
The Word Intelligibility by Picture Identification Test: A Two-Part Study of Familiarity and Use

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The Word Intelligibility by Picture Identification (WIPI) Test was published as a means to "assess the speech discrimination ability of hearing impaired children" (Ross & Lerman, 1970). The WIPI remains a popular test among pediatric audiologists, even though many of the pictures now appear out-of-date and several illustrations seem insensitive to our current social mores. None of the drawings reflect the racial diversity of the American population.

In this two part pilot study, the WIPI was presented to a group of 16 normally hearing five- to eight-years-old children, two boys and two girls at each age level, to determine if they had difficulty identifying any test pictures or vocabulary. The data showed that the six- to eight-year-old children had little difficulty recognizing the test pictures or vocabulary. Children in the five-year-old group demonstrated a considerable number of errors. Eight of the 150 test items were missed consistently across all age groups.

Additionally, an on-line survey was disseminated to approximately 800 audiologists to examine how they currently use the WIPI test. Results confirmed that the majority of pediatric audiologists who responded to the survey use this test. These audiologists indicated that they chose the WIPI more often than any other closed-set word recognition test. However, a substantial number of audiologists reported that they varied their test presentation from the protocol outlined by Ross and Lerman.

Introduction

The Word Intelligibility by Picture Identification Test (WIPI) was published to "assess the speech discrimination ability of hearing-impaired children" (Ross & Lerman, 1970). Although the response pictures of the WIPI are now more than thirty years old, this test is still used to evaluate the word recognition ability of young hearing and hard-of-hearing children. However, the look of the test itself can be seen as a critical factor when working with children in today's audiology clinic. The drawings created in 1970 now appear old fashioned at best, and in some cases, insensitive to the changes that have occurred in our social mores over the last three decades. Many of the vocabulary words used as test items or as foils seem unfamiliar to typical children. For deaf or hard-of-hearing children with delayed vocabulary and/or language skills, the dated words and pictures of the WIPI test present an even greater concern. Altogether, these factors may certainly influence any child's response on the test and affect its outcome.

PART I – Familiarity Study

Methods

Subjects

The test group consisted of four children (two boys and two girls) at four age levels (5, 6, 7, & 8 years). The children were registered in two public school districts in Lancaster County, Pennsylvania. Five of the participants attended a suburban elementary school, and 10 of the children lived in an urban school district. All children were enrolled in general-education programming and received no additional educational support. The children's parents received information regarding the purpose and design of the study, and were asked to complete a short questionnaire about their child's educational placement and health history.

Each child passed a pure tone hearing screening at 25 dB at 250 Hz and 500 Hz, and 20 dB at 1000 Hz, 2000 Hz, and 4000 Hz on the day of speech recognition testing.

Tympanometry was conducted in conjunction with the

pure tone screening. Children who took part in the study demonstrated normal tympanometry results bilaterally as defined by peak admittance greater than 0.3mmho or tympanometric width (TW) less than 200 daPa. The Peabody Picture Vocabulary Test (PPVT) was also presented to each child. Eleven participants obtained scores that fell within one standard deviation of their chronological age, four of the participants scored two standard deviations above the mean for their chronological age and one seven-year-old scored two standard deviations below the mean for her age. Participation in general education and each child's academic history was confirmed by the parent survey.

Procedures

The four WIPI test lists and two lists of foil words (see Appendix A) were presented live-voice, face-to-face, to each child to determine his or her familiarity with the vocabulary and pictures. The investigator prefaced each word with the statement "Show me the...". The child was asked if he/she needed to take a break after each list was presented. All of the children completed the six lists given back-to-back without wanting a break. The order of presentation of the six lists was varied from child to child. The investigator recorded any errors on a score sheet by noting which picture the child chose instead. The children were offered small prizes after the testing was completed.

Results

Most of the WIPI words were correctly identified by all of the children. Of the 150 stimulus words, 107 were not missed by any of the test subjects. An additional 24 words were misidentified by only one child. Fifty-eight percent of these words (14 of 24) were missed by children in the five-year-old group. Across the age groups, 11 words were missed by two children. Thus, 142 of the WIPI words do not appear to be unreasonably difficult for typical children in the five-to eight-year-old age ranges. Table 1 shows the eight most frequently missed words and the number of errors made by each age group.

The number of errors made by the five-year-old group was substantially higher than for any other age group. As a group, the five-year-olds incorrectly identified 30 of the 150 stimulus words presented. This group demonstrated 48 total errors, as several words were missed by more than one child. Children in the five-year-old group committed an average of 12 errors across the 150 stimulus words. The six-year-old group misidentified 11 words, with a total of

Table 1: Number of Errors Made by Age Group for Frequently Missed Words

Test Word	Number of Errors			
	5 yr olds	6 yr olds	7 yr olds	8 yr olds
Farm	4	3	4	3
Spring	3	3	1	2
Cone	3	2	2	
Shoe	3			1
Dress		1	1	1
Fill		2		1
Pail	2	1		
Pipe	3			

18 errors. These children averaged 4.5 errors across all stimulus words. The seven-year-old group made fewer errors than their younger cohorts, with a total of 13 errors. The seven-year-old children each missed an average of 3.25 words. The eight-year-old group incorrectly identified 10 words, with a total of 13 errors. These children also averaged 3.25 errors for all of the WIPI test words.

All 16 children made the fewest number of errors on list 2 of the WIPI (beginning stimulus word broom). Four children missed four different words from this list. Lists 1 and 4 appeared to be equally difficult. Across all age groups, a total of nine errors were committed on seven words in list 1 (beginning stimulus word school), and 10 errors were committed on eight words in list 4 (beginning word spoon). List 3 (beginning stimulus word moon), however, resulted in more errors than the other lists. The children in all four age groups committed a total of 18 errors on eight stimulus words on list 3. The two lists of foil words created for this project (not normed by Ross and Lerman) resulted in more errors than any of the original test lists. Thirty errors were committed on seven words included in the second foil list, and 19 errors were committed on nine words from the first foil list. Table 2 shows the number of errors made by each age group for each of the six test lists.

Table 2: Number of Errors Committed per WIPI 25 Word Test List by Age Groups

Test list	Number of Errors			
	Five-year-olds	Six-year-olds	Seven-year-olds	Eight-year-olds
List 1	9	1	0	0
List 2	1	0	1	2
List 3	11	3	2	2
List 4	7	1	1	1
Foil list 1	10	6	2	2
Foil list 2	10	7	7	6

Results

One hundred and two audiologists responded to the on-line survey. Seventy one percent of the respondents (72 of 102 surveys) provided answers to all 10 questions of the survey and indicated that at least 41% of their workweek was spent with a pediatric population. Analysis was

based on these 72 surveys.

PART II – SURVEY OF AUDIOLOGISTS

Methods

Procedures

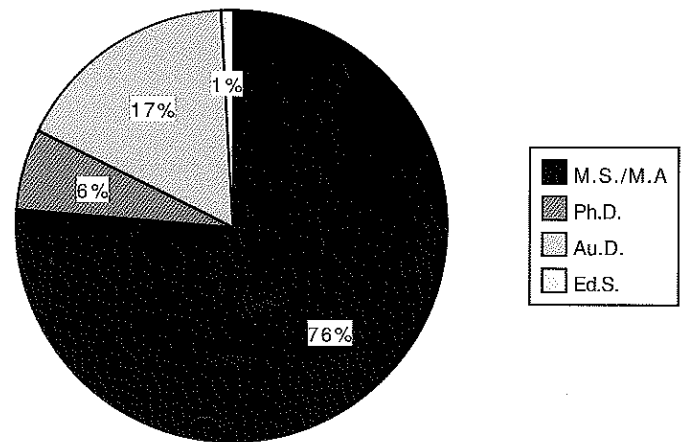
In February 2003, a 10 question survey (see Appendix B) was posted to the 800 member listserv of the Educational Audiology Association’s website. During the same time period, Dr. Robert Keith disseminated the survey to audiologists who were his past or current students in the Central Michigan University/Vanderbilt Bill Wilkerson Center on-line Au.D. program. Participants were asked to return their completed survey to the principal investigator within 10 days. Audiologists who elected to participate in the survey were asked to indicate how often (percentage of time) they worked directly with children under the age of 12. Eight items on the questionnaire were addressed to all survey participants. Respondents were asked to complete the last two questions only if the WIPI was typically part of their clinical routine. Survey items asked about the appearance of the WIPI pictures and vocabulary, and changes in the test protocol that clinicians had implemented themselves.

One caveat should be kept in mind when reviewing these survey results. The instructions that accompanied the survey indicated that the questions focused on the WIPI test. Therefore, audiologists who did not use the test on a regular basis may have simply decided not to participate. Different results may have also been obtained if more audiologists outside an educational setting had participated in the survey.

Demographic Information

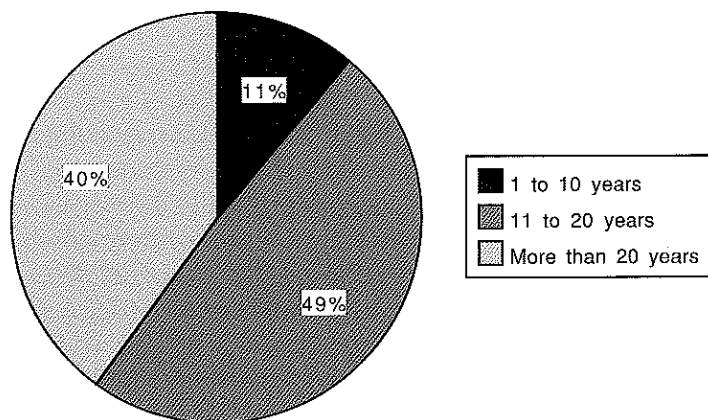
Fifty-five of the 72 pediatric audiologists indicated that their highest degree was earned at the Masters level. Four pediatric audiologists indicated they had earned a Ph.D. and 12 had an Au.D. degree. One participant indicated an Ed.S. as his/her highest degree (Fig. 1).

Figure 1. Educational background of survey responders



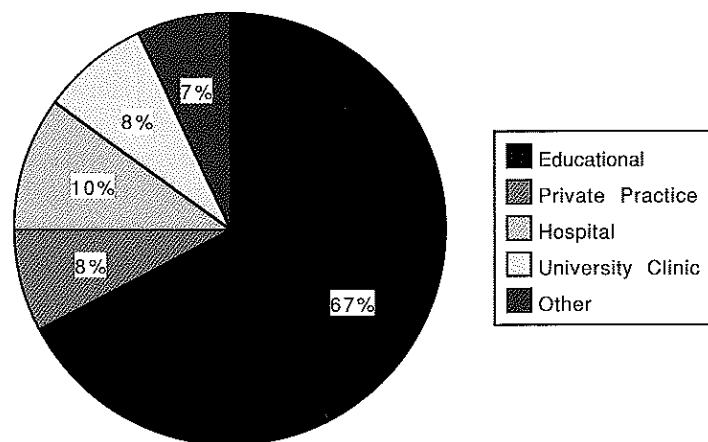
Eight responders indicated that they had been employed as an audiologist from 1 to 10 years. Thirty-five pediatric audiologists indicated they had worked 11 to 20 years in the field, and 29 stated they had worked as an audiologist for more than 20 years (Fig. 2).

Figure 2. Years of experience of survey responders



Educational audiologists in public school systems made up the majority (67%) of these 72 responders. Ten percent of the response group described their work setting as a hospital clinic, 8% indicated they worked in a private practice and 8% worked in a university clinic. The remaining 7% listed other employment settings such as ear, nose and throat (ENT) practice, residential school for the deaf, rehabilitation center, manufacturer's research center, or university (Fig. 3). Of these 72 respondents, 58% indicated that they spent 81% to 100% of their workweek with pediatric patients. Twenty-one percent indicated that 61% to 80% of their work time was with young children. An additional 21% indicated that 41% to 60% of their work was with pediatrics.

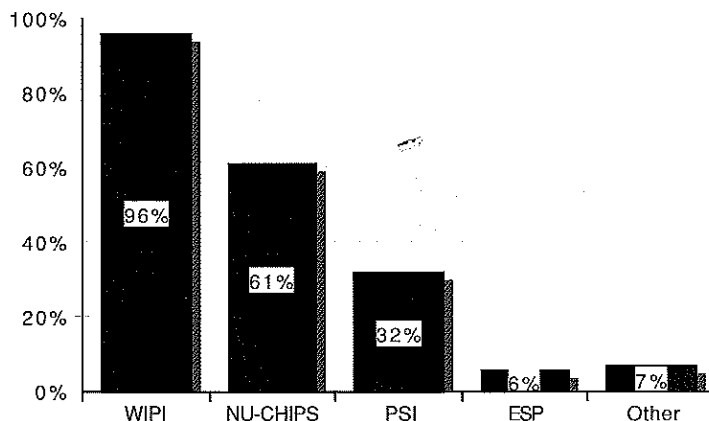
Figure 3. Survey responders' place of employment



Use of closed-set word recognition tests

When asked which closed-set word recognition test(s) were available in their practices, the majority (96%) stated that the WIPI was on hand for their use. The NU-CHIPS was available to 61% of these audiologists and the Pediatric Speech Intelligibility Test (PSI) was available to 32% of the audiologists. Six percent of these pediatric audiologists also listed the Early Speech Perception Test (ESP) as a closed-set test they could select to use at work. The Auditory Perception of Alphabet Letters (APAL), Mr. Potato Head, and privately made picture cards were listed as other closed-set word recognition tests available to 7% of these clinicians (Fig. 4).

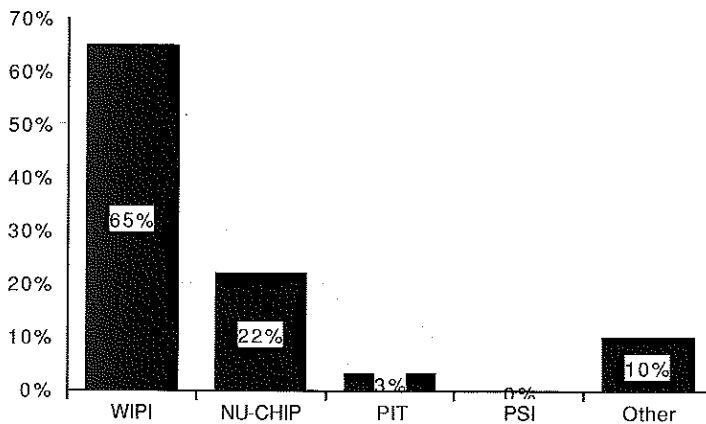
Figure 4. Percent of responding audiologists who have access to specific word recognition tests



Most audiologists indicated that they had more than one test available for use. Thirty five percent of these audiologists indicated that they had two closed-set word recognition tests to choose from in their clinical setting. Another 29% reported that there were three such tests available, and 11% stated that they had access to four or more closed-set word recognition tests. Only eighteen (25%) of these pediatric audiologists reported that there was only one closed-set word recognition test available in their practice setting. Each of these 18 audiologists indicated that the only closed-set word recognition test available to them was the WIPI. The survey also asked what percentage of time the audiologist chose to present the WIPI test when a closed-set word recognition test was required. The data indicated that 57% of the audiologists (41 of 72) used this test with pediatric clients more than 60% of the time.

When asked which closed-set word recognition test the audiologists chose to use most often with pediatric clients, 65% indicated that the WIPI was the test they chose to present most of the time. The NU-CHIPS was the test-of-choice for 22% of the population surveyed. Only 3% of the audiologists indicated that they chose to use the Picture Identification Test (PIT) over other closed-set tests, and 0% indicated that the PSI was the test they would choose most often. Ten percent of the respondents indicated another test, not listed as a possible response for this question, would be the test they chose to use most often (see Figure 5).

Figure 5. Test-of-choice for responding audiologists.



Concerns About the WIPI Among Non-Users

Audiologists who used the WIPI less than 60% of the time were asked to list specific concerns about the test that caused them to choose a different closed-set word recognition tool. Thirty one of the 72 audiologists (43%) who used the WIPI fell in this category. Written responses to this question were obtained from 19 of these 31 audiologists.

Table 3. Why Audiologists do not use the WIPI (N=19)

DON'T LIKE WIPI PICTURES		DON'T LIKE WIPI VOCABULARY		DON'T LIKE WIPI DESIGN	
Outdated	26%	Prefer open-set tests	11%	Too many pictures	11%
Unfamiliar to children	16%	Can't use with non-English speakers	5%	Too few lists	5%
NU-CHIPS better	16%	NU-CHIPS better	5%	Personal Preference	16%
Don't like WIPI pictures	16%	Use vocabulary specific to child	5%		

Many of these 19 audiologists provided more than one reason as to why he/she did not use the WIPI most of the time. Their statements can be grouped into several general categories of concern regarding the pictures, vocabulary, or general design of the test (see Table 3).

The most frequent concern expressed by these audiologists was the old-fashioned appearance of the pictures. Seventy four percent (N = 14) of those 19 audiologists remarked that the pictures were outdated or unfamiliar to today's children, that the NU-CHIPS pictures were more familiar to children, or that they simply did not like the WIPI pictures. The vocabulary used for the WIPI was also listed as a concern by 26% (N = 5) of these audiologists. Some named other closed-set tests that they felt used words more familiar to children. Finally, 16% (N = 3) of the respondents indicated that the general design of the test caused them to choose a different closed-set tool. Some stated that the WIPI had too few test lists to use when evaluating a child's word recognition skills under varying conditions. Others felt that the test contained too many pictures per page to use reliably with young children.

Features Important to WIPI Users

The last two questions were addressed to audiologists who used the WIPI more than 60% of the time when working with pediatric clients. Fifty-three audiologists (74% of 72 surveys) responded to either one or both of these last two questions. Question 9 focused on features of the test that influenced the audiologist's frequent selection of the WIPI. Survey participants were asked to list their own reasons for choosing the WIPI more often than any other test. Forty written responses were obtained to question 9 (see Table 4). Fifty three percent of these responders stated that ease of administration was the primary reason, that the WIPI was used. These audiologists

stated that they found the test quick to administer, simple to use, and reliable. Fifteen percent liked the pictures in the WIPI, and another 8% indicated that they either liked that the pictures were in color or that they preferred the WIPI pictures over those in the NU-CHIPS. Eighteen percent believed that the vocabulary used in the

WIPI was appropriate for children. Only 10% mentioned that the norms for deaf and hard-of-hearing children were an important factor in their choice of this tool. The format of the test and the sturdiness of the book were important to 19% and the closed-set format was mentioned by another 15% of these audiologists. The clinician's own familiarity with the WIPI, or the test's own history was the reason given by 20% of the audiologists for using the WIPI. Finally, 18% of these 53 audiologists responded that they used the WIPI so often because it was the only closed-set word recognition test available to them.

question. Forty-five audiologists (63% of 72 respondents) provided a response.

Seventy eight percent of these 45 audiologists stated that they presented the WIPI to children who were older or younger than recommended by the norms developed by Ross and Lerman (1970) for the test. More than half of the 45 audiologists (53%) indicated that they shortened the test list (gave half lists) for children. Additionally, 44% (N = 20) stated that they omitted specific test words and 33% (N = 15) acknowledged that they substituted a word from another test list for specific test words. Although the survey did not

ask for examples of which words were omitted from their presentation, several audiologists listed the words gun, pail and pipe specifically as words they chose not to present to young children. Forty two percent of the 45 audiologists (N = 19) present the test to children with normal hearing thresholds although the test was not standardized for this population. An alternative to the correct picture was intentionally accepted as a correct response by 9% of the audiologists (N = 4), and 7% (N = 3) stated they have altered or changed test pictures in some way.

A variety of replies were obtained to the open-ended (Other) option of question 10. Many of these responses can be grouped as variations in the presentation of the test. Specifically, 18% of the 45 audiologists

(N = 8) indicated that they either reviewed pictures with a child before the actual test presentation, presented the WIPI as a word recognition test without the pictures (i.e., open-set format), or used an auditory only, visual only, and/or a combined auditory plus visual mode of test presentation. Additionally, 9% of these audiologists (N = 4) reported that they repeated stimulus words for a child, presented the test with sign support, or compiled their own "easy" test list to present to specific children. Other responses provided by these audiologists indicated that the test was often presented to individuals outside the original target population of five- to eight-year-old children with moderate to severe

hearing loss. Nine percent of these 45 audiologists (N = 4) also indicated that they chose the WIPI when working with developmentally-delayed adults, children with poor articulation or communication skills, or children with severe-to-profound hearing loss. Four percent of the 45 responding audiologists (N = 2) indicated that the WIPI was presented as part of the Selective Auditory Attention Test.

Table 4. Features Audiologists like about the WIPI

ADMINISTRATION		FORMAT	
Easy to administer	35%	Six pictures to page	8%
Simple	5%	Sturdy book	5%
Quick	8%	Number of lists available	3%
Reliable	5%	Taped presentation available	3%
		Avoids speech problems (closed-set)	15%
APPEARANCE		VOCABULARY	
Pictures are familiar	15%	Appropriate vocabulary	15%
Pictures are in color	5%	More difficulty than ESP	3%
Don't like NU-CHIPS pictures	3%		
HISTORY/FAMILIARITY			
Most familiar with WIPI/Habit	15%	Only closed-set test available	18%
Good results/Comparable	5%	Other reasons	8%

Variances In Test Presentations

The final question of the survey asked audiologists who used the test more than 60% of the time if he/she altered the presentation of the WIPI in any way. Seven specific examples of alternate presentations were listed as well as an open-ended response option for other alternatives. Participants could choose more than one response for this

Discussion

It is difficult to apply the results obtained in this pilot work to a more general population. The sample size in the familiarity study (N=4 at each age level) was extremely small. Additionally, the online instructions for the survey specified that the questionnaire focused on the WIPI test instead of focusing on word recognition testing for children. Because of this design flaw, audiologists may have chosen not to participate in the study.

In this study, the youngest children had difficulty recognizing specific pictures and vocabulary in the WIPI. The six- to eight-year-olds had fewer errors than the five-year-old children when identifying test pictures or vocabulary. These six- to eight-year-old children averaged 3.6 errors across the 150 WIPI words. However, the children in the five-year-old group demonstrated a high error rate, averaging 12 errors across the 150 words.

Ross and Lerman (1970) designed the WIPI test for use with a specific deaf and hard-of-hearing population. Although this current study did not include children with hearing loss, the results suggest that the pictures and vocabulary of the test may affect scores for this population to an even greater extent because of potential language delays. A deaf or hard-of-hearing child's limited opportunity for incidental learning may significantly impede his/her overall vocabulary development in comparison to peers with normal hearing thresholds. The deaf or hard-of-hearing child's language delay could become as much a factor in his/her WIPI score as his/her hearing thresholds. This concern might also be applied to other groups of children whose language or developmental delays might restrict their familiarity with the WIPI vocabulary or pictures.

One surprising outcome of the children's familiarity study was the suggestion that the test lists are not of equal difficulty. In this study six lists were presented to the children in a "semi-random" order. Of the six test lists, the least number of errors was made on list 2. Of the four original Ross and Lerman (1970) test lists, all the children committed the most errors on list 3. The two lists of foil words resulted in the highest number of errors of all the test lists.

The results of the on-line survey confirmed that the WIPI test is used in the majority of pediatric audiology practices represented by the survey participants. A number of participants reported that they varied their test presentation from the protocol outlined by Ross and Lerman (1970). Normative data are not available for children who demonstrate moderate-to-severe hearing losses but are younger or older than Ross and Lerman's five- to eight-year-old target group, children with either milder or more severe hearing

losses, or children with normal hearing thresholds. Still, survey participants indicated that they regularly used the WIPI with these populations. Although the test could be used as a within-patient measure to monitor an individual child's performance over time, without standardized norms for these groups, WIPI scores may have questionable validity when used to compare children within these populations to their peers.

The survey participants who stated a preference for other closed-set word recognition tests indicated that the old-fashioned appearance of the WIPI was a significant factor in their decision to choose another test. Participants who used the test admitted to changing test lists by omitting specific words or substituting words from other lists. Some audiologists reported in the open-ended survey questions that they did not use test items such as gun or pipe that are considered offensive in today's social climate. Other responses to these open-ended questions led to the conclusion that audiologists alter their test presentation based on their impression that a child may not know the vocabulary word or recognize the picture.

The basic premises of the WIPI are sound. The simple color drawings of the WIPI may help hold a child's interest so that a sufficient number of test items can be given. However, the results of this pilot work may provide suggestions for a revised WIPI test with new drawings and a modified vocabulary. Updated word lists could eliminate ambiguous choices, unfamiliar test items, and words that no longer fit into today's social climate. Pictures of children and adults could reflect the racial diversity now seen in our population. Six new lists could be standardized, and norms established for both normal hearing and deaf and hard-of-hearing children. Norms for hearing children five years of age and younger would allow audiologists to present the test to this population with confidence. These improvements would insure that this standard pediatric tool remains a vital part of the clinical test battery for children.

References

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Appendix A

WIPI Word Lists and Foil Lists

list 1	list 2	list 3	list 4	foil 1	foil 2
school	broom	moon	spoon	shoe	boot
ball	bowl	bell	bow	boat	belt
smoke	coat	coke	goat	comb	cone
floor	door	corn	horn	home	fork
fox	socks	box	blocks	clock	rocks
hat	flag	bag	black	match	bath
pan	fan	can	man	hand	sand
bread	red	thread	bed	sled	head
neck	desk	nest	dress	leg	egg
stair	bear	chair	pear	hair	ear
eye	pie	fly	tie	pipe	kite
knee	tea	key	bee	tree	beans
street	meat	feet	teeth	beets	leaf
wing	string	spring	ring	swing	king
mouse	clown	crown	mouth	house	cow
shirt	church	dirt	skirt	bird	dress
gun	thumb	sun	gum	duck	truck
bus	rug	cup	bug	book	nut
train	cake	snake	plane	plate	lake
arm	barn	car	star	heart	farm
chick	stick	dish	fish	fill	spill
crib	ship	bib	lip	pig	hill
wheel	seal	queen	green	sheep	screen
straw	dog	saw	frog	ball	wall
pail	nail	jail	tail	sail	mail

Appendix B

Audiologists' Survey

Dear Colleagues,

I have chosen to study the WIPI test and its current use among practicing audiologists as part of my capstone project. Would you take a few minutes to complete the following questions? Use the Forward button to send your survey to me at Just *, XXX, or underline your responses to each question. It should take no more than 10 minutes of your time. If you know others who would also be willing to complete the questionnaire, feel free to send it on to them. Please return the survey to me by March 1, 2003. Thank you for your participation in this survey.

1. What is the highest degree you have earned?
 M.S., M.A. or Ed.S.
 Ph.D. or Ed.D.
 Au.D.

2. How long have you been employed as an audiologist?
 0-5 years
 6-10 years
 11-15 years
 16-20 years
 More than 20 years

3. Which of the following best describes your current work setting?
 Private Practice
 Hospital Clinic
 Public Schools (Educational Audiologist)
 Cochlear Implant Center
 ENT Office
 University Clinic
Other _____

4. Please indicate the percent of time you spend each week with pediatric (ages 0-12 years) clients.
 0-20 percent
 21-40 percent
 41-60 percent
 61-80 percent
 81-100 percent

5. Which of the following closed-set word recognition tests for children are available for use in your practice?
 Word Intelligibility by Picture Identification (WIPI) Test
 Northwestern University Children's Perception of Speech (NU-CHIPS)
 Pediatric Speech Intelligibility Test (PSI)
 Picture Identification Test (PIT)
Other _____

6. When using a closed-set word recognition test with children, how often do you choose to present the WIPI test?
- I do not use this test in my audiology practice
 - Less than 20% of the time
 - 21-60%
 - 61-90%
 - It is the only closed-set word recognition test I use

7. Of the following tests, which one do you choose to use most often with pediatric clients?
- Word Intelligibility by Picture Identification (WIPI) Test
 - Northwestern University Children's Perception of Speech (NU-CHIPS)
 - Pediatric Speech Intelligibility Test (PSI)
 - Picture Identification Test (PIT)
 - Other _____

8. If you choose to use the WIPI test with pediatric clients less than 60% of the time, please indicate your reason(s) for choosing another closed-set word recognition test.
-

9. If the WIPI is not part of your clinical protocol for children, please stop here. Thank you for your time. If you use the WIPI test on a regular basis in your clinical practice please continue:

If you choose to use the WIPI test with pediatric clients more than 60% of the time, please indicate your reasons why.

10. Do you alter your presentation of the WIPI test in any of the following ways? (You may choose more than one response.)
- Omit specific test words
 - Substitute different test words
 - Change/alter test pictures
 - Shorten test list (give half list)
 - Present the test to children with normal hearing
 - Accept more than one picture as correct
 - Present the test to children younger/older than recommended by WIPI norms
 - Other (please specify)