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A Reliability Study of the Goldman-Fristoe-Woodcock Test of Auditory Discrimination Used with Learning Disabled Children

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A RELIABILITY STUDY OF THE GOLDMAN-FRISTOE-WOODCOCK TEST OF AUDITORY DISCRIMINATION USED WITH LEARNING DISABLED CHILDREN

by
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This thesis submitted by Bruce W. Stenhjem in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota is hereby approved by the Faculty Advisory Committee under whom the work has been done.

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(Chairman)

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Permission

Title A Reliability Study of the Goldman-Fristoe-Woodcock Test of Auditory Discrimination Used With Learning Disabled Children

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ABSTRACT

The purpose of the study was to compare scores obtained on the two subtests comprising the Goldman-Fristoe-Woodcock Test of Auditory Discrimination (GFW) to determine test-retest reliability and internal reliability of the GFW.

Twenty-three subjects between the ages of six years, six months to ten years, three months previously identified as exhibiting a learning disability (LD) were matched by age levels with twenty-three subjects identified as exhibiting normal learning abilities (NL). These two groups were administered the Quiet and Noise Subtest of the GFW followed by a retest within seven days.

Statistical analysis of the test-retest scores of the Quiet Subtest of the GFW yielded significant coefficients of .78 with the NL groups and .73 with the LD group. Coefficients of internal consistency were .41 for the initial administration of this subtest with the NL group and .39 for the retest. Performance of the LD group revealed a coefficient of .61 on the initial administration and .51 on the retest. Results of the study indicated that the Quiet Subtest of the GFW was a reliable instrument with these study groups.

Statistical analysis of the Noise Subtest yielded coefficients of .21 with the NL group and .36 with the LD group between the test-retest. A significant difference at the .05 level of confidence was indicated between mean scores for the test-retest of the NL group and

the difference between mean scores of the LD group were significant at the .01 level of confidence. Coefficients of internal consistency showed correlations of .49 with the NL group and .47 with the LD group on the initial administration of the Noise Subtest. However, the retest revealed relationships of only .05 for the NL group and .12 for the LD group. These coefficients would indicate that the Noise Subtest has no substantial internal consistency. These results as well as the low correlation between the test-retest indicate the Noise Subtest of the GFW was not a reliable instrument with these study groups.

CHAPTER I

INTRODUCTION AND REVIEW OF THE LITERATURE

It is a generally recognized phenomenon that there are children with both normal intelligence and normal hearing sensitivity who have difficulty discriminating among and interpreting auditory stimuli.

Since a child exists in a world saturated with sound, he cannot react equally to all available signals and must focus his attention on certain select stimuli. In a learning situation a child must also be able to maintain this focus and attend to the required task. In a school environment, children may be placed amid countless varieties of competing stimuli which can interfere with the attention required for learning. This interference may be even greater for children who have learning disabilities. Barr (1973) states that such children may find it difficult to:

1. localize the source of the sound
2. comprehend the meaning of environmental sounds
3. discriminate among sounds and words
4. reproduce the pitch, rhythm, and melody of music
5. distinguish and select the significant or important from other sounds, or
6. combine syllables to form words and words to make sentences.

Measurement devices that are used to assess auditory processing in children have been relatively limited. The Auditory Discrimination

Test (Wepman, 1958) is probably the best known. Proger (1970) reviewed a more recently developed instrument, the Goldman-Fristoe-Woodcock Test of Auditory Discrimination (GFW) (Goldman, Fristoe and Woodcock, 1970). The purpose of the present study was to examine the reliability of the GFW when presented to children identified as learning disabled.

The problem of defining "learning disabilities" is complex because of the many different aspects it must involve. It is not unusual for various disciplines to define a condition on the basis of its own orientation and criteria. For example, an audiologist and an educational consultant would not necessarily define deafness according to the same terms of reference. On the other hand, specified limits, criteria, and definitions are of critical consequence when viewing learning disabilities.

Kass and Myklebust (1969, p. 339) indicated:

1. Learning disability refers to one or more significant deficits in essential learning processes requiring special education techniques for remediation.
   Significant deficits are defined in terms of accepted diagnostic procedures in education and psychology.
   Essential learning processes are those currently referred to in behavioral science as involving perception, integration, and expression, either verbal or nonverbal.
   Special education techniques for remediation refers to educational planning based on the diagnostic procedures and results.

2. Children with learning disabilities generally demonstrate a discrepancy between expected and actual achievement in one or more areas, such as spoken, read, or written language, mathematics, and spatial orientation.

3. The learning disability referred to is not primarily the result of sensory, motor, intellectual, or emotional handicap, or lack of opportunity to learn.

Johnson and Myklebust (1964, p. 9) stated:

In those having a psycho-neurological learning disability, it is the fact of adequate motor ability, average to high intelligence,

> adequate hearing and vision, and adequate emotional adjustment, together with a deficiency in learning that constitutes the basis for homogeneity.

It appears that the criteria employed in psychology and special education is also best suited to differentiate those children with learning disabilities. That is, to classify on the basis of the criterion which makes for greatest homogeneity. This principle has been referred to as "classification on the basis of the major handicap" (Myklebust, 1968, p. 1).

There are recurring statements in the literature that failures of auditory discrimination underlie learning disorders (Katz and Burge, 1971; Flynn and Byrne, 1970; Zigmond and Cicci, 1968; Weiner, 1967; and Wepman, 1960). Disorders of language (Goezinger, 1972; and Witkin, 1971), or reading (Holroyd and Riess, 1968; and Flowers, 1964), and of articulation (Powers, 1971) have all been related to deficits in auditory discrimination. Kronvall and Diehl (1954) defined auditory discrimination as "a judgement calling for a distinction or comparison of sounds" (p. 335). The judgement most commonly used in tests reported in the literature has been the discrimination . . . of two different phonemes (Witkin, 1971). Witkin (1971, p. 42) states:

> A test of speech sound discrimination is the most basic diagnostic tool of the speech therapist and much remedial work centers on discrimination of various kinds . . . . Adequate auditory discrimination is essential for the acquisition of language and learning to read.

Powers (1971) stresses that speech-sound discrimination should be thoroughly tested as part of the complete diagnostic evaluation of functional articulation cases. She considered training in speech-sound discrimination important, especially in the early stages of

articulation therapy. Flynn and Byrne (1970) studied auditory abilities of a selected group of advanced and retarded third grade readers and found that significant differences existed between the two groups, with the retarded reading group having difficulty with the auditory tasks, especially auditory discrimination of speech and non-speech stimuli. Siegenthaler (1970) and Neville and Bucke (1968) found that age could be a factor in a child's auditory discrimination ability. They concluded that auditory discrimination was a skill that developed until approximately eight years of age. This is very similar to the development of speech skills. Katz (1972) cited Tarnopol who listed auditory figure-ground as one of the types of tests which should be included in a battery for learning disabled children. Speech-in-noise is one of the competing message tasks using the figure-ground paradigm. Wepman (1960, p. 332) states:

> Children should be studied as they reach school age to determine whether their auditory abilities have reached the level of maturation where they can benefit from phonic instruction in reading or from auditory training in speech. Unless this is done, we will continue to make the error of approaching all children as though they can learn equally well through the same modality. Children who are poor in discrimination will be given the same instruction as others with good discrimination, etc. The need to individualize instruction, at least to the point of grouping visual learners and auditory learners separately at the onset of reading instruction, seems an obvious way to minimize the problem.

It is anticipated that in a typical group of school age children, one to three percent will have hearing problems (Eagles et al., 1963). In one group of learning disability children between the ages of six and fourteen years, 33 percent had hearing problems (Katz and Illmer, 1972). While these children had essentially normal word discrimination ability for PBK or W-22 words, about 60 percent had more

difficulty in the processing of auditory stimuli consisting of a competing message task. The speech-in-noise tests have obvious application to the classroom situation. A child who is unable to handle competing messages despite his normal hearing and normal word discrimination in a quiet environment is essentially functioning as a hearing disabled child in a noisy classroom. Haring and Ridgeway (1967) found teacher's judgement to be useful in identifying children with learning disabilities but it is difficult to state prior to the evaluation in which areas these problems exist.

Numerous testing procedures have been designed to assess auditory skills in clinical and educational diagnosis. A variety of methods for training children in the auditory abilities considered fundamental to establishing new speech behaviors or learning academic skills have also emerged (Katz and Medol, 1972; and Mueller and Niedzielski, 1968).

Tests of auditory discrimination like those developed by Templin (1957) and Wepman (1958) may be useful in determining whether a child can distinguish similarities or differences between syllables or words in an ideal listening environment. However, these tests do not identify children whose primary disability is between perceiving sounds within words in the presence of a competing signal, such as environmental noise (Johnson and Myklebust, 1964). The latter task involves a higher degree of auditory processing skills.

Dimensions of Auditory Signals

The physical dimensions of auditory signals can be expressed as the product of frequency, intensity, and temporal factors. Ordinarily

pure tone audiometry holds frequency constant while studying intensity thresholds and is, therefore, a study of frequency and intensity interactions. However, patients with unilateral lesions of the temporal lobe generally show normal or near normal pure tone audiograms. Therefore, it is necessary to look at tests which assess the complex integrative functions of the auditory nervous system in ways that yield positive results that can be meaningfully interpreted. Berlin and Lowe (1972, p. 281) stated that "with a few exceptions, tests that use only pure tones . . . rarely reveal the effects of central damage."

Bocca and Calearo (1963, p. 344) defined a central auditory nervous system (CANS) disorder as a defect in the "process of formal integration which takes place in the relays situated at different stages along the auditory pathway, and does not . . . concern the process of symbolization or memorization." Katz (1968) defined "central disorders" as an "impairment of the cerebral cortex and subcortical areas, probably down to the level of the midbrain" (p. 139). This was differentiated from "peripheral" auditory disorders which are defined as an impairment in the "auditory system from the outer ear to the VIIIth cranial nerve, terminating at the cochlear nuclei" (p. 141). He also stated that "since we consider 'central' to involve only the brain, the brain stem is left as a transition area from the peripheral to central systems" (p. 141).

Tests for Assessing CANS Disorders

The development of tests to assess CANS disorders were first described by Bocca, Calearo and Cassinari (1954). In the intervening years since Bocca et al. focused emphasis upon central auditory

disorders, a number of tests have been developed to differentiate lesions at the various levels of the central auditory system.

Brunt (1972) stated that speech audiometry appeared to be the most useful approach in the evaluation of the CANS. Katz (1968) recognized four varieties of central speech tests which are now in use. Distorted speech materials delivered in a monaural mode were the first central speech tests to be employed. The distortion is accomplished by acoustic filtering, low fidelity or other similar means. A second technique is time distortion. Speech which is increased or decreased in rate falls into this category. The third major category is that of supplementary messages, or integration. These methods usually require the listener to combine binaural sources of information in order to obtain an accurate response. A fourth approach is the competing message technique. These methods are usually binaural. Independent signals are presented in an overlapping fashion. One or both of the messages may be required of the listener.

An auditory discrimination test which included a subtest utilizing the competing message technique is the Goldman-Fristoe-Woodcock Test of Auditory Discrimination (GFW). It is an instrument designed to provide measures of speech-sound discrimination ability, relatively unconfounded by such factors as the subject's vocabulary development, his familiarity with the test materials, the memory tasks involved, or the variations of individual examiners in test administration. It provides a measure of auditory discrimination under ideal listening conditions plus a comparative measure of auditory discrimination in the presence of controlled background noise. The

test is comprised of three parts. The first is the Training Procedure, which enables the subject to become familiar with the word-picture associations to be used during the two subtests. The second part is the Quiet Subtest, which provides a measure of auditory discrimination in the absence of background noise. The third is the Noise Subtest, which provides a measure of auditory discrimination in the presence of distracting background noise. Normative data is available on an age range of three years, eight months to eighty-four years. The GFW was standardized on subjects in the general population without regard to the presence or absence of auditory discrimination problems. The administration time is approximately fifteen minutes.

Finkenbinder (1973) studied the GFW and its relationship to selected reading variables when administered to normal children in grades K-3. He concluded the group performance of the children on both subtests of the GFW were too variable to place confidence in the test's relation to the reading variables selected for study. Schmidt (1973) compared the responses of adults on the Noise Subtest of the GFW and the Staggered Spondaic Word Test (SSW). She concluded that the Noise Subtest was not a reliable measure of central auditory function with the adult subjects in her study.

Since these studies of normal subjects calls into question the reliability of all or part of the GFW, it becomes of interest to investigate this characteristic of the test when administered to learning disabled children with whom it is often used. The present study was designed to answer the following questions:

1. What relationship exists between the scores obtained on the initial administration and the retest of the Quiet Subtest of the

Goldman-Fristoe-Woodcock Test of Auditory Discrimination when administered to children identified as learning disabled?

2. What relationship exists between the scores obtained on the initial administration and the retest of the Quiet Subtest of the Goldman-Fristoe-Woodcock Test of Auditory Discrimination when administered to children identified as having normal learning abilities?

3. What relationship exists between the scores obtained on the initial administration and the retest of the Noise Subtest of the Goldman-Fristoe-Woodcock Test of Auditory Discrimination when administered to children identified as learning disabled?

4. What relationship exists between the scores obtained on the initial administration and the retest of the Noise Subtest of the Goldman-Fristoe-Woodcock Test of Auditory Discrimination when administered to children identified as having normal learning abilities?

CHAPTER II

PROCEDURE

Subjects

Forty-six students from eleven Grand Forks elementary schools were selected for this study. They ranged in age from six years, six months to ten years, three months with a mean age of nine years, one month. Twenty-three of these students exhibited a maturational lag or developmental pattern that had resulted in their enrollment in a special program in addition to their regular classwork. These children served as the learning disability (LD) group for the present study. This group of children were homogeneous in the sense that they had emotional, motor, sensory, and intellectual integrity together with a deficiency in learning. Satisfaction of these requirements were established through information derived from their cumulative school records, teacher observations and reports, and selected diagnostic evaluations. The LD subjects met the following criteria:

1. Emotional adjustment was determined on the basis of clinical judgements. Unless aggressive, acting-out behavior or undue preoccupation and withdrawal together with evidence of poor adjustment in school, in the home, or in other social groups were present, it was assumed that the child had no significant emotional problem.

2. Motor abilities were also considered through clinical observation and judgements. The criterion followed was that the

psychomotor involvements commonly associated with deficiencies in learning were included within the category of adequate integrity of motor function, whereas those that were obviously crippling in nature were not.

3. The sensory capacities of visual and auditory abilities were determined by objective criteria. The criteria for adequate auditory performance for the purpose of this study was that all subjects were required to pass a pure tone screening test throughout the speech frequencies of 500 to 2000 Hz at an intensity level of 15dB ANSI. Vision was considered adequate if the cumulative school records showed that the child had been administered a visual acuity test within the last twelve months and that no impairment, or none greater than 20/40 in the eye with less acuity, existed.

4. Because of a school policy regarding intelligence testing of children in this age group, it was necessary to rely on the teacher's perceptions of a child's intelligence based on the child's overall performance in school. For the purpose of this study, their judgements of normal or above normal intelligence were accepted as a basis for inclusion in the study. Keogh, Tchir and Windegath-Behn (1974) supported the use of classroom teachers to screen educationally high-risk children.

The Illinois Test of Psycholinguistic Abilities (ITPA) (Kirk, McCarthy, and Kirk, 1968) was also administered to those subjects identified as learning disabled. The results of this test were used to identify those subjects which could be considered to exhibit primarily auditory or visual processing difficulties.

The control group consisted of twenty-three children considered by school personnel as having normal learning abilities. This group met the same criteria as the LD group with the exception that they exhibited normal learning ability. They were matched to the subjects in the experimental group by chronological age.

Equipment

Ambient noise levels were recorded using a recently calibrated Bruel and Kjaer precision sound level meter. A recently calibrated Telex portable audiometer, Model 88, was used for all audiometric screening tests. A Roberts stereophonic tape deck, Model 770X, provided the input for the Goldman-Fristoe-Woodcock Test of Auditory Discrimination. The output from the tape deck was presented through Arion high fidelity earphones with circum-aural cushions.

Description of the ITPA

The Illinois Test of Psycholinguistic Abilities (ITPA) consists of ten discrete subtests and two supplementary subtests standardized on approximately one thousand children between the ages of two and ten years. Six of the subtests measure aspects of the Representational level of language and include tests of reception, association, and expression. The remaining subtests are located on the Automatic level of language. Two of these latter subtests measure sequential memory and the other four are designed to assess closure or the ability to complete or recognize an incomplete stimulus event. The stated purpose of the ITPA is to provide an instrument that will aid in diagnosis by identifying specific areas of learning difficulty (Kirk, McCarthy, and

Kirk, 1968). In the design of the test, the authors consider mental functioning in three ways: (1) levels of organization, (2) channels of communication, and (3) psycholinguistic processes. The ITPA yields an age score and a scaled score (SS) for each of the twelve areas tested so that the diagnostician has a profile of each child's abilities and disabilities.

General Procedures

Each subject was evaluated on the basis of three measurements: (1) a pure tone screening test, (2) the Quiet Subtest of the Goldman-Fristoe-Woodcock Test of Auditory Discrimination (GFW), and (3) the Noise Subtest of the GFW. In addition, the LD group was administered the Illinois Test of Psycholinguistic Abilities (ITPA).

Initially, the audiometric pure tone screening test was presented to each LD subject. The subject was then administered the ITPA. This procedure was maintained with all subjects previously identified through the school records as exhibiting a learning disability. Within one month subsequent to the administration of the ITPA, the remaining two tests were administered. The Quiet Subtest of the GFW was administered first, followed by the Noise Subtest of the GFW. Periodic measurements of the ambient noise levels were recorded during the administration of the GFW.

For those subjects identified as exhibiting normal learning abilities, the pure tone screening test was administered first, followed by the Quiet Subtest of the GFW and the Noise Subtest of the GFW. Again, measurements of ambient noise levels were recorded at periodic intervals.

Standardized instructions were given to all subjects prior to the administration of individual tests. The GFW was presented again to each subject seven days following the initial administration of this test.

Specific Procedures

A room relatively free from noise and distraction was used for all testing conducted in the school environment. A sound level meter was used to monitor ambient noise levels at fifteen minute intervals. These levels were recorded and ranged from 35dB to 44dB SPL on the A scale. An audiometric pure tone screening test was administered to each subject at an intensity of 15dB ANSI at 500, 1000, and 2000 Hz, bilaterally. The order of presentation was 1000, 2000, and 500 Hz beginning with the right ear. Subjects were included in the study if the hearing screening was passed at all frequencies.

The 1968 Revised Edition of the Illinois Test of Psycholinguistic Abilities (ITPA) was administered to each subject that had previously been identified as learning disabled (LD). Standardized instructions and procedures were followed throughout the administration of this test. It was of particular interest to this study to identify those subjects exhibiting a difficulty in the auditory-vocal or visual-motor channel of communication. A deviation of -10 or more scaled score points from the individual's mean scaled score in either, but not both, of these channels of communication was considered to be significant (Kirk, McCarthy, and Kirk, 1968). If fewer than five subjects were identified as exhibiting a specific disability in either channel of communication

it was concluded that statistical comparisons between subjects grouped on this basis would not be appropriate and they would be excluded from the study.

The pre-recorded Goldman-Fristoe-Woodcock Test of Auditory Discrimination (GFW) was presented to each subject at 70dB SPL. The test tape provided a 1000 Hz tone as a means of a calibration check. The test was comprised of three parts: (1) the training procedure, (2) the Quiet Subtest, and (3) the Noise Subtest.

The first phase of the GFW involved acquainting the subject with the pictures to be used during the test and teaching the names to be associated with each picture. Sixteen training plates with four pictures each were provided. The format of the training plates was exactly the same as for the test plates except the names of the pictures on the training plates were not similar in sound. The training procedure was completed when the subject could correctly identify the four pictures on each of the training plates or had made at least three attempts to match pictures and words correctly. If the subject did not learn all of the word-picture associations, those test words were recorded for later reference.

Upon completion of the training procedure, the testing procedure was begun. Standardized test instructions were provided on the tape. The Quiet Subtest consisted of thirty test plates. Each subject was required to listen to the stimuli and respond by pointing to the picture corresponding to the stimuli. The four words represented on each test plate differed from each other only in a single phoneme.

After the thirty plates in the Quiet Subtest had been presented, the subjects were given the pre-recorded standardized instructions for the Noise Subtest which also consisted of thirty plates. The stimuli were presented in the same format as the Quiet Subtest with the exception of added background noise introduced at a signal-to-noise ratio of plus 9dB. The background noise was obtained by recording environmental noise in a busy school cafeteria. Total number of errors were recorded and translated into percentile scores according to the GFW norms.

The GFW was again administered to each subject seven days following the initial administration. Identical test conditions and procedures were utilized for the retest.

CHAPTER III

RESULTS AND DISCUSSION

Introduction

Each learning disabled child was initially administered the Illinois Test of Psycholinguistic Abilities (ITPA) for determination of the existence of a specific disability. The relationship between the resulting subgroups and the experimental tasks are discussed in this chapter. Analysis of the experimental data was based on raw scores obtained on the initial administration of the two subtests of the Goldman-Fristoe-Woodcock Test of Auditory Discrimination (GFW) with both normal and learning disabled children and the retest of the GFW administered seven days after the initial administration.

Results

The administration of the Illinois Test of Psycholinguistic Abilities (ITPA) to the twenty-four children previously identified as exhibiting a specific learning disability by their teachers resulted in the establishment of four subgroups of learning disabled children: (1) eight children were identified as having a primary learning disability in the auditory-vocal channel of communication by both teacher judgement and a significant discrepancy (as defined in the procedures) on the ITPA, (2) five children were identified as having a primary learning disability in the auditory-vocal channel of

communication as determined by a significant discrepancy on the ITPA only, (3) ten children revealed no significant specific learning disability on the ITPA in spite of their teacher's judgements, and (4) one child was considered to have a primary learning disability in the visual-motor channel of communication as determined by a significant discrepancy in this area on the ITPA. This child failed to meet the procedural criteria of this study establishing a minimum of five subjects in a group for appropriate statistical analysis and was eliminated from the study.

Using the one-way analysis of variance of mean scores of the Goldman-Fristoe-Woodcock Test of Auditory Discrimination (GFW), it was found that there were no significant differences between the three remaining groups. The mean scores were derived from the number of error responses on each subtest (each subtest consisting of thirty items). These results are listed in Table 1. Because of this finding it was concluded that for the purpose of this study the three subgroups of learning disabled children could be treated as one group (LD).

TABLE 1

ONE-WAY ANALYSIS OF VARIANCE: LD GROUP (N=23)

	Group I (n=8)		Group II (n=5)		Group III (n=10)		
	M	SD	M	SD	M	SD	F
Quiet (initial test)	1.25	1.75	1.40	1.95	.50	.97	.83
(retest)	1.00	1.60	.60	.55	.30	.67	.93
Noise (initial test)	7.38	3.34	9.60	2.07	8.20	2.74	.94
(retest)	5.63	2.13	6.60	2.51	5.00	1.05	1.28

F significant at the .05 level with 2,20 d.f. = 3.49

The means and standard deviations of the two subtests of the GFW, which compare performance over a one-week time interval for the two groups of children, are listed in Table 2.

TABLE 2

MEANS AND STANDARD DEVIATIONS OF THE TWO GFW SUBTESTS OVER A ONE-WEEK INTERVAL

Test	Group	Quiet Subtest M	Quiet Subtest SD	Noise Subtest M	Noise Subtest SD
Initial Testing	NL	.13	.46	7.17	2.76
Retest	NL	.13	.46	5.83	1.88
Initial Testing	LD	.96	1.49	8.22	2.84
Retest	LD	.61	1.08	5.57	1.85

In three out of four instances, fewer errors were noted on the retest than on the initial testing with the GFW. This downward progression in mean scores was more evident with the LD group. The GFW manual suggests that this test is a device to measure the strengths rather than weaknesses in auditory discrimination and the results of the Quiet Subtest appear to substantiate this conclusion as few errors were made in either group on this subtest.

The significance of the general progression in mean scores for the Quiet and Noise Subtests was assessed by using the t-test for dependent measures. This information is presented in Table 3.

A significant improvement in the Noise Subtest scores were noted for both groups on the test-retest mean scores. The analysis of the difference between the means of the NL group yielded a t-value of 2.14 which was significant at the .05 level. The difference between

the means of the LD group yielded a t-value of 4.58 which was significant at the .01 level. No significant differences were noted between the means of the Quiet Subtest.

TABLE 3

MEANS, STANDARD DEVIATIONS, AND t-VALUE OF THE TEST-RETEST OF THE GFW

Subtest of GFW	Group-NL M	SD	t-value	Group-LD M	SD	t-value
Quiet (initial test)	.13	.45		.96	1.46	
(retest)	.13	.45	0.0	.61	1.05	1.65
Noise (initial test)	7.17	2.70		8.22	2.78	
(retest)	5.83	1.84	2.14[a]	5.57	1.81	4.58[b]

[a] t with 22 d.f. at .05 level = 1.72
[b] t with 22 d.f. at .01 level = 2.51

The t-test for independent measures was used for the analysis of the difference of mean scores between the two groups of subjects on the Quiet and Noise Subtest of the GFW. Table 4 reports these values and their significance.

The statistical analysis of the difference between the means of the NL group and the LD group yielded a t-value of 2.54 on the initial administration of the Quiet Subtest. This was significant at the .01 level. A t-value of 1.96 for the retest was significant at the .05 level. These results indicate that on both the initial test and the retest the LD group had a significantly greater number of errors than the NL group on the Quiet Subtest. No significant differences were found between the two groups for either the initial or retest of the Noise Subtest.

TABLE 4

MEANS, STANDARD DEVIATIONS, AND
t-VALUES OF GROUP VARIANCE

Subtest of GFW	Group-NL M	Group-NL SD	Group-LD M	Group-LD SD	t-Value
Quiet (initial test)	.13	.45	.96	1.46	2.54[b]
(retest)	.13	.45	.61	1.05	1.96[a]
Noise (initial test)	7.17	2.70	8.22	2.78	1.26
(retest)	5.83	1.84	5.57	1.81	0.47

[a] t with 44 d.f. at .05 level = 1.68
[b] t with 44 d.f. at .01 level = 2.42

Table 5 reports the correlation coefficients between the initial administration and the retest of the GFW. The results for the Quiet Subtest show a high, significant correlation for both groups with the NL group having a correlation of .78 and the LD group a correlation of .73 and were significant beyond the .01 level. The Noise Subtest results indicated low, nonsignificant correlations for both the LD group and the NL group. This data suggests that the test-retest reliability over a one-week time interval for the Quiet Subtest is significant. In contrast, the Noise Subtest intercorrelations are low which indicates that subjects are too inconsistent in their test-retest performance for this subtest to be useful as a measure of auditory discrimination.

Item analysis produced internal consistency coefficients for each subtest, both groups and for the total group. These are listed in Table 6. Coefficients Alpha for the NL group on the Quiet Subtest were .41 for the initial administration and .39 for the retest. These are considered as low-moderate consistency coefficients. Performance

of the LD group on this subtest revealed a coefficient of .61 on the initial administration and .51 on the retest. These correlations would indicate moderate consistency with this group.

TABLE 5

TEST-RETEST INTERCORRELATIONS OF THE TWO GFW SUBTESTS OVER A ONE-WEEK INTERVAL

Group	Quiet	Noise
NL	.78[a]	.21
LD	.73[a]	.36

[a]significant at the .01 level with 22 degrees of freedom

TABLE 6

INTERNAL CONSISTENCY COEFFICIENTS

	Quiet (initial)	Quiet (retest)	Noise (initial)	Noise (retest)
NL	.41	.39	.49	.05
LD	.61	.51	.47	.12
Group (total)	.64	.52	.49	.07

Indications are that the coefficients are affected by the group's performance. Few errors were made on the Quiet Subtest, as the range of error scores were from zero to five. One of the assumptions underlying internal consistency coefficients is that they are greater when the variance of items is greatest. The group results as a whole revealed moderate internal consistency for this subtest.

Both groups revealed moderate consistency coefficients on the initial Noise Subtest with the NL group having a coefficient Alpha of .49 and group LD of .47. However, the retest revealed almost negligible relationships of .05 for the NL group and .12 for the LD group. These coefficients would indicate that the Noise Subtest has no substantial internal consistency.

Discussion

The most obvious difference between the Quiet Subtest and the Noise Subtest of the GFW is the factor of complex cafeteria noise introduced at a signal-to-noise ratio of plus 9dB on the Noise Subtest. Although other factors such as stimulus order, test order, fatigue, etc. may have had some effect on test results, the lower performance of subjects on the Noise Subtest can most logically be accounted for by the noise incorporated in this subtest. Although the noise is different, and more intense than that found in a normal classroom, it is an environmental noise and would have permitted some generalization if this subtest had been a reliable measure. However, the combination of this type of noise and the signal-to-noise ratio at which it is presented evidently constitutes a discrimination task that results in decisions based on factors other than the critical difference between the phonemes of the stimulus words in the Noise Subtest of the GFW.

The results of internal consistency analysis of the Noise Subtest revealed a moderate coefficient Alpha for group performance which was in agreement with the results of Finkenbinder (1973) and Schmidt (1973) who reported coefficients of .38 and .48, respectively. The significant differences between the means and the low correlation

coefficients on the test-retest also substantiates the data reported by the previously mentioned studies regarding the Noise Subtest. These three studies all indicating low reliability of the Noise Subtest of the GFW raise questions as to its usefulness as a diagnostic instrument to identify discrimination problems and its appropriateness for determining a central auditory dysfunction is also doubtful.

CHAPTER IV

SUMMARY AND CONCLUSIONS

Twenty-three subjects ranging in age from six years, six months to ten years, three months with a mean age of nine years, one month identified by their teachers as exhibiting a learning disability (LD) were administered the Illinois Test of Psycholinguistic Abilities (ITPA). For the purpose of this study, they were treated as one group on the basis of an analysis of their later performance on the Goldman-Fristoe-Woodcock Test of Auditory Discrimination (GFW). These subjects were matched by age level with twenty-three children identified by their teachers as exhibiting normal learning abilities (NL). The Quiet and Noise Subtests of the GFW were administered to these two groups of children followed by a retest seven days following the initial test procedure.

An analysis of test-retest results of the Quiet Subtest of the GFW revealed significant reliability coefficients of .78 with the NL group and .73 with the LD group. When the performance between groups was compared, the LD group made significantly more errors than the NL group on the initial administration and a lesser, but still significant, difference on the retest. Moderate internal consistency between individual items and total GFW scores for the Quiet Subtest was indicated.

On the Noise Subtest, a low, nonsignificant correlation of .21 for the NL group and .36 for the LD group was found to exist between the test-retest. Significant differences were noted between the scores of the initial administration and the retest with the NL group and moderate, significant differences between the test-retest scores of the LD group. Results of statistical item analysis of internal consistency for the groups yielded moderate, significant correlations on the initial testing and an extremely low correlation on the retest.

Conclusions

The results of this study indicate the Quiet Subtest of the Goldman-Fristoe-Woodcock Test of Auditory Discrimination is a reliable instrument. However, the results also indicated the Noise Subtest of the GFW is not reliable. Therefore, the use of the Noise Subtest of the GFW as a measure of central auditory function and a predictor of auditory discrimination problems is questionable.

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