic conventions find that deaf students perform relatively well. Kelly (1988) compared deaf college students with age-matched hearing students who were unskilled writers. He found that the deaf students made more semantic and syntactic errors than the hearing students, but fewer punctuation and spelling errors. Gormley and Sarachan-Deily (1987) compared deaf students rated by their teachers as “good” writers with those rated as “poor.” They found a number of differences between the groups in ratings of various aspects of semantics, only a few in syntax, and no differences in spelling, punctuation, or legibility.

Recent years have witnessed a rising interest in text-level aspects of semantics and in discourse processes. In general, studies focusing on this level find fewer differences between deaf and hearing students. Yoshinanga-Itano et al. (1996b), for example, found no differences between deaf and hearing students on the number of propositions, t-units, and cohesive devices in written texts, although deaf students elaborated their ideas less fully. DeVilliers (1991) did find that deaf students used fewer cohesive devices. Maxwell and Falick (1992) found that, while deaf students used as many cohesive devices as hearing children, they used fewer different lexical items to signal cohesion. They also observed that cohesive devices were not competently used to produce coherent narratives. Marschark, Mouradian, and Halas (1994) found that deaf students did not differ from hearing students in the length of their through-the-air stories (either signed or spoken, respectively) or their use of story grammar. The written stories of deaf students, however, were shorter, with fewer complex sentences. Thus, the findings in this area are conflicting, no doubt reflecting differences in both measurement and sampling. They do indicate, however, that performance in written language is not a unitary skill, but reflects a number of skills that may be differentially affected by deafness.

Recently, pragmatics has come to the fore as a concern for those interested in language development (Matluck & Matluck, 1982). As Robert Kretschmer (1989, p. 21) writes: “The writing process begins with a felt need to communicate and a conscious purpose.” His concern is that instruction address, not only the semantics and syntax of language, but the requirements of different writing genres, such as investigative reporting, academic prose, business letters, poetry, etc. Discussing the needs of hearing students, Oller and Damico (1990) argue that written language should be elicited in a rich and engaging context personally meaningful to students. This may be even more critical for deaf students, for whom language instruction has so often proceeded from a deficit model. In this vein, Yarger (1996) criticizes the Test of Written Language (TOWL-3) because the stimulus for eliciting the writing sample (a picture of a space colony) may be less familiar to deaf than to hearing students, and because the story format lacks personal authenticity. Yargar implies that writing tasks that are not personally meaningful may fail to elicit students’ best performance.

There is evidence that genre affects language performance. In an investigation of face-to-face communication, Schick (1997) found that deaf students’ language was less grammatically complex when producing narratives or engaging in spontaneous conversation. She observed that more personally engaging topics elicited a more informal register. Perron (1977a, 1977b, cited in Schick, 1997) found that deaf students produced more complex written language when required to produce an argument, compared to a narrative, description, or expository essay. Thus, grammatical complexity appears sensitive to genre, with more formal tasks enhancing performance.

One might expect that genre would affect semantics. Writing tasks that are more personally engaging might elicit more semantically rich material, both because students have more background information about the topic and because they are more motivated to perform. On the other hand, formal tasks might elicit writing that is conceptually more complex, requiring more explicit and elaborated exposition. While the enhanced motivation accompanying more meaningful writing tasks might stimulate better use of the conven-
tions of writing, performance in these areas might also reflect the particular purpose of the task. Thus, the effect of genre is likely complex.

The purpose of the present study is to describe the written language of deaf adolescents, with particular attention to their relative performance on conventional, semantic, and syntactic measures, as well as the effect of genre in these language components. We hypothesized that performance on measures of orthographic conventions and on semantics will be higher than on syntactic measures. Among semantic measures, we hypothesized that performance on text-level skills will exceed that on word-level skills. And we hypothesized that performance will be better overall on an authentic writing task than on a standardized writing sample.

The study is designed to investigate the skills of students in both Auditory/Oral (A/O) and Total Communication (TC) programs. Most studies have found that A/O students have better written language than TC students (Geers & Moog, 1989; Moores & Sweet, 1990), although there are exceptions (Yoshinaga-Itano, Snyder, & Mayberry, 1996a). Typically, however, A/O students have more hearing and are socioeconomically advantaged than TC students (e.g., Geers, Moog, & Shick, 1984). They also have the advantage of sharing the language of their parents (i.e., speech) and exposure to it from birth.

Since spoken language maps directly onto print, it is not surprising that students who are successful orally also develop better written language. It is also of interest to determine whether the same overall pattern of performance obtains within these two groups. Although TC programs emphasize English-based sign, teachers often do not completely encode the spoken message, most frequently omitting grammatical morphemes (Kluwin, 1981; Marmor & Petitto, 1979). TC students, therefore, are not provided with a consistent and comprehensive model of English grammar. In addition, TC students typically demonstrate some skills in ASL, either from interaction with peers who have deaf parents or with deaf professionals, or because of spontaneous changes to English-based sign that derive from the visual/spatial medium (Gee & Mounty, 1991; Leutke-Stahlman, 1990; Nelson, Loncke, & Camarata, 1993). It is possible that ASL skill negatively influences written language, either because ASL structures intrude directly into students' written English, or simply because its use reduces their exposure to English (e.g., Mayer & Wells, 1996; Paul, 1996). On the other hand, some argue that sign language skills can support and even transfer to English (Israelite, Ewoldt, & Hoffmeister, 1992; Johnson, Liddell, & Erting, 1989). It is thus of theoretical, as well as practical, interest to compare the performance profiles of A/O and TC students. Due to the complexity of the issues, however, no specific hypotheses will be made.

Method

Subjects

The sample included 69 deaf adolescents enrolled in a variety of settings across Ontario, including provincial schools, segregated classes in public schools, resource room programs, and mainstreamed settings. Participants ranged in age from 14.5 to 19.5 years, with a mean of 16.3 years. The sample consisted of all those from the early childhood sample studied by Musselman, Lindsay, and Wilson (1988) who could be located and who agreed to participate. The original sample of 153 children, highly representative of the population of deaf children, had been followed from roughly the ages of 3 through 7 years. In addition to the data collected in adolescence, this study utilizes data obtained in the final year of the early childhood study, when the children averaged 6.9 years.

Due to the greater reluctance of males to participate, the adolescent sample was not equally representative of males and females: only 36% of participants were male and 64% female. On other important background characteristics (i.e., hearing threshold levels, performance IQ, age, fathers' and mothers' socioeconomic status), the adolescent group did not differ significantly from the early childhood group. Thus, except for gender, the sample was broadly representative of the population of deaf adolescents.

The adolescent sample was divided into an Auditory/Oral (A/O) and a Signing group on the basis of their predominant mode of communication. This resulted in a relatively small group of 15 A/O students and a larger group of 54 Signing students.

Information was obtained from audiological records on students' hearing threshold levels (i.e., pure tone average in the better ear at 500, 1000, and 2000
Hz). Parent interviews provided information on chronological age, parental hearing status, and socioeconomic status (Blishen & Roberts, 1976). The Performance Scales of the appropriate Weschler test (Weschler Intelligence Scales for Children—III (WISC-III) or the Weschler Adult Intelligence Scale [WAIS]) were used as an estimate of intelligence.

Students' communication history was determined from school files and parent interviews. Students were categorized as A/O if they were attending an auditory/oral program in adolescence and, otherwise, as Signing.

Writing Samples

Two different tasks were selected to assess written language. The first, a standardized test, was chosen because it provides normalized scores on components of written language of interest to the present investigation. The second task, a letter, was designed to be maximally meaningful and personally engaging.

Test of Written Language (TOWL-2) (Hammill & Larsen, 1988). The TOWL-2 is composed of 10 subtests, five structured tasks and five derived from a spontaneous writing sample. Only the spontaneous task and its five resulting scores were used in the present study. On this task, participants are given 15 minutes to write a story in response to a black and white picture that represents a future space colony on another planet.

Letter. Subjects were asked to compose a letter to a deaf member of the Ontario Provincial Parliament (MPP) on the subject of deaf education. The MPP prepared a brief introduction about himself and his responsibilities as an elected official and asked students to write about themselves, their experiences in the educational system, and their recommendations for change. His introduction was originally signed in ASL and videotaped, and later translated into print. Participants were given as much time as they wished to complete their letter, up to a maximum of 50 minutes.

Scoring of Writing Samples

TOWL standardized scores. The following five standardized scores are derived from the spontaneous writing sample:

1. Contextual style: varying points for proper usage of punctuation and capitalization;
2. Contextual spelling: one point for each correctly spelled word;
3. Thematic maturity: one point for each predetermined element included, such as appropriate vocabulary, character development, reference to objects in the picture, and inclusion of various story elements;
4. Contextual vocabulary: one point for each different word containing seven or more letters;
5. Syntactic maturity: one point for each word in a main clause that is grammatically correct.

These five subtests measure different aspects of written language. Contextual spelling and contextual style tap language conventions specific to print. Thematic maturity assesses aspects of semantics at the text level, while contextual vocabulary assesses semantic development at the word level. Syntactic maturity provides a global assessment of grammatical knowledge. Each subtest yields a standard score that has a mean of 10 and a standard deviation (SD) of 3. These are summed to yield an overall writing quotient (Qscore), which has a mean of 100 and an SD of 15.

Linguistic scoring. Both writing samples were also scored using widely accepted indices of linguistic functioning (Klee, 1992):

1. Holistic score. The samples were coded using a holistic scoring system adapted from Moores et al. (1987). Each sample was read and assigned a score on a six-point scale ranging from “no functional skills” to “superior.” The criteria for each level emphasize the ability to make appropriate use of linguistic form in conveying meaning (see Table 1). A reliability study on the holistic scoring was conducted using a subsample of 16 TOWLS and 16 letters. Overall, there was 91% agreement on assignment to levels; the Pearson product-moment correlation for the TOWL scores was .93 (p < .000) and, for the letter, .95 (p < .000). Thus, scoring was highly reliable.
2. Number of words.
3. Number of t-units. T-units are defined as a main clause together with any subordinate clauses and were identified using criteria originally developed by the Educational Testing Service, as modified by Kluwin and Kelly (1990). T-unit analysis has been found to be a
Table 1 Holistic scoring scale

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superior (5)</td>
<td>Able to use vocabulary and grammar with native-like fluency and accuracy. Writes on the assigned topic with clarity, imagination, originality, and sophistication. Logical organization of ideas.</td>
</tr>
<tr>
<td>Advanced (4)</td>
<td>Able to write with sufficient grammatical accuracy and vocabulary. Vocabulary is broad, grammatical errors are infrequent and do not interfere with meaning. Clear and interesting writing on the assigned topic.</td>
</tr>
<tr>
<td>Intermediate (3)</td>
<td>Able to write with fair to good grammatical accuracy and vocabulary. Grammatical, word-order, and spelling errors only occasionally interfere with conveying meaning. Writes on the assigned topic.</td>
</tr>
<tr>
<td>Survival (2)</td>
<td>Able to satisfy basic survival needs. Grammatical, word-order, and spelling errors occasionally interfere with conveying meaning. Responds to topic, but may ramble; weak in organization.</td>
</tr>
<tr>
<td>Novice (1)</td>
<td>Limited vocabulary, frequent grammatical, word-order, and spelling errors interfere with conveying meaning. Some relevant content, but weak in organization. Lacks clarity.</td>
</tr>
<tr>
<td>None (0)</td>
<td>No functional skills in writing. Writing is unintelligible, full of grammatical, word-order, and spelling errors that distort meaning. Writing consists of a group of sentences written without particular order or plan.</td>
</tr>
</tbody>
</table>

4. Number of different words. The number of different root words, that is, the total number of words minus the number of times the word was repeated and/or inflected.

5. Type-token ratio (TTR). The ratio of the number of different words to total words.

6. Mean words per t-unit. The mean number of words per t-unit.

These linguistic measures were calculated using preprogrammed routines that are part of the Word Perfect 7.0 word processing package, plus specially programmed routines.

These measures also assess different components of literacy. The holistic score emphasizes the appropriate integration of content and form within a particular genre. Number of words and t-units reflect the semantic richness of the text as a whole. Number of different words and TTR are word-level measures of semantic development. Number of words per t-unit reflects syntactic complexity.

Procedures

The adolescent writing tasks were typically administered during school to small groups of students. General instructions for the TOWL and the letter were given using either spoken language, simultaneous communication, or ASL, depending on student preference. The stimulus for the letter was presented both on videotape and in printed form. Information on educational history was obtained from parent and student interviews. Measures of performance IQ and hearing threshold levels had been obtained during the early childhood phase of the study; more recent audiometric assessments were examined to detect significant changes from early childhood.

Data Analysis

Data were first analyzed to detect differences by gender and changes in performance with age. Differences among the language skills assessed by the TOWL were analyzed using a multivariate analysis of variance (MANOVA) with subtest scores as repeated measures and communication mode as a fixed factor. The hypotheses concerning relative performance on the subtests were tested using a set of special contrasts. The hypothesis that performance on writing conventions would exceed that on grammar was tested by comparing the style and spelling scores to the syntactic maturity score. Although no hypothesis was made, the style and spelling scores were also compared to one another. The hypothesis that semantic skills would exceed grammatical skills was tested by comparing the maturity and vocabulary scores to the syntactic maturity score. The hypothesis that text-level semantic skills would exceed
those at the word level was assessed by comparing the maturity and vocabulary scores.

The hypotheses that performance would be higher on the letter than on the TOWL was assessed by a series of 2 (genre) × 2 (mode) ANOVAs. Intercorrelations and factor analysis were used to identify the independent components of written language assessed by the entire battery of measures used.

Results

Characteristics of the Sample

Students averaged 16.3 years at time of testing. The average unaided hearing threshold level was 100.6 and Weschler Performance IQ. averaged 110.9. A/O and Signing students did not differ in age, or mothers’ and fathers’ socioeconomic status (Blishen & Roberts, 1976). A/O students tended to have a higher IQ score than Signing students (118.13 versus 108.81, respectively), $F(1,66) = 3.50, p = .066$, and had significantly more hearing (93.2 dB versus 102.59 dB), $F(1,67) = 5.53, p = .022$.

All of the A/O students had hearing parents and had been enrolled in A/O programs throughout their educational history. At the time of the study, 13 were fully integrated, one was partially integrated, and one was enrolled in a segregated A/O class.

Nine of the Signing students had two deaf parents and had been exposed to sign language from birth. The age at which the remaining students began to sign varied widely, ranging from 0.5 to 14 years, with a mean of 5.1 years. Most (37) of the Signing students attended segregated classes in adolescence; 17 were partially or fully integrated, most of these with interpreters.

Effects Associated With Gender

The 24 males and 45 females in the sample did not differ on age or hearing threshold levels. The TOWL subtest scores were subjected to a 5 (subtests) × 2 (gender) multiple analysis of variance (MANOVA), with TOWL subtests as a repeated measure and gender as a fixed factor. There was a main effect for gender, $F(4,64) = 5.21, p = .026$. Females had an average standard score of 8.5 over all tests, while males averaged 7.0; thus, females scored approximately half an SD below the mean across all subtests, while males scored a full SD lower (see Table 2). There was a main effect for subtest, $F(4,64) = 18.07, p = .000$, but no interaction of subtest with gender. Thus, the female advantage was consistent across all subtests. A similar pattern was also observed on the Qscore, where females averaged 89.7 and males, 78.8. In a one-way ANOVA, this difference was found to be significant, $F(1,67) = 6.32, p = .014$.

Gender differences on the linguistic measures were analyzed using one-way ANOVAs (see Table 3). There was only one significant difference by gender on these measures for the TOWL: on number of words per t-unit, females scored significantly higher than males. There were, however, significant differences on all of the letter scores: females scored higher than males on all these measures, except for TTR, on which they scored significantly lower.

### Table 2 TOWL scores by gender

<table>
<thead>
<tr>
<th>Measure</th>
<th>Males ($n = 24$)</th>
<th>Females ($n = 45$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Style</td>
<td>7.96</td>
<td>9.89</td>
</tr>
<tr>
<td>Maturity</td>
<td>8.63</td>
<td>8.82</td>
</tr>
<tr>
<td>Spelling</td>
<td>7.42</td>
<td>8.87</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>6.25</td>
<td>8.31</td>
</tr>
<tr>
<td>Syntax</td>
<td>4.79</td>
<td>6.53</td>
</tr>
<tr>
<td>Qscore</td>
<td>78.75</td>
<td>89.73</td>
</tr>
</tbody>
</table>

TOWL subtest scores are standardized with a mean of 10 and a standard deviation of 3.

### Table 3 TOWL and letter linguistic scores by gender

<table>
<thead>
<tr>
<th>Measure</th>
<th>Males ($n = 24$)</th>
<th>Females ($n = 45$)</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holistic</td>
<td>2.13</td>
<td>2.22</td>
<td>.736</td>
</tr>
<tr>
<td>No. words</td>
<td>140.83</td>
<td>168.38</td>
<td>.086</td>
</tr>
<tr>
<td>No. t-units</td>
<td>14.62</td>
<td>15.31</td>
<td>.650</td>
</tr>
<tr>
<td>No. diff. words</td>
<td>73.08</td>
<td>84.56</td>
<td>.118</td>
</tr>
<tr>
<td>TTR</td>
<td>.54</td>
<td>.51</td>
<td>.181</td>
</tr>
<tr>
<td>No. words/t-unit</td>
<td>9.72</td>
<td>11.61</td>
<td>.048</td>
</tr>
<tr>
<td>Holistic</td>
<td>2.22</td>
<td>2.84</td>
<td>.016</td>
</tr>
<tr>
<td>No. words</td>
<td>178.21</td>
<td>369.44</td>
<td>.000</td>
</tr>
<tr>
<td>No. t-units</td>
<td>19.33</td>
<td>34.89</td>
<td>.000</td>
</tr>
<tr>
<td>No. diff. words</td>
<td>90.38</td>
<td>142.73</td>
<td>.003</td>
</tr>
<tr>
<td>TTR</td>
<td>.52</td>
<td>.43</td>
<td>.000</td>
</tr>
<tr>
<td>No. words/t-unit</td>
<td>9.21</td>
<td>10.61</td>
<td>.015</td>
</tr>
</tbody>
</table>
Effects Associated With Age

Differences in scores by age were analyzed using one-way ANOVA, with age as a fixed factor. In order to have sufficient numbers within each group for analysis, the sample was divided into four age groups: 13–14 years (n = 16); 15 years (n = 19); 16 years (n = 24); and 17–18 years (n = 10). For the analysis of the TOWL subtests, raw scores were used rather than standard scores. Results from these analyses revealed no significant effects for age, neither on the TOWL subtest scores, nor on the linguistic scores for the TOWL and the letter. Inspection of the data showed no consistent trends for age, except for the TOWL TTR, which did show a small linear increase. A confirmatory analysis using Pearson product-moment correlations between age and the various measures found a significant correlation only for TTR, although it was small (r = .32, p = .007).

TOWL Skill Levels

Figure 1 shows the mean scores for each of the five TOWL subtests. The average scores for style and maturity were a little more than one point below the norm of 10; the spelling and vocabulary scores, while roughly 2 and 3 points below the mean, respectively, still fell within the normal range for hearing peers. At approximately 4.5 points below the mean, however, the syntactic maturity score fell more than 1 SD below that expected.

To test the hypotheses concerning relative performance on the language components assessed by the TOWL, these data were analyzed using a 5 (subtests) × 2 (mode) MANOVA, with TOWL subtests as a repeated measure and communication mode as a fixed factor. While the previous analysis by gender had shown that females scored higher than males, the absence of a significant interaction of gender with subtest indicated that the overall pattern of scores was the same; therefore, gender was not included as a factor in the current analysis. It was noted, however, that 80% of the A/O students were female, compared to only 61% of the Signing students. While this difference was not significant (Fisher's exact test), cases were weighted by gender, so as to provide an unbiased estimate of the population parameters.

The analysis revealed a main effect for communication mode, which will be described in a subsequent section. Germaine to the present discussion is the main effect obtained for subtest, F(4,64) = 21.16, p = .000, indicating significant differences among scores on the various sections of the TOWL.

The specific hypothesis regarding subtest performance were tested using a set of special contrasts. The hypothesis that scores would be higher on measures of writing conventions (style, spelling) than on the syntactic maturity score was confirmed, F(1,67) = 87.29, p = .000. Although no prediction was made, a contrast was included to compare performance on the style and spelling subtests; the results reveal a marginally significant difference in favor of style, F(1,67) = 3.64, p = .061. The hypothesis that the two semantic scores would exceed the syntactic score was confirmed, F(1,67) = 50.07, p = .000. The hypothesis that the text-level semantic score (maturity) would exceed the word-level semantic score (vocabulary) was also confirmed, F(1,67) = 11.39, p = .001. Overall, the interaction of contrast and communication mode was not significant, indicating that both A/O and TC groups had similar patterns of scores.

Comparison of Performance on the TOWL and the Letter

TOWL and letter linguistic scores were compared using 2 (genre) × 2 (mode) ANOVAs, with cases weighted for gender. This section will consider only
Table 4  *TOWL* and letter linguistic scores overall and by mode

<table>
<thead>
<tr>
<th>Measure</th>
<th>Total group</th>
<th>A/O</th>
<th>Signing</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TOWL</td>
<td>Letter</td>
<td>TOWL</td>
<td>Letter</td>
</tr>
<tr>
<td>Holistic</td>
<td>2.17</td>
<td>2.53</td>
<td>3.21</td>
<td>3.56</td>
</tr>
<tr>
<td>No. words</td>
<td>154.67</td>
<td>274.28</td>
<td>171.65</td>
<td>379.98</td>
</tr>
<tr>
<td>No. t-units</td>
<td>14.97</td>
<td>26.95</td>
<td>14.01</td>
<td>32.77</td>
</tr>
<tr>
<td>No. diff. words</td>
<td>78.85</td>
<td>116.68</td>
<td>90.53</td>
<td>154.66</td>
</tr>
<tr>
<td>TTR</td>
<td>0.53</td>
<td>0.48</td>
<td>0.53</td>
<td>0.46</td>
</tr>
<tr>
<td>No. words/t-unit</td>
<td>10.67</td>
<td>9.91</td>
<td>13.22</td>
<td>11.42</td>
</tr>
</tbody>
</table>

Cases are weighted by gender.

Table 5  Summary of factor analysis on written language measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOWL subtests</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Style</td>
<td>.48714</td>
<td>.09764</td>
<td>.42648</td>
<td>.10159</td>
</tr>
<tr>
<td>Maturity</td>
<td>.81757</td>
<td>.02867</td>
<td>.07844</td>
<td>.16536</td>
</tr>
<tr>
<td>Spelling</td>
<td>.82043</td>
<td>.22563</td>
<td>.15493</td>
<td>.01206</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>.60795</td>
<td>.26150</td>
<td>.46558</td>
<td>.26675</td>
</tr>
<tr>
<td>Syntax</td>
<td>.46532</td>
<td>.39350</td>
<td>.67904</td>
<td>.04332</td>
</tr>
<tr>
<td>TOWL linguistic measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Holistic</td>
<td>.10497</td>
<td>.09736</td>
<td>.85692</td>
<td>.04737</td>
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<tr>
<td>No. words</td>
<td>.87959</td>
<td>.27203</td>
<td>.26957</td>
<td>-.06045</td>
</tr>
<tr>
<td>No. t-units</td>
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<td>.13965</td>
<td>.07573</td>
<td>-.54917</td>
</tr>
<tr>
<td>No. diff. words</td>
<td>.86513</td>
<td>.20080</td>
<td>.30598</td>
<td>.20587</td>
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<td>TTR</td>
<td>-.29316</td>
<td>-.26562</td>
<td>-.04550</td>
<td>.59055</td>
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<tr>
<td>No. words/t-unit</td>
<td>.17761</td>
<td>.20378</td>
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<td>.69358</td>
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<td>Letter linguistic measures</td>
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<td></td>
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<td></td>
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<tr>
<td>Holistic</td>
<td>.10497</td>
<td>.29024</td>
<td>.83916</td>
<td>.23025</td>
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<tr>
<td>No. words</td>
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<td>.91342</td>
<td>.25271</td>
<td>.16159</td>
</tr>
<tr>
<td>No. t-units</td>
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<tr>
<td>No. diff. words</td>
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<td>.22822</td>
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<td>-.90806</td>
<td>.05592</td>
<td>.04492</td>
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<tr>
<td>No. words/t-unit</td>
<td>.28827</td>
<td>.31819</td>
<td>.24433</td>
<td>.69474</td>
</tr>
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</table>

the results pertaining to genre, which are included in Table 4. Main effects for genre were obtained on the holistic score, which was higher for the letter than the *TOWL*. Similar differences were found on the measures of verbal productivity (number of words and t-units). Letter scores also exceeded *TOWLS* on number of different words and number of words per t-unit. In contrast, TTRs were significantly lower on the letters than *TOWLS*.

Components of Written Language

The five subtests of the *TOWL* were all significantly intercorrelated, with coefficients ranging from moderate (.43) to high (.73). Inspection of the pattern of intercorrelations reveals no dramatic deviations from those evidenced by the original norming sample. Factor analysis (Principal Components Analysis) indicated that all five subtests loaded on one factor, which explained 63% of the variance.

A factor analysis with VARIMAX rotation was also undertaken of the total battery of measures used to assess written language (5 *TOWL* subtests, 7 linguistic *TOWL* scores, 7 linguistic letter scores) (see Table 5). Factor 1 includes all of the *TOWL* subtests and most of the linguistic scores, but none of the letter scores. Factor 2 primarily consists of the semantic scores from the letter. The highest loadings on Factor 3 are provided by the *TOWL* and letter holistic scores and the *TOWL* syntactic maturity score; the style and vocabu-
Table 6  *TOWL* subtest scores by communication mode

<table>
<thead>
<tr>
<th>Measure</th>
<th>A/O (n = 15)</th>
<th>Signing (n = 54)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Style</td>
<td>9.88</td>
<td>8.70</td>
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<tr>
<td>Maturity</td>
<td>10.01</td>
<td>8.41</td>
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<tr>
<td>Spelling</td>
<td>9.04</td>
<td>7.93</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>8.79</td>
<td>6.92</td>
</tr>
<tr>
<td>Syntactic maturity</td>
<td>7.78</td>
<td>5.15</td>
</tr>
<tr>
<td>QScore</td>
<td>92.5</td>
<td>82.3</td>
</tr>
</tbody>
</table>

Cases are weighted by gender.

Effects Associated With Communication Mode

As indicated above, the two-way MANOVA on the *TOWL* subtests obtained a significant main effect for communication mode, $F(1,67) = 4.59, p = .036$. Table 6 presents the average subtest scores by group. As is evident, A/O students consistently scored higher than Signing students. A/O students averaged 9.41 over all subtests, and had an average Qscore of 92.5. Signing students averaged 7.55 over all subtests, with an average Qscore of 82.3. A/O students, therefore, scored only slightly below the hearing norm, while Signing students scored more than 1 SD below the norm.

Scores were not uniformly low within the sample. Females scored significantly higher than males, with an average Qscore of 90, compared to 79 for males. The small group of A/O students had an average Qscore of 92, which was significantly higher than the Signing group, a finding that also confirms previous research (e.g., Geers & Moog, 1989; Moores & Sweet, 1990). Differences associated with communication mode were not evident on all measures. Signing students did not differ significantly from A/O students in the number of ideas they expressed (i.e., t-units). They were, however, less able to elaborate their ideas, as evidenced by the use of fewer words and fewer different words.

Performance did not change systematically with age, replicating the “plateau,” which has been described by other researchers (Allen, 1986; Yoshinaga-Itano & Downey, 1996). In contrast to Yoshinaga-Itano et al.’s findings (1996b), the plateau was found to characterize development in both semantics and syntax, as well as orthographic conventions.

Scores were not uniformly low across written language skills. Students did relatively well on orthographic conventions, including the *TOWL* style subtest (representing punctuation and capitalization) and the spelling subtest. Students scored higher on semantic than syntactic measures, and higher on the text-level semantic score (i.e., maturity) than the word-level score (i.e., vocabulary). Average scores on all four of these subtests fell within the normal range. Syntactic maturity was the lowest score, falling considerably below the normal range.

Most previous studies of written language, which have generally emphasized language form, have
painted a dismal picture of the skills possessed by deaf adolescents. The picture presented here indicates that deaf adolescents do evidence considerable difficulties with the vocabulary and syntax of English. They are able, however, to convey content with greater success than their language skills would suggest possible. They also demonstrate higher-than-expected skills in writing conventions. These findings confirm the hypotheses regarding relative skill levels and are consistent with the small body of previous literature, which has documented relatively good semantic and orthographic skills in deaf adolescents (Gormley & Saracchan-Deily, 1987; Kelly, 1988; Marschark et al., 1994; Maxwell & Falick, 1992; Yoshinaga-Itano et al., 1996b).

To emphasize that deaf students do relatively well in communicating content appropriate to the task is not to minimize the importance of language form. Factor analysis of the TOWL indicated that all five subtests loaded on one factor, indicating a high degree of inter-relationship. In a factor analysis of the total battery of measures, one factor was found to include the two holistic scores from the TOWL and the letter, together with the TOWL syntactic maturity and, to a lesser extent, the TOWL vocabulary score. It is thus evident that limited knowledge of language form did constrain the ability of these students to communicate in writing.

Apart from this factor, however, most measures derived from the TOWL and the letter loaded on different factors. Factor 1 could be characterized as a general measure of performance on the TOWL, and Factor 2 as general performance on the letter. Thus, these two tasks tapped somewhat different skills, and most measures derived from each task were highly associated. Genre, therefore, was a more important factor in describing performance than conventional linguistic distinctions between semantics and syntax. While Yoshinaga-Itano et al. (1996a, 1996b) found that syntactic and semantic variables loaded on different factors, their measures were all derived from a single task (Peabody Language Development Kit), which, like the TOWL, uses a picture stimulus. The results obtained in the present study suggest that language behavior is, to an important degree, organized around function, and not only around levels of language form.

The final and fourth factor consisted of number of words per t-unit from both samples, the TTR from the TOWL, together with number of t-units on the TOWL. The latter had a negative load and likely reflects a trade-off between complexity and productivity in this brief, timed sample. The fourth factor might be considered a measure of elaboration. Number of words per t-unit reflects the extent to which students attempted to construct grammatically complex phrases. In contrast, a high score on the TOWL syntactic maturity measure could be obtained by writing only simple sentences, as long as they were correctly structured. TTR, which represents lexical diversity, might also reflect the extent to which ideas were elaborated.

Overall, the letter elicited higher levels of performance than the TOWL. Level of productivity was higher, both in terms of ideas (i.e., number of t-units) and words (i.e., number of words, number of different words). This is not surprising since more time was allowed for this task. The letter, however, also yielded a higher holistic score, indicating that more than time was involved.

These differences may reflect the different knowledge base underlying the two genres—general knowledge in the case of the TOWL contrasted with personal knowledge requested in the letter. Students may also have been differentially motivated to respond to these two tasks because of the contrasting ways in which their were elicited, that is, standardized format versus personal, videotaped invitation. The manner in which the letter was elicited also provided a model upon which students could scaffold a response. Many students used the speaker's framework to respond, writing letters which modeled his ideas and organization.

In contrast, TTRs were lower on the letter. Interpretation of TTRs, however, is not straightforward. While TTR values indicated somewhat less lexical diversity in the letters, TTRs were still close to the expected value of .50 (Klee, 1992). Perusal of the letters reveals that most students wrote on a restricted number of ideas, most notably communication mode and school placement. These, however, were typically dealt with at some length. The picture stimulus for the TOWL, which contained numerous objects, may have encouraged greater breadth of ideas. Thus, a lower TTR, while signaling less lexical diversity, might reflect increased elaboration of ideas. This interpretation is corroborated by the strong negative loading of TTR on
Factor 2, which included most of the measures derived from the letter.

In contrast to this pattern of superior performance on the letter, t-units tended to be longer on the TOWL, suggesting greater grammatical complexity. A reading of the samples suggests that this reflects increased use of complex sentences, as students attempted to explain the origin of the events depicted, for example, that people had immigrated to the moon because of overcrowding on earth, or the significance of the buried tablet and the consequences of its discovery. This is consistent with Schick’s (1997) observation that decontextualized topics elicit a more formal register. Grammatical performance, therefore, did not show the hypothesized relationship to genre.

The letter not only elicited generally higher levels of performance but also permitted greater variability among students. Differences between females and males were more pervasive on the letter than the TOWL, and some of the differences between A/O and Signing students were larger. It seems that the longer time allowed and the more motivating content of the letter provided an increased opportunity for advanced students to display their skills. While A/O students generally scored higher than Signing students, both groups evidenced the same relative profile on the TOWL subtests. Thus, communication mode did not appear to alter the basic processes underlying the acquisition of written language. This is somewhat surprising, given what would appear to be important differences in their primary mode of communication. There are several possible interpretations of this phenomenon. One is that both communication modes represent English, albeit in different sensory modalities. Thus, the primary language of both groups is English, which then forms the substrate for both groups upon which written English is acquired. If this interpretation is correct, students educated primarily using ASL might show a different pattern of relative skills. A second possibility is that deaf students acquire written English directly, without reference to the system used for face-to-face communication. A third possible interpretation is that the two profiles are only phenotypically similar, while resulting from different underlying processes; thus, A/O and Signing students might acquire written English in different ways, with the similarity in resulting profiles being merely coincidental.

We prefer the second explanation as most consistent with the overall pattern of findings and suggest that the primary processes involved are direct visual learning and increased reliance on semantic strategies. This notion is based on Stanovich’s (1980) interactive-compensatory hypothesis, which posits that hearing readers may compensate for poor phonological skills by increasing their reliance on use of context. Applying this notion to deaf students requires extending the theory to allow for the compensatory use of a broader range of skills, in this case due to deaf students’ relatively weak knowledge of language form. This hypothesis is supported by Kelly’s (1988) finding that deaf students fail to monitor grammar to the extent that even similarly skilled hearing writers do, suggesting that the two groups achieve roughly the same level of performance using different approaches to the task.

Reliance on direct visual learning can account for the relatively good performance of deaf students on the conventions of writing. These are specific to print and would seem amenable to acquisition by visual means. Of course, it is known that hearing readers also use orthography in learning to read, but generally only in the beginning stages (Stanovich, 1980). There is evidence that orthography may play a larger role in learning to read a nonalphabetic language (Huang & Hanley, 1994). Given their intact visual skills, it is not surprising to find that deaf students make more use of visual processing in learning an alphabetic language. Padden (1993), for example, found that deaf students used unique visual strategies in learning to spell. There is also evidence that deaf students use orthography rather than phonology in word recognition during reading (Parasnis & Whitaker, 1992; Quinn, 1982), although this is a controversial finding (see Leybaert, 1993, for a review). Other orthographic conventions are likely similarly amenable to visual learning.

Increased reliance on higher-level semantic skills capitalizes on the unimpaired intellectual abilities of deaf students (Moores, 1987). There is evidence that deaf students use context in reading (Gormley & Franzén, 1978; Israelite & Helfrich, 1988), although it appears that they make less use of context than hearing readers do (Andrews & Mason, 1991; Jackson, Paul, &
Smith, 1997). The demand to produce text, however, may mobilize increased use of higher-level processes, as writing cannot occur without the active involvement of the writer.

Programs that emphasize meaningful and purposive writing would appear to build on deaf students’ strengths, while providing an authentic medium in which to address their weaknesses. Yoshinaga-Itano, Synder, and Mayberry (1996a) argue that the increasing focus on semantics within programming and assessment is a welcome trend, and descriptions of authentic writing programs do exist in the literature (Andrews & Gonzales, 1991; Ewoldt, 1981).

Their use with deaf children implies adoption not only of the notion of compensation but recognition of the interactive nature of language skills. Kluwin and Kelly (1992) found that a process writing program was successful in improving the writing of elementary and secondary school deaf students, including grammatical complexity as well as overall quality. The present study is consistent with this trend, emphasizing the importance of integrating language content, form, and use in literacy activities that are truly communicative.

References


