MODIFICATIONS TO THE PEABODY PICTURE VOCABULARY TEST FOR USE WITH SIGNING DEAF STUDENTS

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The study investigates the feasibility of modifications to the Peabody Picture Vocabulary Test for use with deaf students. Previous efforts involved modifications to the test for the purpose of developing deaf norms. This time, however, we have incorporated the use of American Sign Language and a means to allow deaf students' signed language knowledge to support their test performance. Thus, a cross-linguistic mediation is proposed as an appropriate way of assessing deaf students' ability to decipher English vocabulary. The oral English vocabulary test subsequently underwent two modifications: 1) word items were converted to print and 2) students were allowed to access a special material when taking the test. Deaf students can use the special material to look up and decipher unfamiliar English words. With this modification, ASL sign equivalents are written in a signed language alphabet, thus allowing deaf students to decode them. This process then allows deaf students to identify an individual English word's meaning and respond accordingly. The preliminary results of our study indicate that elementary-aged students demonstrated improvement in their test performance when they used the special material consistently. In addition, we compared the deaf students' performance with deaf norms. The deaf students in our study were found to surpass the average performance of normed deaf results. This occurs in both cases of participants using The resource book or rather using it sparingly or not at all. The reported superior performance was achieved even though a more stringent cut-off criterion was imposed on students in the study versus the deaf norms. It appears our participants performed well, and the signed language-based curriculum developed and used with these participants may have played an important role in their modified test performance. Discussion of these findings includes future directions in test development that include deaf students' learning written English as a second language.

INTRODUCTION

The academic standards for students in the United States have long revolved around English as the primary language of instruction. For this

reason, English plays a central role in the core curriculum in public schools (e.g., Bennett, Finn, & Cribb, 1999; Hirsch, 1997). The majority of Americans learn and use English as their native language, frequently their only language. As a result, monolingualism best describes reading development in American schools. To measure students' progress in the classroom, a number of standardized tests have been developed. The test developers' primary aim is to come up with effective measures, where test results inform teachers and support the curriculum. The well-known Peabody Picture Vocabulary Test (PPVT) serves as a good example. This test is used nationwide to help determine the individual student's knowledge of oral English vocabulary based on norms. This information is important to predict the student's prospect of achieving reading skills at grade level.

For deaf students, however, English is most likely not their first or native language. This is due to the status of English as a spoken language. Deaf students, instead, are able to become proficient in American Sign Language (ASL, see Singleton, Supalla, Litchfield, & Schley, 1998 for further discussion on the issue of language modalities). Because deafness was once erroneously treated as synonymous to language impairment, the notion of deaf students being linguistically competent is rather new. The linguistic issues for deaf students continue to be clouded by the impact of hearing loss when it comes to English. That is, hearing loss is found to be a major obstacle to deaf students' performance on the PPVT (Lederberg & Spencer, 2001). This finding may not be surprising given that deaf students do not have the advantage that hearing students enjoy in learning English vocabulary through oral (or spoken) discourse at home and in school. Not having sufficient vocabulary knowledge has had adverse effects on deaf students' reading performance in English (e.g., King & Quigley, 1985). The PPVT results confirm a less than desirable amount of oral English vocabulary knowledge among these students. The degree of hearing loss is found to play an important role in predicting deaf students' performance on the PPVT. That is, the more hearing the students have, the better they perform on the PPVT (Brackett & Maxon, 1986; Davis, Elfenbein, Schum, & Bentler, 1986; Gilberston & Kamhi, 1995).[1]

What can be done about this? First, we need to understand that the oral to print avenue for English vocabulary is not the only way to teach deaf students. Print *can* become a primary source of learning English vocabulary for these students, however, with the understanding that ASL provides the 'oral language' support. By this, we mean deaf students must rely on ASL to help build a sizable English vocabulary. In order for this to occur, there would need to be a special writing system. The text would then enable deaf students to read based on how they sign (i.e., ASL), while exposing them to English vocabulary at the same time. Students would also need a way to access English words based on ASL vocabulary knowledge, thus utilizing a cross-linguistic mediation process (Supalla, 2003). This type of ASL support would help to alleviate the impact of hearing loss and foster deaf students' reading development in English as a second language.

The existence of an innovative curriculum requires us to create vocabulary measures appropriate to the unique needs of deaf students. Our modifications to the PPVT aim at developing a tool with which we can make deaf students progress in English vocabulary more pedagogically reasonable. We can explore the possibility of creating national signed language-based norms such as deaf norms have been created in the past. This constitutes a long-term goal, but for the purpose of this paper, we focus on investigating the feasibility of two modifications to the PPVT. The first modification turns the oral test into a print version. We are aware of the effects of such changes to the test. One is that the norms developed for hearing students taking the PPVT would not be applicable. The test is no longer oral. The other is that with English word items in print, this task becomes more 'difficult' and decoding becomes essential to the modified test performance.

The second modification follows with the use of a special material to allow deaf students to look up 'unfamiliar' words and decode them in ASL. The special material consists of an inventory of paired written English and ASL words for reference purposes (that resembles a bilingual dictionary). Two deaf students from an elementary school that promotes the use of the innovative curriculum were recruited for the study. For analysis, we compared their performance with norms that include a large number of deaf students who took the print version of the PPVT. We also investigate instructions given to students taking the test with the special material that will maximize their ASL knowledge for deciphering English words in the modified test. But first, we need to understand how bilingualism came to influence the education of deaf students. This is followed with a discussion on the development of deaf norms and the print version of the PPVT prior to our study. We will point out limitations and lay out a rationale for actions needed to improve English vocabulary testing with deaf students.

Bilingual Considerations for the Education of Deaf Students

The notion of 'bilingual education' for deaf children is new and merits attention. In the last few decades, educators have explored the use of ASL with deaf students in the classroom. This arose due to the fact that ASL was first recognized as a (potentially) true language in the 1960's. The pioneering work of William C. Stokoe and his colleagues (1960; 1965) demonstrated that ASL has linguistic properties found in spoken languages worldwide. This initial discovery led to further work by other researchers on the signed language in ensuing years. They came to the conclusion that ASL should be treated as a language in its own right (see Klima & Bellugi, 1979; Wilbur, 1979 for further discussion on ASL linguistic structure). Consequently, new light has been shed on the well-known fact that deaf students struggle in the classroom, especially with English. Johnson, Liddell, and Erting (1989) proposed that deaf students should use ASL academically and learn English as a second language through the print form. The designation of English as a second language suggests that deaf students need to tap into their strength with ASL as a first (or native) language. This

reasoning appears plausible, but the additional designation of English as a written language for deaf students is not something we would normally do in a bilingual education context with hearing students.

For clarification, we need to distinguish oral and written languages. English is displayed in both forms, whereas ASL is strictly an 'oral' language. Furthermore, we must understand that written language is inherently difficult to learn and thus, formal instruction and schooling is required (Padden & Hanson, 2000). Hearing students are expected to become proficient in a spoken language at home, and then use this knowledge in making a transition to print in school. Spoken language knowledge is essential for the purpose of reading development. This helps ease the difficulty posed by the written language and increases a hearing student's chances of mastering the written language.

During the elementary school years, hearing students begin decoding words in print and reading aloud text as part of learning to read. The teacher monitors their progress through running records and miscue analysis, for example. Hearing students in a second language learning context also learn to read with support of a spoken language. In a review of bilingual education literature, Paul and Quigley (1987, p. 145) noted the strong relationship of oral and print modes in two languages as follows:

> 1. Instruction in early grades is in L1 [the first language].
> 2. Reading is introduced in L1 after oral proficiency is established.
> 3. Intensive instruction is given in L2 [the second language]; L1 may be used to teach L2; by this time, reading may be established in L1.
> 4. Reading in L2 is introduced after oral proficiency in L2 is established.

It should be made clear that there is some dispute within the bilingual education context over whether second language reading instruction should wait until oral language skills are developed or rather occur simultaneously with the development of oral language skills (McLaughlin, 1985). However, the importance of oral language skills cannot be ignored in either case. The process concerning oral and print modes is repeated between the two languages. Spanish-speaking hearing children, for example, learn to read in Spanish by relying on the spoken form and then transferring skills to English. They understand the function of phonetic skills in Spanish and begin to apply these skills when learning English. They can proceed with decoding English words. They also read English text aloud as part of their bilingual learning experience. Equally important, their exposure to spoken English occurs simultaneously and supports the learning process involved.

Although attempts have been made to develop a writing system for ASL (enabling deaf students to develop reading skills in the signed language, see Prinz & Strong, 1998 for a review of ASL writing systems with educational considerations), the gap to learning English remains large. As deaf

students learn to read in ASL (if possible), they do not have the physical capacity to develop a good understanding of sound access to English words. This includes the inability to read English text aloud when they do not know how to 'sign' in English. They instead sign in ASL, whereas English text requires speaking. It is important for a student to experience matching the text with what they know in English, but this causes difficulties for deaf students. In addition, they do not learn English through its spoken form, which hampers the application to reading.

For these reasons, action is needed to close the gap between ASL and English. Supalla, Wix, and McKee (2001) argue for the development and use of special tools and a process with the purpose of linking ASL to written English. Gloss is one of these tools; and it becomes the intermediary system in which deaf students are able to develop reading skills with English words, however, written according to ASL's morpho-syntactic structure. Unlike almost all other traditional writing systems that represent one language, gloss is a hybrid of two languages, ASL and English. Gloss is designed to bring the two languages closer to each other, so that deaf students can learn written English as a second language in an effective manner. The benefits of gloss are two-fold. First, deaf students could read text in the language they already know (i.e., ASL). These students could focus on developing reading skills when sentences are consistent with how they sign. Second, the spelling and orthography of gloss closely resemble English text. Many English words serve as roots in the gloss text. This helps deaf students make an initial transition to written English, once they develop a strong sense of familiarity made possible through gloss.

As deaf students learn to read with gloss text that matches how they sign, they still need additional support. Comparative analysis is a process that helps deaf students complete the transition from gloss to written English. Translation exercises presented in gloss and regular English texts showcase similarities and differences between ASL and English, and serve as a basis for teaching English. Deaf students can take advantage of the structural similarities as expected between any two languages, and their teachers can target specific structural properties not found in ASL (but present in English). This includes the vocabulary domain as some words may appear in the English text, but not in the translated version of ASL in the gloss format. Such English vocabulary requires explicit instruction to ensure that deaf students master the words that have no ASL equivalence (see Supalla, McKee, & Blackburn, 2004 for further discussion on structural comparison and transparency issues associated with gloss and regular English texts). Teaching English revolves around this approach, and it occurs simultaneously with learning to read in English. However, the comparative analysis component discussed thus far does not address the challenge associated with decoding. Hearing students would 'sound out' the words and make associations with their spoken language knowledge. Deaf students still need a way to decipher the individual glosses (as they are essentially English).

Even though the glosses are written according to English's spelling and orthography, deaf students can 'sign out' the words as part of the cross-linguistic mediation process. This is made possible via another ASL-based literacy tool. *The resource book* is presented in a two-part series, Level 1 and 2 (the first for use with kindergartners and 1st graders and the second for 2nd and 3rd graders). Both levels rely on the use of an ASL alphabet (ASL-phabet) developed for the purpose of writing signs. A set of graphemes (totaling 32) represents the three basic 'phonological' categories of ASL signs: handshapes, locations, and movements. Graphemes representing each of these categories are written and combined in a string, and function as a written ASL sign (see Supalla, Wix, & McKee, 2001 for an example of written signs).

In *The resource book*, ASL/English word pairs are organized alphabetically. It is important to note that when a deaf student wants to write an English word, but does not know its spelling, the student needs to know the ASL-phabet's distinct ordering of letters. This way, the deaf student can use *The resource book* to look up a sign, and locate the corresponding English word. This ASL-to-English section constitutes one half of *The resource book*. In the second half of the book, a deaf student can decipher an unfamiliar English word while reading gloss text. The student would look up the word via its gloss spelling, and then decode its corresponding ASL grapheme string to come up with the sign for the word. This constitutes the English-to-ASL section of *The resource book*.

The Peabody Picture Vocabulary Test

The Peabody Picture Vocabulary Test has long been used in the United States, Canada, and other countries as well. The primary intention of using the PPVT is to measure a student's (standard) English oral vocabulary skills (Dunn & Dunn, 1981; Jongsma, 1982; Kipps & Hanson, 1983; Maddux, 1999). The PPVT has been used in schools, as it is easy for educators to administer and assess. The procedure to administer the PPVT is quite simple. There is no time limit for taking the test; although the test usually takes about 10 to 15 minutes to administer, depending on the student's vocabulary knowledge. The PPVT test plate includes four black and white sketched pictures for each item, with one being the correct answer. The tester first sets up the test plate where the student is able to see the pictures. The tester verbally speaks the target word; the student hears this word, and responds by pointing to the corresponding test item picture.

A basal is established for the PPVT after 8 consecutive correct responses. The test continues until the student makes 6 errors out of 8 consecutive items, where a ceiling is established. At this point, the test administration stops. When the student produces frequent errors in sequence, the test administrator begins to suspect that the student is nearing his limit. The PPVT has norms for age appropriate performance on the vocabulary test. With this information, the tester can evaluate the student's vocabulary knowledge in relation to the grade that he is in at school. If the student falls below the norm, it should raise concern regarding boosting the student's level of oral English

vocabulary knowledge. This test function and scoring criteria are used in all three versions of the PPVT developed to date.[2] At this point, we can see how the PPVT has been developed for hearing students. The test's presentation of English vocabulary in the speech mode requires intact hearing on the part of students.

Development of Deaf Norms

In the field of deaf education, one research team decided to engage in a different course of test administration with the PPVT. The target words were presented in the print form instead of spoken. A study conducted on deaf students' performance with the print mode of the PPVT was done by Forde (1977) and later by the same researcher along with Bunch (i.e., Bunch & Forde, 1987). They studied the PPVT in the print mode with students from two residential schools for the deaf in the province of Ontario, Canada. These researchers implemented a print letter size of 1/2 inch for each word item in the PPVT. Forde proceeded with administering the test to 342 deaf students to develop norms. There were two components of Forde's study: 1) the PPVT was administered to deaf students in 7th grade classes from 1969-1975, and 2) the same procedure was used in two elementary schools (this time with first grade to seventh grade students) from 1973-1974 to the spring of 1975.

Forde began his study by setting up a norm based on grade level and deaf students' average raw scores on the PPVT's two forms, A and B. He categorized deaf students into seven different grades (1st to 7th grades). As a result, the deaf norms were established according to grade levels. One can see the mean score increasing from one grade level to the next in Table 1.

Table 1: Deaf Norms with the PPVT

	Number of Participants	Mean Scores	
Grade		Form A	Form B
First Grade	22	12	11
Second Grade	17	21	20
Third Grade	21	27	21
Fourth Grade	25	36	33
Fifth Grade	21	37	38
Sixth Grade	12	48	51
Seventh Grade	55	47	49

It is important to note that Forde (1977) set the norm for deaf students by scaling back the criterion for the students taking the test. That is, the researcher modified the PPVT by changing its error criterion for ceiling points. Forde explained that 6 errors out of a string of 8 consecutive items was too strict for deaf students, and would deflate their scores. Thus, 6 out of 8 errors

(for the ceiling) was changed to 12 out of 18 errors. With this modification, Forde found that deaf students in the study did develop vocabulary progressively across grades, however they did so in plateaus.

Forde (1977) responded to the introduction of the PPVT-R (a revised version of the PPVT), by conducting a second pilot study with Bunch in 1987, using the new version. Similar to the first study, the goal of their pilot study was to get norming information on the PPVT-R for deaf students. They studied 102 deaf students from the ages of 4;7 to 14;6 from the same schools in Canada. They followed the same procedure administering the test as was done with the original work.

Bunch and Forde (1987) reported the deaf norm for the PPVT-R based on their students' raw scores that allowed them to create a mean score for each age category. The computations across the ten age categories show a constant increase in deaf students' performance on the PPVT-R's two forms, L and M, except for the last age category. That is, deaf students in the age range of 13;7 and 14;6 performed worse than the preceding age group. Table 2 shows the computations, this time, based on age categories.

Table 2: Deaf Norms with the PPVT-R

	Number of Participants	Mean Scores	
Age		Form L	Form M
4;7 - 5;6	8	9.63	7.75
5;7 - 6;6	9	12.78	15.89
6;7 - 7;6	9	17.56	20.44
7;7 - 8;6	13	24	27.69
8;7 - 9;6	12	28.17	31
9;7 - 10;6	8	42.13	43.75
10;7 - 11;6	8	44.88	46.13
11;7 - 12;6	12	48.75	53.50
12;7 - 13;6	15	69.47	74.53
13;7 - 14;6	8	59.63	61.38

Bunch and Forde (1987) mentioned in their study with the PPVT-R that the plateau effect was repeated. They made three conclusions: 1) deaf students take longer to pass through English vocabulary acquisition stages; 2) the PPVT-R is a good measure for hearing students and not for deaf students; and 3) the effect of slow and uneven lexical development may reflect an inadequate educational approach adopted for deaf students. Bunch and Forde reported that the third conclusion may be untenable as they explained that deaf students had undergone an educational reform where signing was adopted in the classroom. During the time of Forde's study, signing was not allowed in the classroom. However, the results remained basically the same even after signing became part of the curriculum.

It is interesting to note that the PPVT studies discussed above do not consider ASL or how it can, in fact, support deaf students' performance with English vocabulary. This may very well underlie the inadequacy of educational approaches adopted for deaf students. Historically, the field of deaf education has been occupied with different communication strategies; one focusing on teaching students to speak and the other encouraging them to sign in the classroom (Baynton, 1993; Benderly, 1980). The pedagogical use of ASL, a linguistically valid language, has essentially been avoided as communication modes are confined to English. At the time of the study conducted by Bunch and Forde, the notion of bilingualism with for deaf students was beginning to emerge in deaf education. The Deaf Ontario Now movement in Canada actually took place afterwards, and it led to the official recognition of ASL as the language of deaf people in Ontario in 1993 (Carbin, 1996).

THE STUDY

Up to this point, it is clear the PPVT and PPVT-R have been administered to deaf students without support from ASL. The curriculum in the schools for the deaf is best described as monolingual or English. Forde and Bunch (1987) engaged in the test modification studies during a time when ASL-based literacy tools were not yet devised. For us, we believe that the results may differ for deaf students if they are able to link the English words to their knowledge in ASL. Students would need to experience reading gloss texts and using *The resource book* to develop vocabulary in English. They also could engage in comparative analysis to ensure that they learn translation skills effectively. The testing takes place with the understanding that its administration is in the print mode. More importantly, deaf students must be allowed to use *The resource book*. This is especially true when deaf students are young and rely on the decoding mechanism to a great extent.

The PPVT-R is used in our study, as this edition improved its test quality as compared to the PPVT. At the time of the study, we were not sure what kind of instruction is best for the use of *The resource book* with the PPVT-R. This addresses the first question of whether testing instruction results in deaf students using *The resource book* more effectively. We are interested in how long it takes to complete the test and whether deaf students understand how to take the test. A second research question follows related to their performance based on two different instructions. Compared to deaf norms, we can determine the benefit, if any, for deaf students who use *The resource book* when taking the PPVT-R.

MATERIALS AND PROCEDURES

Test Design

There were two modifications made to the PPVT-R. The first modification was to list the English words in the print form, rather than

spoken. This modification is similar to what Forde and Bunch did in their studies. Instead of using index cards, all the target words from the test were inputted into a computer. The deaf students read the individual words on the computer screen, one by one. The word list was stored on the computer using PowerPoint software, with a letter font size of 84 points.

The second modification to the PPVT-R was the provision of *The resource book*. Deaf students using this tool would be able to identify unfamiliar English words in the PPVT-R with their knowledge in ASL. For example, if a deaf student encountered the word, "reading" and it is unfamiliar to him, he could first find the word listed alphabetically in *The resource book*. Then he would identify the word's corresponding ASL equivalent written in the ASL-phabet, and decode the print word into an ASL sign. A guide book version of *The resource book* was utilized in the administration of the test. This version includes a total of 572 ASL/English word pairs (listed on 49 pages). It is smaller in volume as compared to *The resource book* series. Of the 572 ASL/English pairs listed in the guide book, approximately 50% are English words appearing in the test. The rest are randomly selected from *The American heritage children's dictionary* (1997). This combination of target and non-target English words creates a mixture in the guide book.

We took advantage of the fact that the PPVT-R has two forms. With Form L, deaf students were instructed to use *The resource book* as needed. In this case, the use of *The resource book* was optional, or rather at the discretion of the students. With Form M, deaf students were instructed to use *The resource book* at all times. They were told to use *The resource book* every time they saw a new English word in the test.

Deaf students taking the PPVT-R are expected to encounter a small number of English words that do not have an ASL equivalent, and are thus not listed in *The resource book*. There were six such vocabulary items that did not have ASL/English equivalents, and they were scattered throughout the L and M word lists (i.e., 2 items and 4 items respectively). The students were informed about the possibility that *The resource book* may not provide an ASL equivalent for every word on the test. With this information, the students were prepared and could guess as to the English word's meaning when there was no ASL equivalent.

In administering the PPVT-R, deaf students were given Form L and M several days apart. The students' performance on Form L was recorded on videotape to capture their test-taking behavior. No videotaping was conducted for Form M as the students were instructed to use *The resource book* at all times. On both forms, the PPVT-R's test book was used which depicted four pictures on a test page. The test book was not modified, although *The resource book* and computer were used. The deaf student took the test sitting in front of the computer. The test book was located on the table beside the computer and in front of the student and the tester. *The resource book* was placed on the left side of the test book. The student was instructed to read the English word on the screen, and then point to its corresponding picture in the test book.

The PPVT-R uses 8 consecutive correct answers to establish a basal and 6 out of 8 consecutive errors to establish the ceiling (which differs from the Forde (1977) and Bunch and Forde (1987) studies). The modified test we administered adopted the original PPVT-R's basal and ceiling as developed. There was a difference, however, in determining the starting point in the English word list. In our study, the starting point is based on 1 1/2 to 2 years below the deaf student's age, instead of at the age of the student as proposed in the PPVT-R's manual. In order to establish a basal, the tester can regress in the list, if needed.

Subjects

The students in the study attended an elementary school that implements a program using ASL-based literacy tools including *The resource book*. These students possessed knowledge of the ASL-phabet. This is critical to the administration of our modified PPVT-R. This means the students in our study could translate the target English words in the test after decoding the sign equivalent written in the ASL-phabet.

Originally, a total of four students met the eligibility criteria. The students were all profoundly deaf (since birth), and they possessed ASL as their native language. They had either deaf or hearing parents who used ASL at home and participated in deaf community activities. The students' signed language proficiency was identified through the American Sign Language Proficiency Assessment (Maller, Singleton, Supalla, & Wix, 1997). They were ranked as fluent signers. However, two students were removed from the study. One student did not follow the instructions critical to the test. With the second student, an error was made in the test administration and no ceiling was established (on Form L). Thus two deaf students remained in the study. Both students are females; the first deaf student is Lucy (pseudonym) age 6;11 and the second is Barb (pseudonym) age 9;11.

It is important to note that the two remaining students in the study have some differences in their educational experiences. Lucy enrolled at the school when she was four years old, and had been at the school for three years when she took the PPVT-R. Barb (who is three years older than Lucy) had been at the school for only two years, when she transferred from another educational program where ASL-based literacy tools and a process of becoming proficient in written English as a second language were not used. These differences cannot be controlled due to the small number of students available for the study. Nevertheless, these differences will be subject to later discussion.

Coding and Analysis

During the PPVT-R administration, the tester timed Lucy and Barb's performance on both Form L and M. The tester also used a checklist for administering both forms. Information noted on the checklist includes name of student, chronological age, begin and end times for the test, item number, vocabulary item, name of tester, test response, errors, and raw score. The Form

L checklist that was developed for the PPVT-R was adopted without any change. There was one change, however, made for the Form M checklist. On Form M, a column was added to allow the tester to indicate whether or not *The resource book* was used.

After the test administration, the checklist is used to compute the PPVT-R raw score. It is calculated by establishing a basal and a ceiling, and then subtracting the errors produced within the basal and ceiling. The raw score for Lucy and Barb with the PPVT-R is compared with Forde and Bunch's (1987) raw score average for the corresponding subject age categories of 6;7-7;6 and 9;7-10;6. The checklist developed provides information on how each of these students performed with *The resource book* based on the answers they produced. The frequency of Lucy and Barb's use of *The resource book* is subject to analysis. The videotape of both students (done on Form L only) provides descriptive data on how they engaged in the cross-linguistic mediation task with the test items.

RESULTS

The data analysis produced results with respect to the two questions raised in this study. First, we will discuss how the different test instructions affected the use of *The resource book*. Second, we will see how the two students, Lucy and Barb performed in comparison with the deaf norms.

A Comparison of the Form L and M Instructions

On Form L, Lucy and Barb appeared to understand the test instructions to use *The resource book* as needed. However, both either used *The resource book* sparsely or not at all during the PPVT-R administration. Lucy needed 20 minutes to complete the test. She responded to a total of 42 English words, and used *The resource book* two times. Barb, on the other hand, did not use *The resource book* for any of the 20 English words that she encountered, and needed 20 minutes to complete the test. There was one English word that she tried to identify through *The resource book* below the basal.

During the administration of Form L, Lucy's successful cross-linguistic mediation process with the English word "tying" was captured on videotape. She first saw the target word on the computer screen and then looked it up in *The resource book*. She scanned the page for the gloss, TYING. She then looked at the string of ASL graphemes next to the gloss. Lucy first recognized the location symbol which represents where the sign is produced. In this case, it was in the signing space (in front of the signer). She then looked at the next two handshape symbols and formed the appropriate handshapes with her hands. Both handshapes were identical, with extended and bent index finger and thumb touching each other by the tip for both hands. She looked back to the string of ASL graphemes for TYING to check on the movement symbols. They represent a complex set of movements required for the sign:

circular, left and right, and repeated.[3] It was then that Lucy fully decoded the written sign and pointed to the correct illustration.

On Form M, the results were different in regard to the use of *The resource book*. Lucy used *The resource book* at all times. For this reason, she required more time and needed two separate administrations to complete the test; the first required 22 minutes and another 19 minutes to complete the test. The total time spent on administering the test was 41 minutes. Lucy looked up a total of 38 words using *The resource book*. She produced 30 correct answers out of the 38 vocabulary items (or 72%). She could not identify 8 English words after reading the ASL equivalents in *The resource book*.

Barb, on the other hand, did not use *The resource book* at all times, but rather most of the time. As with Lucy, she needed more time and two separate administrations to complete the test. The first required 12 minutes and another 19 minutes to complete the test. The total time spent on the test was 31 minutes. Barb looked up a total of 51 words using *The resource book* out of 59 vocabulary items (or 86%). With the 51 words, she produced 32 correct answers (or 62%). She could not identify 19 English words after reading the ASL equivalent in *The resource book*. This computation indicates that Barb did not perform as well as Lucy with *The resource book*.

A Comparison with the Deaf Norms

Both Lucy and Barb demonstrated strong performances on the PPVT-R as compared with the same-age deaf norms. On Form L, Lucy began the test at the first vocabulary item, *bus*. She reached the ceiling at the 42nd vocabulary item, *vegetable*. A basal for this student was never established, and she had a total of 15 errors. Based on this computation, Lucy's raw score was 27. In comparison to Bunch and Forde's study (1987), the average raw score for a deaf student aged 6;7 to 7;6 was 17.56. Lucy's raw score surpassed the noted average by 54%.

On Form M, Lucy began the test at the 10th vocabulary item, *reading*. She reached the ceiling at the 49th vocabulary item, *coin*. Unlike on Form L, a basal was established for Lucy with a total of 8 errors. Based on this computation, her raw score was 41. In the same age category in Bunch and Forde's study, the average raw score on Form M was 20.44. Lucy's raw score surpassed the noted average by 100%.

Barb performed similarly on forms L and M. On Form L, she began the test at the 44th vocabulary item, *dripping*. She reached the ceiling at the 63rd vocabulary item, *signal*. A basal for this student was established with a total of 5 errors. Based on this computation, her raw score was 58. In comparison to Bunch and Forde's study, the average raw score for a deaf student aged 9;7 to 10;6 was 42.13. Barb's raw score surpassed the noted average by 38%.

On Form M, Barb began the test at the 30th vocabulary item, *whale*. She reached the ceiling at the 90th vocabulary item, *triplet*. A basal was established for Barb, and she had a total of 20 errors. Based on this computation, her raw score was 70. In the same age category in Bunch and

Forde's study, the average raw score for Form M was 43. Barb's raw score surpassed the noted average by 63%. Table 3 shows raw scores (on both forms) for the students participating in this study in comparison to Bunch and Forde's deaf norm scores.

Table 3: PPVT-R Raw Scores Using *The resource book* and Deaf Norm Comparisons

Student and Form	Resource Book	Deaf Norm	
Lucy			
Form L	27	17.56	+ 9.44
Form M	41	20.44	+ 20.56
Barb			
Form L	58	42.13	+ 15.87
Form M	70	43	+ 27

When comparing Lucy's and Barb's outcomes on the PPVT-R with the deaf norms, it appears test instruction played an important role in performance. Both students used *The resource book* more effectively when instructed to use it at all times (Form M), as opposed to using it at their discretion (Form L). To explain this, it is likely that Lucy and Barb missed some items on Form L because they did not use *The resource book*. Without the ability to decipher the words, they were less likely to point to a correct picture. This may have resulted in an inferior cut-off score for both students. However, (when required to use *The resource book*) the same students benefited as they correctly identified more vocabulary items, which allowed them to progress farther on Form M.

DISCUSSION AND CONCLUSION

The results produced based on the relationship of *The resource book* and deaf students' performance on the PPVT-R indicates that this testing approach is feasible. The notion of ASL supporting deaf students' performance on the test is confirmed. The finding that the two students in our study performed best with consistent use of *The resource book* must be taken into consideration. The actual decoding example provided for one ASL written sign and its resulting successful identification of the English word indicates that a similar process has occurred with other test items. The students concentrated on the spelling of the English word on the computer screen before they used *The resource book*. The spelling of gloss and English words is the same. For this reason, the students were able to scan and identify the gloss listed in the guide book version of *The resource book*. They utilized their knowledge of the English alphabet to find the correct gloss amidst more than

500 glosses in *The resource book*. This is a first step in the cross-linguistic mediation process. The students then looked at the string of ASL graphemes (representing the ASL sign equivalent of the English word) located next to the gloss. There they decoded the graphemes in terms of handshape, location, and movement. Once they identified the word written in ASL successfully, they understood the meaning of the English word. They were then able to identify the correct picture in the test.

When comparing the two deaf students in our study, it is important to remember that they were enrolled in an elementary school where both ASL-based literacy tools (including *The resource book*) and a process of becoming proficient in written English as a second language was used in the classroom. The skills that they gained from this reading program were evidently put to good use. The younger student (Lucy) was enrolled at the school from kindergarten, and for a longer period of time than the older one (Barb). This may have influenced her performance on the PPVT-R. Their use of *The resource book* is of particular interest. When using *The resource book* to decipher English words, the younger student is found to be more successful than the older one. The older student struggled more when using *The resource book*. She did not read or decode written signs as fluently as the younger one. Fluency with the ASL-phabet is apparently an issue here. If the older student had a more lengthy experience in the reading program, she likely would have performed better on the test. These findings are valuable to a teacher who teaches using an ASL-based reading program. The teacher can make sure that the older student becomes more skilled with the ASL-phabet through a remedial program.

Recall how Bunch and Forde (1987) created normative data for deaf students taking the PPVT-R. The target English words were presented in print, but deaf students took the test without the support of ASL (or *The resource book*). The researchers were forced to make less stringent criterion for cut-off in order to capture progress (in plateaus) in English vocabulary development. In our study, we did not adopt Bunch and Forde's cut-off criterion, and instead used the cut-off developed for hearing students. With this in mind, it would be reasonable to predict our students might turn in a dismal performance falling below the raw score average for deaf students. However, the two deaf students in our study demonstrated superior performance as compared to deaf norms. They apparently had developed a sense of connection between ASL and written English, including comparative analysis between the two languages. In addition, they read gloss extensively, and it is our opinion that they learned how to draw on the text to capture the meaning of individual English words. Finally, they had an opportunity to use *The resource book* in the classroom on a regular basis and gained a degree of fluency in ASL-phabet. We suggest that these reading development opportunities explain, in large part, why our students performed well on Form L (with little or no use of *The resource book*) and even better on Form M (with consistent use of *The resource book*).

The results of our study also offer insights in regard to test taking procedure. When instructed to use *The resource book* as needed, our students

did not perform as well as when they were instructed to use *The resource book* at all times. This finding indicates that good judgment on whether or not to use *The resource book* was not exercised. Another finding, that Form M required twice as much time to complete as compared to Form L, requires consideration as well. First, teachers must prepare students to take the modified PPVT-R. Second, students need to understand that they should use *The resource book* every time they encounter an unfamiliar English word. This would alleviate guessing and pointing to incorrect pictures. Third, students should point to a picture when they are confident they know the meaning of the word, thus avoiding having to look it up in *The resource book*. This also could save a significant amount of time.

The process in which deaf students use *The resource book* to decipher English words in the PPVT-R should not be considered unusual, as they are able to rely on ASL to facilitate access to concepts concerning English words. We note that hearing students learning English as a second language demonstrate similarities to the deaf students in our study. Hearing second language learners do, in fact, process in their first language when they read English. To develop lexical proficiency in the second language, bilinguals are found to 'translate' English words with their first language (Spanish, for example) counterparts to facilitate access to concepts. This occurs most actively during the early stages of learning English as a second language (Kroll & Tokowicz, 2001; de Bot & Kroll, 2002). The deaf students in our study are quite young and were in elementary school when they took the modified PPVT-R.

We must now question the appropriateness of the previous efforts in the modification of the PPVT and PPVT-R. Had hearing students taken the print mode of the tests, they would likely rely on decoding the unfamiliar English words. Those who learn English as a second language would do the same. We cannot expect deaf students to take the modified test without *The resource book*. This would be denying them a decoding mechanism afforded to hearing students. Moreover, hearing students learning English as a second language engage in translation as they read English words. We should allow a similar opportunity to occur for deaf students. They can use *The resource book* to help them translate English words into ASL signs. Of course, decoding is required for the written signs to ensure that deaf students read in their own language in order to comprehend the meaning of an English word. A cross-linguistic mediation process as described here is required if we intend to remove the adverse effects of deafness as reported in the deaf education literature. This is a proposal worthy of investigation, albeit it beyond the scope pursued in this paper.

With our small sample, we controlled for the variable of ASL proficiency. Both of our students were proficient in ASL. Varying levels of ASL proficiency among deaf students are found to influence their potential of reading in English (e.g., Hoffmeister, 2000; Padden & Ramsey, 2000; Strong & Prinz, 2000). The performance with English vocabulary (in print) is also influenced by how proficient deaf students are in ASL (Singleton, Morgan,

DiGello, Wiles, & Rivers, 2004). The deaf normative studies conducted by Forde and Bunch did not consider such a linguistic variable. It is highly possible that deaf students who are proficient in ASL would perform better than the deaf norms on the PPVT and PPVT-R as reported. However, we predict that deaf students who enroll in an ASL-based reading program would demonstrate a superior performance as compared to those who did not. The basis for this prediction lies in the superior performance as reported for the two students in our study when they use *The resource book* consistently. We note that the beneficial use of *The resource book* with the print mode of the PPVT-R is based on the assumption that deaf students know the ASL-phabet and are able to read written signs. Ideally, a normative study would take into account for *both* the provision of the reading program and ASL proficiency.

At the time of our preliminary work, only one school in the nation had implemented the ASL-based reading program. Consequently, it was from that school where the students were recruited for the study. A normative study will become feasible once more schools and programs serving deaf students commit to the provision of effective reading instruction. We could then undertake a large-scale work such as Forde and Bunch. At that time, we could examine whether students make progress in a timely manner (i.e., one year and grade level annually). We understand that the original function of the PPVT-R of measuring oral English vocabulary knowledge of hearing students, but our aim is different. If deaf students make appropriate progress, we can assume their fluency with English vocabulary in print.[4] In addition, the reported case of a few English words in the test not having ASL equivalents requires further examination for its effect on deaf students' performance and the modified test's effectiveness. This includes considerations for how the comparative analysis and gloss reading components of the ASL-based reading program support deaf students' performance with English items in the modified PPVT-R. In any case, the potential test development work as described holds promise for measuring deaf students' curriculum-based knowledge and progress with English vocabulary over time.

ENDNOTES

1. In one instance, Moeller, Osberger, and Eccarius (1986) undertook a study with the PPVT-R (a revised version of the PPVT) and gave particular attention to deaf students who signed. Unlike the other studies (i.e., speech only), this research team explored the use of simultaneous communication while administering the PPVT-R. Simultaneous communication included the use of signed English along with speaking. The idea behind the study was that deaf students might perform better on the vocabulary test if the target words were signed to compensate for a lack of auditory access to spoken words. Deaf students with profound hearing loss, for example, could rely on signing when taking the test. The researchers administered the PPVT-R to 150 deaf students between the ages of 4;6 to 20 years old. They reported a similar outcome; that is, deaf students on average performed lower than the hearing norm. One

possible explanation for the continuing inferior performance of the signing deaf students with the PPVT-R lies in the fact that signed English is not a natural language (see Supalla & McKee, 2002 for further discussion on the limitations of such sign system). For this reason, deaf students fail to master English (including its vocabulary) through the signed mode, and their PPVT-R performance reflected this outcome.

2. The original PPVT was created in 1959, and the PPVT-Revised (PPVT-R) was revised in 1981 (Jongsma, 1982; Kipps & Hanson, 1983). The third revisions to the test occurred in 1997 (see Dunn & Dunn, 1997; Williams & Wang, 1997 for further discussion on the latest revisions of the PPVT or PPVT III).

3. The way the deaf student participating in the study reads the written sign is noted. The location grapheme is frequently subject to decoding first before handshape and movement.

4. Note that we do not overlook the value of measuring oral ASL vocabulary knowledge among deaf students. Should a deaf student perform poorly on the modified PPVT-R using *The resource book*, the teacher can administer an ASL version of the vocabulary test to determine whether this student possesses ASL vocabulary expected of his age. If the results include an inferior performance, the teacher can focus on expanding the student's vocabulary in order to perform better with English vocabulary in print. There appears to be one example of such an ASL vocabulary test, that is, Brenda Schick's American Sign Language Vocabulary Test as reported in Singleton and Supalla's 2003 review of measures in ASL and other signed languages worldwide.

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