Some Language Skills of the Students in a Residential School for the Deaf

M.P. Moeller, M.J. Osberger,
A.J. McConkey, and M. Eccarius
Boys Town Institute for Communication Disorders in Children

This paper presents a preliminary analysis of the performance of a large group of hearing-impaired students on a battery of language tests. The students, who comprised the population of a residential school for the deaf, ranged in age from 5 to 20 years. Whenever possible, performance was examined developmentally across students. The language measures used were selected to assess form, content, and function of language over a range of developmental tasks. Not unexpectedly, the students showed delays in concept development, vocabulary skills, and syntax/morphology skills both receptively and expressively. The data also showed a plateau in the growth of specific language skills after 12 to 13 years of age. Test format was found to have a strong influence on student performance. The advantages and disadvantages of the various test procedures are also discussed.

Within recent years, a considerable body of data has been collected on the developmental patterns of speech and language acquisition by normal-hearing children. In contrast to this, few studies have examined the speech and language skills of hearing-impaired children on a developmental basis. Although it is generally agreed that severely and profoundly hearing-impaired students experience considerable delays in acquiring language, it is not clear how great the delays are or if the extent of the delay is similar across all language forms.

A major obstacle in assessing the communication skills of the hearing impaired is that relatively few tests have been standardized on hearing-impaired students. When tests which have been normed on hearing children are used with the hearing impaired, modification of test procedures is often necessary in order to obtain the desired diagnostic information. In turn, such

M.P. Moeller, M.S., is Coordinator of Aural Rehabilitation at Boys Town Institute for Communication Disorders in Omaha, Nebraska. A.J. McConkey, M.S., and M.A. Eccarius, B.A., are Aural Rehabilitation Specialists who serve on a multidisciplinary evaluation team at Boys Town Institute. M.J. Osberger, Ph.D., is a Research Associate and Coordinator of the Clinical Research Program in Aural Rehabilitation at Boys Town Institute.

modifications can affect test scores. An example of this is the administration of test items using some form of sign language rather than spoken English. In addition, until we have more standardized data on hearing-impaired students, a clinician is not able to evaluate accurately the performance of an individual hearing-impaired student relative to her/his hearing-impaired peers.

The purpose of this paper is to present preliminary data on the performance of a large group of hearing-impaired students on a battery of language tests. The students ranged in age from 5 to 20 years, and whenever possible, their performance was examined on a developmental basis across students. The majority of tests which we used were ones standardized with hearing children. The performance of the hearing-impaired students will be described relative to their hearing peers and the other hearing-impaired students evaluated in the study. Information will also be presented regarding the language tests which were found to be the most appropriate for hearing-impaired individuals. The information being reported represents only a small part of the results of a larger project in which medical, audiological, psychoeducational (intellectual, academic, memory, and information processing), and communication evaluations were performed. One of the major objectives in performing the comprehensive evaluation was to provide the school with data which could be used to develop an appropriate educational program for each student. The data reported in this paper are only descriptive in nature. Future work will include analysis of the interactions and relationships between variables.

PROCEDURES

Subjects

The students who were evaluated in this study comprised the entire student body of a state residential school for the deaf. A total of 154 students ranging in age from 5 to 20 years were tested. Approximately 70% of the students were profoundly hearing impaired, and 25% of them were severely hearing impaired; the other 5% of the students had moderate-to-severe hearing losses. Hearing loss was congenital for a majority of the students. Roughly half of the students were identified as having, or possibly having, hereditary disorders. A small number of students had physical handicaps in addition to their hearing loss, such as cerebral palsy and cleft palate.

The mode of communication employed in the school and used by the students was manual/simultaneous communication. Preliminary analysis of the students' signing ability indicated that they were using a variation of Pidgin Sign English (Woodward, 1972) which employs essentially the same syntax as English but with modifications in inflections and other structures. The oral communication skills of the students were poorly developed. Al-

though a small percentage of them appeared to have good speech skills, most students had low speech intelligibility. Sixty percent of the students produced totally unintelligible speech, and there was only a small percentage whose speech was completely intelligible.

Test Administration

The tests in the communication battery were administered individually to the students by an aural rehabilitation specialist. An exception was the administration of the Test of Syntactic Abilities (Quigley, Steinkamp, Power, & Jones, 1978), which the students completed at their school under the supervision of a classroom teacher. The communication test battery required approximately four hours to administer. All test instructions and test items were presented using Total Communication. Every effort was made to ensure that the signs used in the testing sessions were the same as those used by the students in their school. It is important to point out that our intent was not to assess the students' use of American Sign Language or any of the sign systems; rather, our goal was to assess the students' comprehension and use of the English language.

Test Battery

The tests which were used to assess receptive and expressive language skills are summarized in Table 1. A brief description of each test appears in the Appendix. The measures were selected for the purpose of assessing form, content, and function of language over a range of developmental tasks. Many of the tests are used commonly with hearing children, and prior clinical experience suggested that these particular tests also were sensitive in differentiating among hearing-impaired students. Not every test was administered to each student. Guidelines for selecting tests were based on the student's chronological age and suspected performance level.

When tests were administerd to students spanning a large age range, performance was examined as a function of age. For the majority of analyses, the students were divided into four age groups (5 through 10 years; 10 through 12 years; 13 through 15 years; and 16+ years) which approximate the grouping of students in traditional school settings (e.g., elementary, intermediate, junior high, and high school).

RESULTS

Receptive Language Tests

Miller-Yoder Test of Grammatical Comprehension (Miller & Yoder, 1975). This test was administered to students 5 to 10 years of age (N = 18). The performance of the students on the 12 different syntactic forms is ranked in order of percent correct reception in Table 2. The highest score was

Table 1

Summary of Language Test Battery

Communication Evaluation Tool	Area Assessed	Normative Data	Developmental Age Range	Response Format
Receptive:				
Test of Syntactic Ability (TSA)	Understanding of Grammatical Structures in Print	Deaf Students	10-19 years	Multiple Choice Written/Read
Miller-Yoder Test of Grammatic Comprehension	Receptive Syntax	Hearing Children	3-6 years	Picture Selection of Sentence Pairs
Child Language Ability Measures (CLAM): Grammatic Comprehension	Receptive Syntax Presented in Minimal Grammatic Contrasts	Hearing Children	4-8 years	Picture Selection
Woodcock-Johnson Quantitative Concepts	Understanding of Math Concepts	Hearing School-Aged Students	1st-12th Grade	Respond to Numeral Supported Examiner Questions
Vocabulary Comprehension Scale (VCS)	Understanding of Concepts of Position, Size, Quantity, and Quality	Hearing Children	2-6 years	Object Manipulation 3-Dimensional Space
Boehm Test of Basic Concepts	Understanding of Space, Time, Size, and Quantity Concepts	Hearing Children	Kindergarten-2nd Grade	Picture Selection: 2-Dimensional
Reynell Verbal Comprehension Scale	Understanding of Simple to Complex Connected Information	Hearing Children	18 months-7 years	Object/Toy Manipulation
Peabody Picture Vocabulary Test	Understanding of Vocabulary	Hearing Children	2½-18 years	Picture Selection

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Table 1 (Continued)

Summary of Language-Test Battery

Communication Evaluation Tool	Area Assessed	Normative Data	Developmental Age Range	Response Format
Test of Language Development (TOLD)				
a) Picture Vocabulary	Understanding of Vocabulary	Hearing Children	4^{0}-8^{11}	Picture Selection
b) Grammatic Understanding	Understanding of Grammatical Structures			
Expressive:				
Woodcock-Johnson Psychoeducational Test Battery:				
a) Picture Vocabulary	Expressive One-Word Vocabulary	Hearing School-Aged Students	1st-12th Grade	Picture Labeling
b) Antonyms/Synonyms	Expressive Vocabulary Opposites and Similarities	Hearing School-Aged Students	1st-12th Grade	Oral (Signed) in Response to Printed-Word Query
c) Analogies	Expression of Verbal Analogous Relationship	Hearing School-Aged Students	1st-12th Grade	Provide Final Word in Analogy Presented in Print
Reynell Expressive Scale	Expressive Content, Vocabulary and Grammar	Hearing Children	18 months - 7 years	Object, Picture Labeling, and Description
Test of Language Development (TOLD)				
a) Oral Vocabulary Subtest	Ability to Define Words and Concepts	Hearing Children	4 years - 8 years, 3 months	Oral (Signed) Descriptions
b) Grammatic Completion Subtest	Ability to Use Grammatical Endings	Hearing Children	4 years - 8 years, 11 months	Fill-in-the-Blanks

obtained on the Modification structures, followed by the Negative/Affirmative statements, and Prepositions. Progressively lower scores were obtained on the other structures, with performance only slightly above chance level for the Verb Inflection structures.

Table 2

Rank Order of Percent Correct Reception of Syntactic Forms, Averaged Across Students 5 to 10 Years of Age (N = 18)

Structure	Percent Correct
Modification (subject and object)	74.1
Negative/Affirmative Statements (has/doesn't have; can/can't; is/is not)	67.9
Preposition (on/under; in/beside)	67.1
Active (subject/object)	50.0
Reflexivization (her/herself; him/himself)	47.5
Singular/Plural (noun; noun/verb inflections)	43.8
Verbs (is/are)	37.5
Possessive	36.1
Pronouns (subject and object)	28.1
Passive (reversible)	21.5
Subject	24.4
Verb Inflection (present progressive/future present progressive/past future/past	21.7

The Test of Grammatical Comprehension also specifies test items by four age levels (4-year items, 5-year items, 6-year items and, 6+-year items) at which 60 and 90% of the normative population met the passing criteria. The age levels of the particular items are based on data from normative samples reported by Owings (1972). His data were obtained from 30 normal children in each age groups, 3, 4, 5, and 6 years.

Table 3 shows the mean score and the standard deviation for different age

Table 3

Mean Scores (Percent Correct) and Standard Deviations of 5 to 10-Year-Old, Hearing-Impaired Students (N=18) on the Items of the Miller-Yoder Test as a Function of the Age Level of the Test Item

	Test Items			
	4-Year Items	5-Year Items	6-Year Items	6-Year+ Items
Mean	70.0	50.3	40.6	26.9
S. D.	20.4	24.9	28.2	20.6

levels, averaged across students. On the average, performance decreased as the age level of the items increased. Only about 70% of the items of the youngest age level (4 years) were identified by the 5 to 10-year-old hearing-impaired students. The average scores on the 6+-year items were only slightly above chance performance. There were, however, large individual differences among the students for the four different age items as evidenced by the large standard deviations.

Vocabulary Comprehension Scale (VCS) (Bangs, 1975). This test was also administered to the younger students. The VCS permits analysis of the students' comprehension of pronouns and concepts of position, size, quantity, and quality. Mean performance scores for the students who received the test averaged across students (N = 15) are plotted in Figure 1. The students obtained almost perfect scores on the items assessing comprehension of size and quality. Only about 60% of the items assessing quantity and position were correctly comprehended. The most difficult items were those involving pronouns, with only about 55% of these items being correctly understood by the hearing-impaired students.

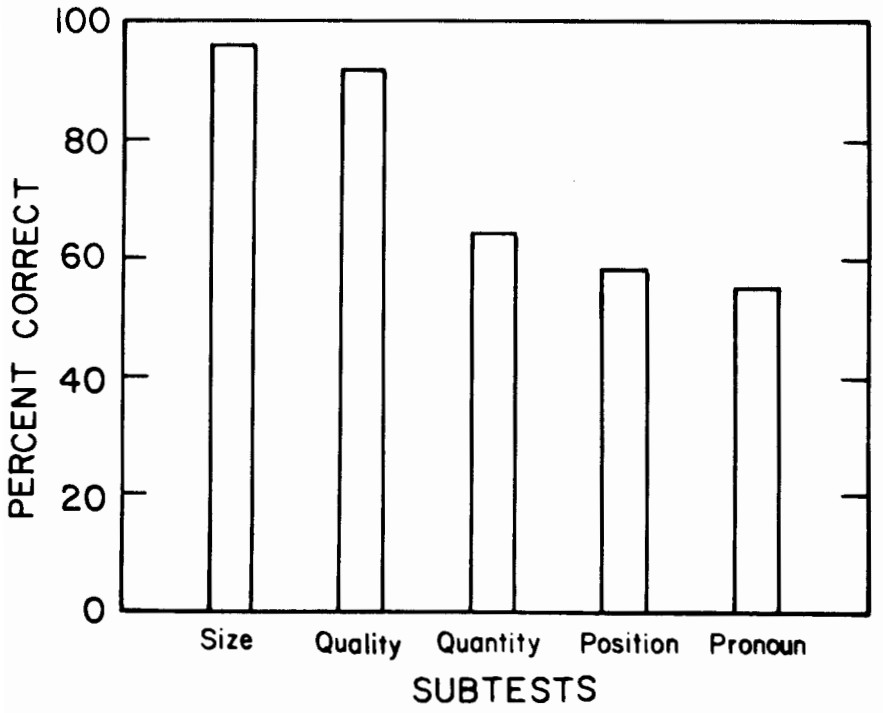

Figure 1: Scores on the Vocabulary Comprehension Scale averaged across students for the five types of items (N = 15).

Items on this test are specified by an age level at which 80% of the normal-hearing standardization sample passed that item. The age levels span a range of 2.0 to 5.6 years in six-month intervals. The hearing-impaired students' scores calculated as a function of age level of the items appear in Table 4. These data show that there is no obvious relationship between the age level of the test items and the students' performances. The items in the 2.0 to 2.6-year developmental age range presented the least difficulty for the hearing-impaired students, as shown by the mean score of 89.8% for these items. However, the students achieved higher scores on the 3.0 to 3.6-year items ($\bar{X} = 75.3\%$) than on the 2.6 to 3.0-year items ($\bar{X} = 63.3\%$), suggesting gaps in the developmental order. Also, the 4.0 to 4.6-year items were easier than the 3.6 to 4.0 items. Items in the 3.6 to 4.0, 4.6 to 5.0, and 5.0 to 5.6-year groups were equally difficult for the hearing-impaired students.

Table 4

Mean Scores (Percent Correct) and Standard Deviations of the 5 to 10-Year-Old, Hearing-Impaired Students (N=15) on the Items on the Verbal Comprehension Scale as a Function of the Age Level of the Test Item

	Age Year of Items						
	2.0 to 2.6	2.6 to 3.0	3.0 to 3.6	3.6 to 4.0	4.0 to 4.6	4.6 to 5.0	5.0 to 5.6
Mean	89.8	63.0	75.3	52.0	61.9	52.3	55.6
S. D.	20.9	17.0	18.3	19.0	19.5	25.1	16.7

Reynell Developmental Language Scale: Verbal Comprehension Scale (Reynell, 1977). The test is designed so that each set of items comprising the categories represents increasingly difficult language tasks for hearing children. For the purpose of this analysis, this test was subdivided into six different subtests. The subtests and item numbers included in each subtest are: (a) Category A (items 1-21), object identification; (b) Category B (items 22-25), relational directions; (c) Category C (items 26-35), object identification by functional descriptor; (d) Category D (items 36-45), following directions with an increased number of critical elements; (e) Category E (items 46-59), following directions with a still greater number of critical elements; and (f) Category F (items 60-67), conceptual reasoning.

The performance of the hearing-impaired students, 5 to 10 years of age, on the subtests is summarized in Figure 2. On the average, a nearly perfect score was obtained on the items in Category A (object identification). For the other categories, the data show that the scores of the hearing-impaired students do not reflect the expected relationship between performance and item difficulty. The score for the items in Category C (identification of object

by functional description) was higher than the scores for the items in Category B (relational directions). Performance on the items in Category D was similar to that for Category B. The most difficult category of items was E (following directions with increased number of critical elements and, therefore, increased length). Only about 40% of the items involving conceptual reasoning (Category F) were answered correctly by the hearing-impaired students.

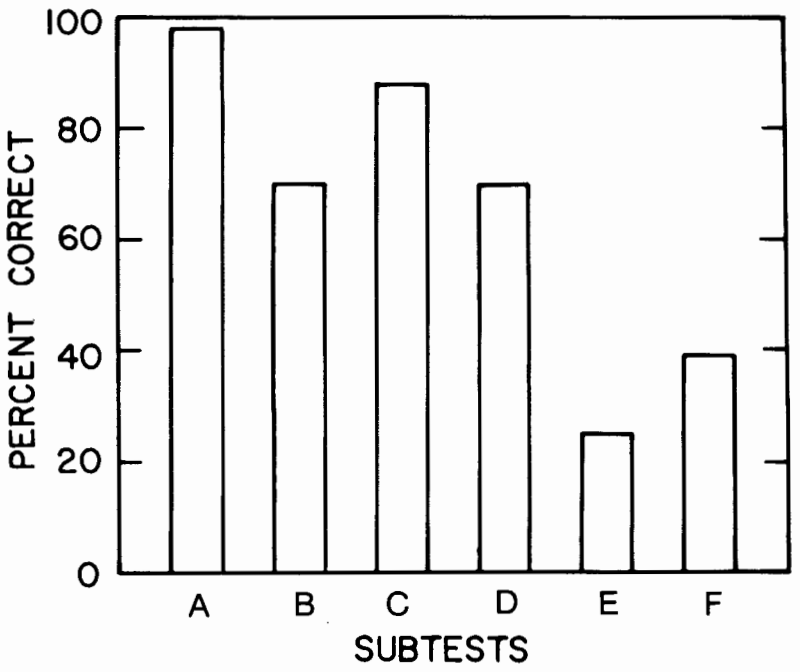

Figure 2: Scores on the Verbal Comprehension Scale of the Reynell Developmental Language Scale averaged across students for the six different subtests (N = 18).

Test of Syntactic Ability (Quigley et al., 1978). The students' performance on the various syntactic forms is summarized in Table 5. Data have been averaged across students 9.5 to 20.0 years of age (N = 80). On the average, the highest score (76.8%) was obtained on the Negation forms. As shown in Table 5, the students' performances on this particular syntactic form were far superior to that on any other form. The next highest scores were obtained on the following forms: Question, Determiners, Conjunction, and Pronominalization. There was an average difference of only a few percentage points in the students' performances on these four forms. The lowest scores were obtained

Table 5

Rank-Ordered Percent Correct Scores on the Syntactic Forms of the TSA, Averaged Across Students 9.5 to 20.0 Years of Age (N=80)

Form	Score
Negatives	76.8
Question	60.1
Determiners	59.8
Conjunctions	56.5
Pronominalization	54.6
Complementation	49.6
Nominalization	48.7
Verbal Processing	49.6
Relativization	45.2

on the Complementation, Nominalization, Verbal Processing, and Relativization forms. Not shown in the table is data on the performance as a function of age. These data showed a sharp increase in performance between the 10 to 12 and 13 to 15-year age groups. There was negligible improvement in the test scores between the 13 to 15 and 16+-year age groups; and in some cases, the scores of the older students were lower than those of the younger students.

Vocabulary Tests: Peabody Picture Vocabulary Test (PPVT) (Dunn, 1959) *and Picture Vocabulary Subtest of the Test of Language Development (TOLD)* (Newcomer & Hammill, 1977). Each student's raw score on the PPVT and the TOLD Picture Vocabulary Test was converted to an equivalent language age. An average language age was then computed for students 10 to 12, 13 to 15, and 16+ years of age. These data are plotted in Figure 3. First, the data reveal that all students show severe delays relative to their hearing peers in receptive vocabulary skills. Second, the performance in the two youngest age groups was very similar, and there is very little growth in vocabulary skills between the ages of 10 and 15 years. Third, although the older students obtained a higher language age, the gap between their language age and chronological age is larger than that for the younger students. Finally, consistently higher scores were obtained on the Peabody Picture Vocabulary Test than on the Picture Vocabulary subtest of the TOLD.

Grammatic Understanding Subtest of the TOLD and Grammar Comprehension Subtest of the CLAM (Mehrabian & Moynihan, 1979). These tests were given primarily to students above 10 years of age. Both tests reportedly assess similar syntactic and grammatic structures. The data showing the performance on these two measures are plotted in Figure 4. Each raw score on the tests was converted to an equivalent language age. On the average, the students obtained a higher language age on the TOLD subtest than on the

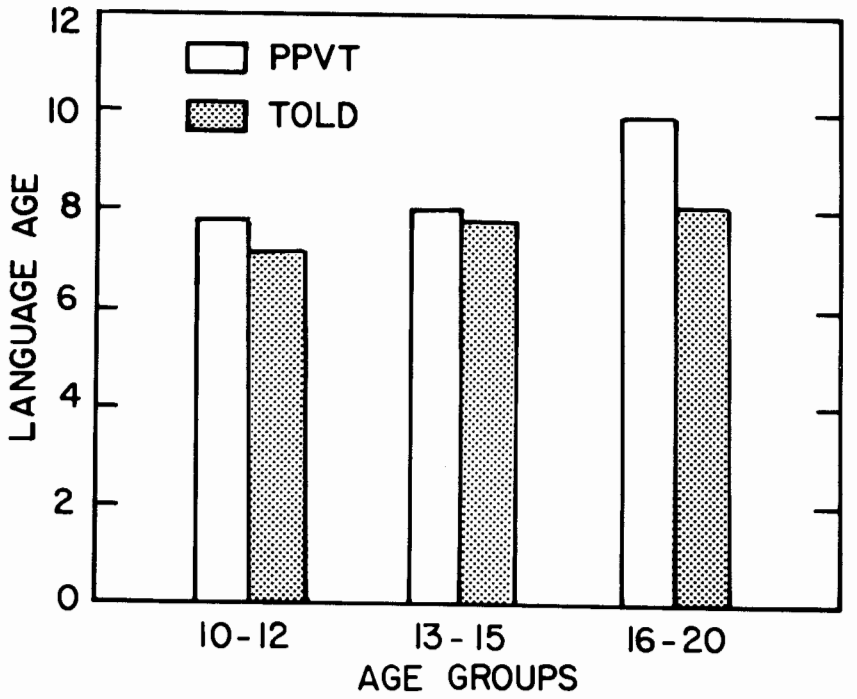

Figure 3: Performance of students on two receptive vocabulary tests, the Peabody Picture Vocabulary Test and the Picture Vocabulary Test of the TOLD (raw scores converted to equivalent language age and averaged across students by age groups) 10 to 12 years (N = 12), 13 to 15 years (N = 35), and 16 to 20 years (N = 23).

subtest of the CLAM. The difference in performance on the two tests is particularly apparent for the data in the 13 to 15-year age group. The performance on both the CLAM and TOLD tests indicates that there is little growth in syntactic skills with age. The highest language age achieved by the students is around 6.8 years, and little evidence is given on the average of growth in syntax skills beyond this point. In fact, the language age of the oldest group of students is poorer than the language age of the two younger age groups.

Boehm Test of Basic Concepts (Boehm, 1971). This test, although designed for 5- to 7-year-old students, was administered to students ranging in age from 8 to 19 years. The scores for the four types of concepts tested are shown in Table 6. Performance was the highest for Space Concepts, followed by the Miscellaneous items and Quantity Concepts. Time Concepts were the most difficult for the students. The data also show that there is very little

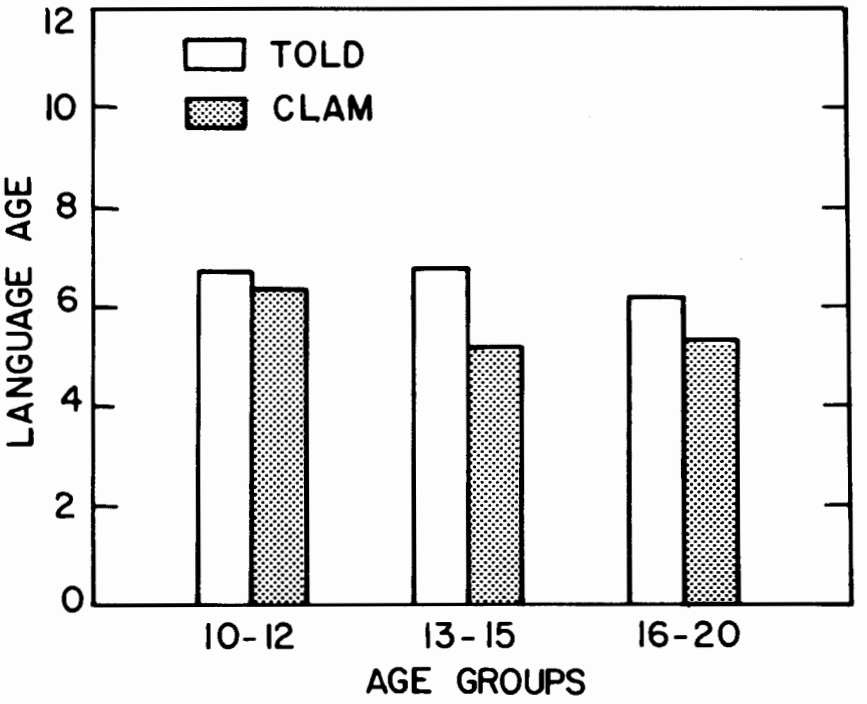

Figure 4. Performance of students on two syntax tests, the Grammar Comprehension Subtest of the CLAM and the Grammatic Understanding Subtest of the TOLD (raw scores converted to equivalent language age and averaged across students by age groups): 10 to 12 years (N = 18), 13 to 15 years (N = 12), and 16 to 20 years (N = 10).

growth in conceptual skills with age, except for the Time concepts which were easier for the older than the younger students. On the average, performance never exceeded 84% correct on a test which was developed for 5 to 6-year-old hearing students.

Expressive Language Tests

Reynell Developmental Language Scale: Expressive Language (Reynell, 1977). The results of this test for the 5 to 10-year-old students are shown in Table 7. The data show that Structure (syntactic) forms were the easiest, followed by Vocabulary and Content (expression of meaning). These data show that hearing-impaired students who are 5 to 10 years of age obtain an average score of 50 to 70% on a test with a ceiling language age of 7.0 years.

Vocabulary Tests: Oral Vocabulary Subtest of TOLD (Newcomer & Hammill, 1977) *and Picture Vocabulary Subtest of the Woodcock-Johnson Psycho-Educational Test Battery* (Woodcock & Johnson, 1977). These two vocabulary tests were administered to students 10 to 20 years of age. The task

Table 6

Mean Scores (Percent Correct) and Standard Deviations of the Students on the Concepts of the Boehm Test

	Concept			
Age Group	**Space**	**Miscellaneous**	**Quantity**	**Time**
8 to 10 Years (N=8)				
Mean	79.3	75.0	71.1	43.8
S. D.	12.7	20.7	17.1	29.1
11 to 13 Years (N=10)				
Mean	73.4	76.0	69.4	60.0
S. D.	20.1	15.8	21.3	29.3
14 to 16 Years (N=20)				
Mean	89.2	79.0	77.8	78.9
S. D.	11.3	28.6	22.7	30.3
17 to 19 Years (N=12)				
Mean	84.3	82.1	80.3	75.3
S. D.	21.6	28.9	24.0	27.2

Table 7

Scores on the Expressive Items of the Reynell Developmental Language Scale, Averaged Across Students 5 to 10 Years of Age (N=19)

Test Items	**Mean Percent Correct**	**S. D.**
Structure	71.8	7.04
Vocabulary	56.7	12.7
Content	54.0	21.2

required of the students was different for each test in that the Woodcock-Johnson requires the student to name a picture, and the TOLD requires the student to provide the meaning of the test word. For each test, the raw scores were converted to an equivalent language age. The data are plotted in Figure 5. The results show that all students are delayed in expressive vocabulary skills. There is improvement in vocabulary skills after age 12, but there is negligible growth after age 15. Performance was similar on the two vocabulary tests for students in the two older age groups, but a language age difference of almost 1.5 years was observed for the youngest group on the two tests, with the Woodcock-Johnson being the easier of the two.

Oral Vocabulary and Grammar Completion Subtests of the TOLD (Newcomer & Hammill, 1977). The students' performances were compared on two subtests of the TOLD. One subtest evaluates vocabulary skills (Oral Vocabu-

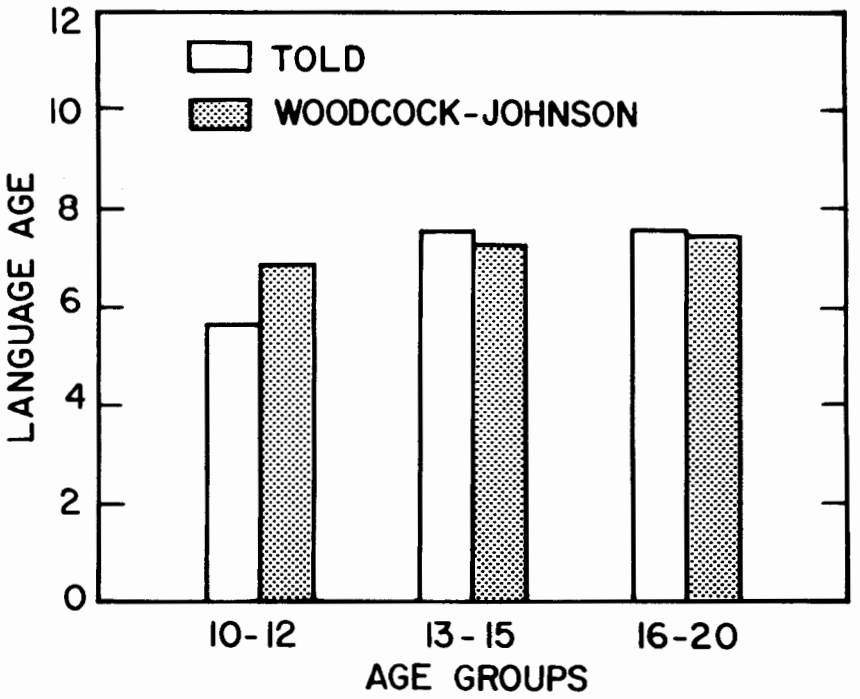

Figure 5. Performance of students on two expressive vocabulary tests, the Oral Vocabulary Subtest of the TOLD and the Picture Vocabulary Subtest of the Woodcock-Johnson (W-J) (raw scores converted to equivalent language age and averaged across students by age groups with N for TOLD and W-J stated, respectively): 10 to 12 years (N = 12/21), 13 to 15 years (N = 35/45) and 16 to 20 years (N = 23/46).

lary), while the other subtest evaluates morphological and syntactic skills (Grammar Completion). These data appear in Table 8. As might be expected, performance was higher on the Oral Vocabulary subtest than on the Grammar Completion subtest. Although there is some indication of growth in expressive vocabulary skills with age, this does not appear to be accompanied by a growth in syntactic skills. On the average, there is a 1.0 to 1.5-year language age gap between vocabulary and syntactic skills for all three groups of students.

Quantitative Concepts, Antonyms-Synonyms, and Analogies Subtests of Woodcock-Johnson Psycho-Educational Test Battery (Woodcock & Johnson, 1977). These subtests were administered to students 10 to 16+ years of age. Raw scores were converted to equivalent language ages. The results appear in Table 9. For the youngest group (10 to 12 years), performance was similar on the three subtests. There is a slight increase in performance between the 10 to 12- and 13 to 15-year age groups, but no additional growth

Table 8

Performance of the Students on Two Expressive Language Tests of the Test of Language Development (TOLD); Raw Scores Converted to Equivalent Language Age and Averaged Across Students by Age Group

	TOLD Subtest	
Age Group	Oral Vocabulary[a]	Sentence Completion[b]
10 to 12 years	6.8 (N=12)	5.9 (N=8)
13 to 15 years	7.3 (N=35)	6.1 (N=12)
16+ years	7.5 (N=23)	6.0 (N=10)

[a]The Oral Vocabulary Subtest assesses vocabulary skills.
[b]The Grammar Completion assesses morphological and syntactic skills.

in the language skills assessed on these subtests is apparent between the 13 to 15 and 16+ age groups. The youngest group achieved similar scores for all three subtests. The two older groups achieved the highest scores on the Quantitative Concepts subtest. Performance on the Analogies and Antonyms-Synonyms subtests was very similar for the older students.

Table 9

Performance of Students on Three Subtests of the Woodcock-Johnson Psycho-Educational Test Battery; Raw Scores Converted to Equivalent Language Age and Averaged Across Students by Age Groups

	Subtest		
Age Group	Quantitative Concepts	Antonyms/ Synonyms	Analogies
10 to 12 years (N=21)	8.8	8.5	8.9
13 to 15 years (N=45)	11.4	9.7	9.5
16+ years (N=46)	11.7	9.8	10.1

A Comparison Between Receptive and Expressive Measures

Vocabulary Tests: Picture Vocabulary and Oral Vocabulary Subtests of the TOLD (Newcomer & Hammill, 1977). The data comparing the students' performances on a receptive vocabulary test (Picture Vocabulary) and

expressive vocabulary test (Oral Vocabulary) are shown in Table 10. As might be expected, the students' performances were higher on the receptive vocabulary test than on the expressive test. For the two younger groups, the difference in performance between receptive and expressive vocabulary, expressed in a language age, is six months. There is a larger difference between receptive and expressive skills for the oldest group, primarily due to an increase in receptive vocabulary skills. The oldest group demonstrated only a small growth in expressive vocabulary skills, and the performance in this area is only slightly better than that of the 10 to 12-year-old students.

Table 10

Performance of Students on the Receptive (Picture Vocabulary) and Expressive (Oral Vocabulary) Subtests of the TOLD; Raw Scores Converted to Equivalent Language Age and Averaged Across Students by Age Group

Age Group	Picture Vocabulary Subtest (Receptive)	Oral Vocabulary Subtest (Expressive)
10 to 12 years (N=12)	7.2	6.8
13 to 15 years (N=35)	7.8	7.2
16+ years (N=23)	8.5	7.5

Syntax Tests: Grammatic Understanding Subtest and Grammatic Completion Subtest of the TOLD (Newcomer & Hammill, 1977). The data for the receptive and expressive syntax tests of the TOLD appear in Table 11. As the data show, higher scores were obtained on the receptive test than on the

Table 11

Performance of Students on Receptive (Grammatic Understanding) and Expressive (Grammatic Completion) Language Subtests of the TOLD; Raw Scores Converted to Equivalent Language Age and Averaged Across Students by Age Groups

Age Group	Grammatic Understanding Subtest (Receptive)	Grammatic Completion Subtest (Expressive)
10 to 12 years (N=8)	6.7	5.9
13 to 15 years (N=12)	6.8	6.1
16+ years (N=10)	6.2	6.0

expressive test, and there is essentially no growth in expressive syntax skills with age. Unlike the performance of the students on the receptive vocabulary test, their performance on receptive syntax tests does not appear to improve with age. In fact, the performance of the oldest group of students on the receptive syntax test is poorer than that of the two younger groups.

DISCUSSION

In this section, the results described previously are discussed relative to two key issues: (a) the description of *overall performance* of a group of residential hearing-impaired students on a language test battery and (b) the relative *appropriateness of various tests* for use in assessing the language skills of hearing-impaired students.

Student Performance: Receptive/Expressive Language

Plateau in learning. Perhaps the most striking feature of the language data is the presence of a plateau in the growth of specific language skills after 12 to 13 years of age. A majority of the students achieved language ages of 6 to 7 years in syntax and 8 to 10 years in content, with little growth or change occurring after 12 years of age. This plateau in learning in profoundly hearing-impaired students has been reported frequently in the literature relative to a variety of language skills (Clarke & Rogers, 1981; Meadow, 1975). In the present study, the performance of the younger students was even superior to their senior peers on selected measures. This pattern of performance and the plateau itself may be partially influenced by psychometric and population variables which are addressed below.

First, the presentation of tests through manual communication is, as yet, unstandardized and requires cautious interpretation of test results. Clinical observation suggests that scores may be reduced or inflated by this presentation mode, particularly when vocabulary skills are assessed. For example, many of the advanced vocabulary items on the Peabody Picture Vocabulary Test were not represented by signs in the sign system used in the students' school. These items were presented to the students via fingerspelling rather than sign. Thus, the vocabulary scores achieved by the older students was influenced by their receptive fingerspelling abilities. The younger students were often adept at guessing unfamiliar words on the basis of sign similarity cues, which appeared to inflate their scores. In contrast to this, the older students tended not to use sign cues (or could not use them because the item was fingerspelled). The older students also tended not to guess at unfamiliar items; rather, they appeared to respond to test items only if they were certain of the correct answer. Thus, the differences in response strategy and the use of fingerspelling with more difficult and advanced test items may have inflated the test scores of the younger students but reduced the scores of the older students.

Another factor which should be considered in evaluating performance as a function of age is the nature of the tests used in the study. These tests, for the most part, evaluated vocabulary and syntax skills. The tests were limited in their ability to assess later developing abstract language functions which are more dependent on conceptual reasoning and formulation skills than on syntactic skills. An example of such a test is the Test of Concept Utilization (Crager & Spriggs, 1972). This test was part of our test battery, but the data have not yet been analyzed. Differences between age groups may be more apparent on a test of this nature.

Finally, it should be pointed out that some of the older students in the study had been enrolled in the residential school for only a short period of time. These students had failed in mainstreamed programs, usually because they were not provided with adequate resource help. For some, their language deficiencies were in excess of those students trained for a longer period of time in the residential school. Also, the school's adoption of a signing system which reflected English word order and rules was a recent instructional change which had little influence on the secondary students. This may have influenced their performance on tests assessing English syntax and may contribute to the "plateau effect."

Overall, the data suggest that these students do not demonstrate linear gains in language with increasing age and habilitation. In fact, the gap between chronological age and language skills continues to widen with age.

Syntactic skills. Not unexpectedly, the data showed that vocabulary and content skills were consistently superior to English syntactic/morphological skills. The exception to this pattern was the students' performances on the expressive items on the Reynell Developmental Language Scale. Recall that on this test the students achieved higher scores on the Structure than on the Vocabulary items. The Structure items may have yielded higher scores than the Vocabulary items because the use of structure is assessed with a checklist format in which the examiner rates the student's use of language on the basis of observation. Since many of the items on the checklist are related to skills in the prelinguistic stage (such as repeated babbling), almost every student will be credited with some of the items.

Whereas receptive vocabulary skills improved across the age categories to an average 9-year, 11-month level, three independent measures of grammatic development showed markedly delayed progress and no syntactic growth after 10 years of age. Few students achieved beyond a 6 to 7-year maturational level in receptive or expressive syntactic language skills.

The ordering of rule mastery from the screening test of the TSA is similar to that reported by Quigley, Wilbur, Power, Monatanelli, and Steinkamp (1976). Error patterns on the CLAM, TOLD, and Miller-Yoder also reflect data consistent with developmental expectancies, with the later developing structures being consistently most difficult for the deaf students. Overall, the

syntax results suggest some normal acquisition patterns receptively, but there is a marked delay in acquisition, with certain structures failing to be achieved by even the oldest students.

Content skills. All performance measures showed that the students were severely delayed in receptive and expressive vocabulary. A common observation made during the testing was that students showed many scattered errors before the ceiling score was established. It appeared as if the students' vocabulary skills were related more to previous exposures and teaching experiences rather than to any developmental pattern. These results are somewhat depressing in that they suggest that the hearing-impaired students have been directly taught most of the words they know.

Verbal/conceptual skills were assessed by the Quantitative Concepts, Antonyms/Synonyms, and Analogies subtests of the Woodcock-Johnson Psycho-Educational Test Battery. A striking feature of the data was that the hearing-impaired students' performance on these subtests is considerably better than would be predicted by their expressive vocabulary scores. This may be due to the fact that vocabulary tests require labeling which may be affected by problems in retrieving specific content or fingerspelling sequences, or the students may not have been taught many of the vocabulary items which were tested. The other three subtests of the Woodcock-Johnson are not heavily dependent on lexical skills. In particular, the Quantitative Concepts Subtest controls maximally the linguistic demands (i.e., length of directions, syntax load) allowing for measurement of the concept without penalizing the student for other language deficiencies. Thus, the expression of the relationship being probed is not dependent on specific lexical knowledge or syntactic expression but rather on conceptual reasoning.

Deviations in developmental patterns. The younger students' performance on the Vocabulary Comprehension Scale and the Reynell Verbal Comprehension Scale revealed patterns inconsistent with the expected developmental progression. Such inconsistencies in development appear to be a result of several variables. First, instructional priorities for preschool deaf students may not coincide with developmental data. For example, the VCS results suggested much earlier mastery of quality and size concepts than quantity, position, and pronoun concepts. Quality and size concepts, somewhat easier to illustrate visually, are often introduced earlier in a student's program. Clinician observation suggests that position concepts, although introduced early, may take much longer in mastery since generalization beyond specific activities is more complex for these concepts than for those involving quality and size concepts. Quantity concepts, considered "preacademic" are often introduced after achievement of other language skill areas.

Personal pronoun concepts were limited which is not surprising in view of the fact that most hearing-impaired students are first taught noun referents (at a delayed age relative to hearing peers) and then pronoun referents. In

addition, we learned that the students in our study had not been systematically exposed to pronoun signs within their program; rather, pronouns were introduced by the school at a later stage in fingerspelled forms.

Second, concept strengths and weaknesses may influence the student's ability to process connected information. On the Reynell Scale, for example, deficits in position concepts influenced the students' ability to follow relational directions. That is, when asked to "put the knife on the plate," the students often failed to attend to the spatial relational concept and instead focused on the key words, handing the examiner the knife and the plate. Yet, object identification by functional descriptor (which is reported to be much more difficult conceptually than relational directions for hearing students) elicited responses with greater precision than the preceding category by the hearing-impaired students. This category required the student to relate an internalized concept (an attribute) to a perceived object (e.g., "Which one do we sleep in?"). In this case, linguistic features (such as prepositions) do not need to be comprehended by the hearing-impaired student since key words (such as "sleep") cue the relationship. Divergence from developmentally expected performance may be related to the task allowing the student to draw upon "inner language" or conceptual understanding versus specific linguistic comprehension. The perplexing finding is that the relational directions should be implicit (i.e., spoons usually go in cups), yet the hearing-impaired youngsters attended to the content words of the subtest sentences rather than to the contextual cues. It does appear, however, that certain tasks facilitate reliance on the underlying conceptual base, which for so many hearing-impaired students (from a nonverbal intellectual standpoint) is far in excess of linguistic competence. This appears to explain variable performance on the Reynell tasks.

This same point was illustrated further by the last two sets of items of the Reynell. The one which required assimilation of several semantic and syntactic details (following directions with an increased number of critical elements) was extremely difficult, yet on the following task (Category F: conceptual reasoning), in which the ideational content goes far beyond the concrete evidence available, the students' performance improved. This final task is much more abstract and requires limited verbal reasoning, yet the linguistic demands were reduced enough to allow the student to draw upon his conceptual base.

Third, especially for the younger students, the length of input of signed instructions dramatically affected performance. This also explains some of the nondevelopmental patterns on the Reynell since most of the students relied on a "key word" comprehension strategy. In other words, given an examiner directive, the student reacted on the basis of key ideas s/he could store in short-term memory, often to the sacrifice of less salient grammatic or semantic cues (i.e., "Put the three short pencils in the box" resulted in any

three pencils in the box). Diagnostic teaching revealed that chunking of the information ("See *3 short pencils?* Put them in the *box.*") and selective emphasis were effective in obtaining the correct response. Thus, several items were apparently influenced not by lack of semantic mastery but by inability to handle utterance length within short-term memory.

Comprehension/production gap. Not unexpectedly, the students performed better on receptive language measures than on expressive. Expressive language measures on the whole reflected reduced development with age, as well. However, such results are affected by the lack of expressive language measures with ceilings above an 8 to 9-year level. Tasks designed for older students such as the Test of Concept Utilization were also administered as part of our test battery, but the results of this test have not been analyzed.

Evaluation of Assessment Tools

Based upon qualitative and quantitative results of the student evaluations, we have reached several conclusions regarding the relative usefulness of the diagnostic procedures we employed. These impressions are summarized below.

Syntax/morphology. The TSA clearly differentiated strengths and weaknesses in students' performances across many major syntactic categories tested. Although it is a time-consuming test to administer, the TSA appears to yield useful information about a student's ability to comprehend structures that s/he encounters frequently in print. Another advantage is the availability of norms on hearing-impaired students. This test can be administered by the classroom teacher to the students as a group. However, students who tend to respond impulsively or who exhibit visual scanning deficits may require close monitoring to insure accuracy of results.

Major differences were found in the students' performances on the Syntactic/Grammatic Subtests of the CLAM and TOLD, both of which contain similar structures. Test format appears to be a significant variable. The CLAM uses a format of minimally contrastive pairs (i.e., horse's white truck vs. white horse's truck) which makes it necessary for the student to process the linguistic rule in order to respond accurately. The TOLD, on the other hand, is a screening measure which presents lengthy stimuli paired with a multiple choice of pictures. On many items, the students obtained correct choices by merely attending to key words and the pictured context (i.e., "She has fallen and broken her leg" was easily determined by integrating, "fall, break" and the picture). Thus, the CLAM appears to be a more sensitive measure in that its format dictates that the student attend to word-order relationships and syntactic rules rather than to key-word clues.

The Miller-Yoder Test of Grammatical Comprehension was found to be a useful measure with younger students. The results were consistent with an expected developmental response pattern. The requirement that both items

of a stimulus pair be identified before mastery is assigned is particularly useful in limiting scores inflated by guessing.

Finally, the TOLD Grammatic Completion Subtest, which is an expressive morphology test, was a useful measure with students older than 10 years. This subtest was presented in print rather than in sign, since experience demonstrated much less confusion on the students' part regarding the task demands (largely due to item length and topic shifting). The results gave useful prescriptive information and were comparable to patterns observed in the students' written language samples. We did attempt to use the Sentence Repetition Subtest of the TOLD, but our pilot data indicated that this test would not be appropriate as the presentation required heavily inflected signing, which was not consistent with these students' experiences or short-term visual memory constraints. Most students performed below the basal level, and no useful diagnostic information was gained.

Content. A variety of measures was used to assess the students' understanding and application of language content. By content, we refer not only to vocabulary skills, but also to verbal/conceptual and reasoning skills. The relative effectiveness of the measures used to assess these areas is discussed below:

1. *Receptive Vocabulary:* Scores on the Peabody Picture Vocabulary Test (PPVT) were better than those obtained on the TOLD Picture Vocabulary Subtest. The PPVT appears to estimate more accurately receptive vocabulary level, since many more available items allow for typical scatter in the deaf student's responses to occur prior to achieving a ceiling. The TOLD, on the other hand, is a screening measure with few items and a low-ceiling level (8 years, 11 months). This test appears to be less sensitive to developmental change, whereas the PPVT reflects growth with age. The PPVT scores of some students, however, tend to be inflated by their reliance on iconic sign cues (visual association cues from the sign) to "guess" at unfamiliar meanings. Experience with receptive vocabulary measures also suggests that a hearing-impaired student's performance may reflect specific gaps in experience and splinter skills rather than show a clear developmental picture. As mentioned before, many scattered errors may be made before a ceiling is established. Thus, an instrument with a large number of items is preferred.
2. *Expressive Vocabulary:* Two separate measures of expressive vocabulary (Woodcock-Johnson Picture Vocabulary and TOLD Oral Vocabulary) yielded highly similar age scores for the students over 13 years. This was a surprising finding in that two dissimilar lexical skills were measured. The TOLD requires the student to give an oral definition of common words whereas the Woodcock-Johnson requires the student only to label a picture. Both tests are recommended for use with hearing-impaired students. The Woodcock-Johnson may be adminis-

tered rapidly, provides age and grade scores, has a liberal ceiling (12th grade), and is sensitive to students exhibiting word-retrieval difficulties. Although the TOLD has a low ceiling (8 years, 3 months), it proved to be a useful screening measure which identified students having formulation problems. Many students exhibited difficulty (particularly the younger students, which accounts for the wider split between scores in this group) in isolating specific attributes in order to provide an efficient definition. Since such skills may be taught and are important as a basis for classifying information, the results of the Oral Vocabulary Subtest were of particular interest.

3. *Verbal/Conceptual Skills:* The Antonyms/Synonyms, Analogies, and Quantitative Concepts Subtests of the Woodcock-Johnson Psycho-Educational Test Battery were useful measures with this population. Since the linguistic demands are relatively controlled, it is possible to tap "inner" language or conceptual growth in spite of other language deficiencies. However, vocabulary deficits often promote an "earlier-than-expected" ceiling. The skills tested by these subtests appear to be closely related to academic/classroom demands and needs.

The Vocabulary Comprehension Scale was found to be a useful measure of three-dimensional concept mastery in the younger students. Although a developmental pattern was not found, it effectively identified gap areas which could be addressed in remediation. In our test protocol, the Boehm Test of Basic Concepts was used once a student was able to handle lengthy directions and two-dimensional tasks. The results we obtained regarding the order of difficulty of the concepts tested are consistent with those obtained by Davis (1974) with a group of 6 to 8-year-old, hard-of-hearing students. This test also provides useful prognostic information but seemingly in a restricted age span. By 8 to 10 years of age, the students had achieved a mastery level comparable to much older students. Davis also reported no significant difference between the younger and older students in her study. These results suggest that either hearing-impaired students reach a plateau in their development of specific language concepts at a fairly young age, or the Boehm test is not sufficiently sensitive to detect the developmental changes which are taking place in this population of students. At this time, we do not have adequate data to address this issue.

Finally, for younger students, the results of the Reynell Developmental Language Scales yielded useful prognostic information. The graduated increases in abstraction presented on the separate subtests appear to be consistent with the increasing demands language learning places on a child as s/he matures. The tasks are designed to reflect conceptual maturation as well as integration of semantic and syntactic information. The test effectively identifies hearing-impaired students whose visual memory constraints negatively influence language learning. One problem with the Reynell is that the

test may not assess some of the more refined aspects of language comprehension. For example, the results of a study by Bishop (1979) indicated for a group of normal-hearing, language-disordered children, that those children who performed at ceiling on the Reynell showed significant problems in understanding unusual words and complex grammatical structures. Even with this limitation, our data and clinical impressions suggest that the Reynell Developmental Language Scales can be a useful measure in assessing many receptive language abilities in hearing-impaired students.

SUMMARY AND CONCLUSIONS

In summary, the data show that hearing-impaired students are severely delayed in many receptive and expressive language skills and that there is very little evidence of growth in these skills after about 13 years of age. These results are discouraging, although not unexpected. Of particular concern are the response patterns which suggest that most lexical items are not acquired naturally; rather, they must be taught by parents and teachers before they are learned by students. Davis (1974) made a similar observation regarding hearing-impaired students' ability to learn basic concepts. These findings suggest that we need to emphasize increasing the independent learning skills of hearing-impaired students so that they do not rely only on others to develop the necessary conceptual and verbal skills of English.

The results of this study also suggest that the language problems of hearing-impaired students are not simply ones of delayed development, as their performance also reveals patterns inconsistent with expected developmental progression. These deviations in the developmental pattern may reflect, in part, the instructional priorities of many programs for hearing-impaired individuals.

Finally, our results have defined specific areas of weakness in the receptive and expressive language skills of hearing-impaired students that need to be addressed in their educational programs. The plateau in the learning of language skills after about 13 years of age is of grave concern. Future investigations by researchers and educators are needed to determine if this pattern of performance can be changed.

It should also be mentioned that a written language sample was obtained from all the students, but we are still in the process of analyzing these samples. Data obtained from this sample may provide valuable information about the linguistic rules used by the students and their proficiency in the spontaneous use of language.

Based on the results of this investigation, the following conclusions are drawn:

1. Certain measures designed for use with hearing students are also useful with hearing-impaired students.
2. Developmental and experiential gaps can influence measurement of spe-

cific language skills.
3. Syntax/morphology measures may be affected by the test format.
4. Measures of content/concepts which control other linguistic variables (i.e., length, syntactic complexity) often reveal valuable information about abstract verbal reasoning abilities.
5. A battery of tests is a necessity in order to evaluate accurately the language skills of hearing-impaired students, since test format differences can affect performance. In addition, a number of skill areas enter into communicative competence which need consideration in the assessment process.

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APPENDIX

Receptive Language Measures

1. **Test of Syntactic Ability (TSA)** (Quigley et al., 1978)
   This test measures comprehension of nine major syntactic structures through written/read language. The student answers 120 multiple-choice items written at a second-grade reading level. The items assess receptive knowledge of negation, conjunction, determiners, question formation, verb processes, pronominalization, relativization, complementation, and nominalization. The test was constructed for use with deaf students, aged 10 to 19 years, and normative data have been obtained with hearing-impaired students in this age range.
2. **Miller-Yoder Test of Grammatical Comprehension (Experimental Edition)** (Miller & Yoder, 1975)
   This picture-selection test presents the child with 42 sentence-probe pairs designed to assess syntactic structures emerging between 3 to 6 years of age. Four pictures are presented on a page, and the child is asked to identify the appropriate picture. The sentence pairs were constructed to differ only in terms of the particular syntactic feature being probed, and the child must successfully identify each of the two sentence probes presented in random order to obtain credit for the item (i.e., "Spot is barking at *her*" and "Spot is barking at *him*" must be correctly identified on separate trials to obtain credit for the pronoun form). Syntactic structures probed include: active voice, prepositions, possession, negative-affirmative, objective and subjective pronouns, singular/plural noun and verb markers, verb inflections, modification, passive reversible, and reflexivization.
3. **Child Language Ability Measures (CLAM)** (Mehrabian & Moynihan, 1979), Grammar Comprehension Subtest
   The Grammar Comprehension Subtest of the CLAM consists of 50 items, probing syntactic structures emerging through 8 years of age in hearing children. The test uses a two-alternative, picture-selection task which consists of minimal grammatical contrasts. The items of the test were designed to cover a wide range of grammatical forms such as number, tense, voice, negation, pronominalization, modification, and conjunction.
4. **Woodcock-Johnson Psychoeducational Test Battery** (Woodcock & Johnson, 1977)
   The Quantitative Concepts Subtest assesses a student's receptive mastery of concepts necessary for math application. Mathematic concepts developing from first to twelfth grade are surveyed. The child is presented with numerals or a figure and is asked to respond to a query about the numerals (i.e., viewing 5, 10, 15, __, 25, the student responds to "What number is missing?").
5. **Vocabulary Comprehension Scale (VCS)** (Bangs, 1975)
   This test was utilized to assess concept development in the younger deaf children. The test measures concepts of position, size, quantity, and quality emerging between the ages of 2 and 6 years. All concepts are probed in three-dimensional space as the child manipulates small toys in response to examiner directions.
6. **Boehm Test of Basic Concepts** (Boehm, 1971)
   The Boehm Test was used as a screening device to assess the students' understanding of 50 basic concepts presented in two-dimensional space. Concept categories assessed include: space, position, quantity, size, and miscellaneous items. The test is designed to measure children's mastery of concepts considered necessary for achievement in the first years of

school. The student is presented with pictures and is asked to circle an object in the picture consistent with the verbal instructions (i.e., "Circle the one that is medium-sized.").

7. **Reynell Developmental Language Scale; Verbal Comprehension Scale** (Reynell, 1977)
   This scale measures understanding of content for children aged 1.5 to 7.0 years. The task demands progress from realistic object/toy manipulation in response to simple directives to manipulation of representational toys in response to abstract and semantically complex demands. The instrument assesses ability to identify objects, follow relational directions, identify representational objects on the basis of a functional description (i.e., "Which one barks?"), and follow directions involving increased number of critical elements (i.e., "Put the small black pig behind the pink pig.").
8. **Peabody Picture Vocabulary Test** (Forms A and B) (Dunn, 1959)
   This test measures the students' understanding of single-pictured vocabulary items. The test consists of 150 plates, each containing four pictures and spanning the age range 2.5 to 18.0 years. Items were presented in sign or fingerspelling and the student was instructed to find the pictured representation. All fingerspelled items were supported by the printed word presented on cards.
9. **Test of Language Development (TOLD)** (Newcomer & Hammill, 1977)
   This screening measure assesses syntactic and semantic skills in the age range 4 years, 0 months to 8 years, 11 months. Receptive subtests administered included: (a) The Picture Vocabulary Subtest, a picture-selection receptive vocabulary measure, where four pictures are presented on a page, and (b) the Grammatic Understanding Subtest, a picture-selection task which assesses understanding of syntactic forms and morphological markers. Three pictures are presented in the latter closed-set task.

Expressive Language Measures

1. **Woodcock-Johnson Psycho-Educational Test Battery** (Woodcock & Johnson, 1977)
   The following subtests were administered to assess expressive word meaning abilities: (a) The Picture Vocabulary, an expressive one-word vocabulary test requiring the student to label single pictured nouns; (b) Antonyms/Synonyms, a test of word meanings requiring that the student provide the opposites of a set of printed words and then provide another "word meaning the same" as the stimulus words presented; and (c) Analogies, a test requiring that the student provide a word to complete a verbally analogous relationship (e.g., when shown the printed words "mother-father, sister, ...", the student is expected to supply "brother" to complete the analogy).
2. **Reynell Developmental Language Scale: Expressive Scale** (Reynell, 1977)
   The expressive scale of the Reynell assesses form (syntax), vocabulary, and content (expression of meaning) through object naming, object description, and picture description. The syntax scale rates the complexity of spontaneous language. Vocabulary is assessed through picture and object naming and by asking the child to define terms with no referent available (i.e., "What is an apple?") Content is assessed by asking the child to describe simple action pictures, and points are awarded for the complexity of ideas expressed. The scale is appropriate between 1.5 to 7.0 years of developmental language abilities.
3. **Test of Language Development (TOLD)** (Newcomer & Hammill, 1977)
   Two subtests were used to further assess expressive language and included: (a) Oral Vocabulary which evaluated the student's ability to define objects and concepts (i.e., "What is a *bird*?" and "What does *rest* mean?"). The scoring criteria require that the student be able to formulate a definition including appropriate attributes (i.e., for "bird" to say "an animal" is insufficient as a response, whereas "an animal that flies and builds a nest" is credited and (b) Grammatic Completion which measures the student's ability to apply appropriate morphological endings to nouns, verbs, and attributes. Endings assessed include plural markers, verb tense, comparative/superlative, and derivational suffix +er (painter). The student is

required to read a sentence and provide the omitted word (i.e., "Joan is a woman. Mary is a woman. They are both _____.")