AN INVESTIGATION OF ILLINOIS TEST OF PSYCHOLINGUISTIC ABILITIES PROFILES OF CHILDREN WITH MINIMAL CEREBRAL DYSFUNCTION AND CHILDREN WITH OMISSION TYPE MISARTICULATIONS

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Bachelor of Science

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Stillwater, Oklahoma

1969

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
MASTER OF ARTS
May, 1970

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ACKNOWLEDGEMENTS

I would like to express my appreciation to those who contributed to the completion of this study. Special thanks is extended to Mr. David K. Williams who directed this investigation. His helpful comments and encouragement are greatly appreciated. Appreciation is extended to Dr. Burchard Carr, Dr. Joseph Carrier, and Dr. Fred Tewell who served as the advisory committee. Special appreciation is extended to Dr. Burchard Carr and Dr. Joseph Carrier for their helpful comments and criticisms. I would like to thank Mrs. Dobson for reading the study and adding her comments.

Appreciation is extended to the superintendents, principals, and speech therapists of Crescent, Oklahoma City, Perkins, Ponca City, Ripley, and Stillwater for their cooperation in the completion of this study. Dr. J. Leroy Folks and Mr. Richard Brown of the Mathematical and Statistics Department deserve recognition for their time and assistance in the statistical analysis of the data.

I would like to thank my husband, Michael, for his patience and understanding throughout the completion of this study.

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CHAPTER I

THE PROBLEM

During the past several years, research has investigated children who exhibit learning disorders. This syndrome has been labeled minimal brain damage, minimal cerebral dysfunction, "Strauss" syndrome, psycho-neurological disorder, perceptual handicap, learning disability, and many others (Kirk, 1966). Researchers have attempted to discover the etiological basis for this disorder and to discover appropriate remedial measures.

In addition, some research has concerned children who exhibit an "omission syndrome;" that is, children who have severe articulation disorders consisting of nine or more omissions of consonant phonemes in medial and final positions (Silverstein, 1967). From this research has come evidence that these children exhibit short auditory memory spans, short attention spans, are hyperactive, distractible, and have case histories that reveal the possibility of brain damage.

> Because the symptomatology found in so many of these cases suggested brain damage, and since this differential diagnosis was frequently supported by case history information, the constellation of symptoms described in this paper has been variously referred to by the author as a "neurological syndrome" or as an "aphasoid type articulation disorder," but perhaps can best be understood as an articulation learning disability resulting from mild cerebral dysfunction (Silverstein, 1967, p. 4).

Aten and Davis (1968) found that children with minimal cerebral dysfunction were disturbed in perception, storage and reproduction of

sequential stimuli. One of the subtests of the Illinois Test of Psycholinguistic Abilities is constructed to test auditory memory. If children with minimal cerebral dysfunction and children who omit consonant phonemes exhibit short auditory memory spans, the ITPA profiles of these groups may reveal disabilities in the auditory memory skills. Also, the Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy, and Kirk, 1968) has been used as a diagnostic/teaching model for children with learning disabilities. In view of this, it should be an appropriate tool for use in investigating the possible existence of learning disabilities among children exhibiting the "omission syndrome." If such a relationship does exist, it may be possible to treat some of the problems of children who omit consonant phonemes in the same fashion as children with learning disabilities.

Thus, the following questions were considered:

1. Is there a difference between the Illinois Test of Psycholinguistic Abilities profiles of the children who omitted consonant phonemes and the children with minimal cerebral dysfunction?
2. Is there a difference between the Illinois Test of Psycholinguistic Abilities profiles of children who omitted consonant phonemes and children who substituted and/or distorted consonant phonemes?
3. Is there a difference between the Illinois Test of Psycholinguistic Abilities profiles of children who substituted and/or distorted consonant phonemes and children with minimal cerebral dysfunction?

4. Is there a difference between the Illinois Test of Psycholinguistic Abilities profiles of children who omitted consonant phonemes and normal-speaking children?
5. Is there a difference between the Illinois Test of Psycholinguistic Abilities profiles of children who substituted and/or distorted consonant phonemes and normal-speaking children?
6. Is there a difference between the Illinois Test of Psycholinguistic Abilities profiles of children with minimal cerebral dysfunction and normal-speaking children?

CHAPTER II

REVIEW OF THE LITERATURE

This chapter includes a selected review of the previous research concerning: (1) the omission articulation syndrome; (2) children with minimal cerebral dysfunction; and (3) the Illinois Test of Psycholinguistic Abilities.

The Omission Articulation Syndrome

Articulation is defined by Margaret Powers as "the production of speech sounds by stopping or constricting of the vocalized or non-vocalized breath stream by movements of the lips, tongue, velum, or pharynx" (Powers, 1957, p. 707).

Irwin (1951) found in infant vocalizations that the frequency of occurrence of initial, medial, and final consonants ranged from greatest to least respectively. Metreaux (1950) found that 90 percent of vowels are produced correctly by 30 months and 90 percent of consonants are produced correctly by 54 months.

In view of this information concerning normal development of sounds, we may consider that an articulation disorder occurs when a child misarticulates sounds that should be developed by his chronological age. Margaret Powers defines an articulation disorder as:

> faulty placement, timing, directing, pressure, speed, or integration of these movements, resulting in absent or incorrect speech sounds (Powers, 1957, p. 707).

Powers (1957) divides articulation disorders into omissions, substitutions, distortions, and additions. Templin (1957) in conducting a study of 480 subjects of all ages found that substitutions occurred most frequently, followed by "defectives," and that omissions occurred least frequently.

An omission is characterized by leaving out phonemes where they should occur. Snow (1963) in testing 438 first graders found that /r/ and /l/ are omitted more frequently than other phonemes. Consonant sounds are more frequently omitted in medial and final positions and initially when they appear in blends (Powers, 1957). Templin (1957) found that while omissions increase from initial to medial to final position, substitutions decrease from initial to medial to final.

Many researchers in speech pathology have recently begun to categorize articulation disorders in ways other than mild, moderate, or severe. Prins (1962a) studied ninety-two children with defective articulation for the purpose of dividing them into appropriate subgroups. The Ammons Full Range Vocabulary Test and an articulation test were administered. The articulation test consisted of forty-two picture items which stimulated spontaneous responses from the subjects. In addition to this, the Minnesota Scale for Paternal Occupations was administered for determination of socioeconomic status. He found that four subgroups existed:

> Group I, variables correlated with the interdental lisp,
> Group II, variables correlated with the omission error,
> Group III, variables correlated with the phonemic sound substitutions, in which one articulatory feature is altered,
> Group IV, variables identified by non-phonemic distortions in which all articulatory features are altered, either individual or in combination (Prins, 1962a, p. 157).

Individuals in Group II seemed to have different types of problems concerning the accuracy of speech sound production. The children who produced omission errors seemed oblivious to the types of substitutions they made. In this group, there was a predominance of glottal stop substitutions. Prins speculated that the cause might have occurred prior to the development of any "appreciable articulation specificity" (Prins, 1962a, p. 158).

Prins (1962b) conducted another study using the same subjects for the purpose of investigating differences among the sub-groups in non-speech variables such as motor and auditory abilities. He found that children who had omission type misarticulations exhibited depressed performance in selected motor skills and digit span. These subjects were found to be depressed in socioeconomic status and intelligence as measured by receptive vocabulary. No such differences were found between the other sub-groups.

Smith (1967) conducted a study of twelve children with non-organic articulation problems and twelve normal children for the purpose of comparing the performance regarding short term storage of auditory and visual stimulation. The experimental group recalled significantly fewer digits both in immediate and delayed recall for single, sequential, and simultaneous digit sets. This provides evidence that the children with articulation problems tend to have shorter auditory memory spans than those not demonstrating articulation difficulties.

Silverstein (1967) found that children evidencing omission type misarticulations tended to have short auditory memory spans as revealed by a digit span test. He stated that in this population it is common to find all medial and final consonant sounds omitted and the initial

semi-vowel sounds occasionally omitted. Very few sounds are found to be articulated correctly, and these are sounds found early in the normal developmental sequence. The clinical syndrome he describes was identified in 577 cases over a thirteen year period. The criterion for diagnosis as an omission type articulation disorder was that the child exhibited nine or more omissions.

> Presumptive evidence of brain damage was found in case histories of 255 of the 577 cases studied. . . . The incidence of presumptive evidence of brain damage in 44 percent of the case histories is in all probability a low estimate of the actual occurrence in view of the difficulty to elicit this kind of information and since it is frequently unknown to the informant (Silverstein, 1967, p. 3).

This evidence in addition to behavioral symptoms such as short attention span, hyperactivity, and short auditory memory span led Silverstein to hypothesize that this articulation syndrome is the result of minimal cerebral dysfunction.

Blaunstein (1967) conducted a study with twenty children; Group A consisted of children evidencing omission type misarticulations and Group B consisted of children evidencing substitutions and distortions. The purpose of the study was to see if any differences existed between the two groups on a neurological examination, electroencephalogram, and a case history questionnaire. No observable difference was found between the groups as evidenced by the neurological examination. However, she concluded that the examination

> yielded information about gross changes of sensation, motor activity, reflexes, or of the cranial nerves, rather than minimal dysfunctions of the central nervous system (Blaunstein, 1967, p. 57).

In Group A, 37.5 percent of the children had abnormal EEG's, while no abnormal EEG's were revealed in Group B. The children with omissions evidenced more than the expected number of abnormal EEG's (Blaunstein, 1967).

A significant difference in the amount of presumptive evidence of brain injury from the case history was found. Group A revealed thirty-six factors suggestive of brain injury, while Group B only revealed twenty-one factors. From this it was concluded by Blaunstein that there is a relationship between the omission syndrome and minimal cerebral dysfunction evidenced by the electroencephalographic tracings and case history information. There is a weaker relationship between substitutions and distortions and minimal cerebral dysfunction as evidenced by these measures. Both groups were revealed to have low auditory memory spans. These conclusions must be viewed within the limitations of the study, suggested by Blaunstein, which include a small population, and questionable reliability of both case history interview and diagnostic information from a neurological examination (Blaunstein, 1967).

Scott (1967) conducted an investigation of twenty-six subjects for the purpose of finding if the incidence of reading retardation was greater in children who exhibited omission type misarticulations or children who exhibited substitutions and distortions. A test of reading readiness was administered to both groups. It was found that there was a greater incidence of reading retardation in the subjects who omitted consonant phonemes than in the subjects who substituted and distorted consonant phonemes. A positive correlation was found between auditory memory span test and reading readiness test in both groups. However, there was no difference found between the two groups on the auditory memory test.

Minimal Cerebral Dysfunction

The term minimal cerebral dysfunction is one of the many terms derived for the child who exhibits a learning disability which refers to a specific disorder in one or more of the processes of speech, language, perception, reading, spelling, or arithmetic (Kirk, 1966). Learning disability implies certain assets in addition to specific disabilities or wide discrepancies between abilities (Kirk, 1966).

Some of the terms which have been applied to this syndrome are brain injury, brain damage, minimal cerebral dysfunction, neurophysiological dysynchrony, organic disorder, central nervous system disorder, "Strauss" syndrome, and psychoneurological disorder. These terms imply etiology. Other terms have been devised for this disorder which indicate behavioral characteristics. Some of these terms are perceptual handicap, conceptual disorders, reading disability (dyslexia), catastrophic behavior, hyperkinetic disorder, developmental imbalance, learning disability, and others (Kirk, 1966).

Schiller (1969) defines children with minimal brain dysfunction or learning disability as:

> children of near average, average or above average intelligence with certain learning or behavioral difficulties ranging from mild to severe, which are associated with deviations of function of the Central Nervous System. These deviations may manifest themselves by various combinations of impairment in perception, conceptualization, language, memory and control of attention, impulse or motor function (Schiller, 1969, p. 509).

Strauss (1951) states that the basic deviations in the mental make-up of the brain-injured child are disturbances in perception, disturbances in concept formation (thinking and reasoning), disturbances

in language, and disturbances in emotional behavior. He contends that education should focus on these four deviations.

Strauss (1951) noted that brain-injured children who have perceptual difficulties are distracted by the parts of a background which impede the perception of the scene as a whole. The brain-injured child may perceive the same thing differently than the normal child. This may interfere with concept formation, language, and emotional behavior.

Other perceptual-motor deficits of the child with minimal cerebral dysfunction are deficits in printing, writing, drawing, and poor and erratic performance in copying geometric figures (Clements, 1962). In addition to the perceptual motor deficits, this child may show specific learning deficits in reading, spelling, arithmetic, and general coordination. He may have hyperkinesis or constant motion, impulsivity, emotional lability, short attention span and/or distractibility, "equivocal" neurological signs such as transient strabismus, mixed and confused laterality or speech defect, and abnormal or borderline abnormal EEG (Clements, 1962). Some of these same behavioral signs have been evidenced in children with omission type misarticulations as mentioned previously. Clements (1962) speculated that the problem these children evidence may be a "deficiency in inhibitory functions having to do with checking and suspending verbal or motor activity until incoming sensory data are compared with stored information" (Clements, 1962, p. 188).

Clements (1962) suggests that a minimal psychological battery of tests be given to these children, including Wechsler Intelligence Scale for Children, Bender Visual Motor Gestalt, Gray's or Gate's Reading Test. As support for administering the Illinois Test of Psycholinguistic Abilities as part of this battery, Benton states:

> There is no priori reason why linguistic behavior, reasoning, or such more or less general characteristics as behavioral flexibility [in terms of the capacity to respond appropriately to disparate stimuli] should not be as sensitive indicators of behavioral impairment consequent to brain damage as visumotor tasks (Benton, 1962, p. 207).

Schiller (1969) lends support to use of the ITPA. He suggests Osgood's Model of Communication as a starting point for planning a remediation program for children with minimal cerebral dysfunction. Osgood's Model is the model on which the ITPA is based.

Aten and Davis (1968) conducted a study using twenty-one children with minimal cerebral dysfunction and learning disabilities. The neurologically impaired children were significantly deficient in performance on all three non-verbal tests and on backward-digit span, serial noun span, multisyllabic word repetition, scrambled sentence arrangement, and oral sequencing accuracy. Errors in syntax included omission of words and psycholinguistic regressions to more familiar grammatical forms. They concluded that the children with minimal cerebral dysfunction seemed to have shorter perceptual spans, fewer retained stimuli, and less accurate reproduction of sequential information than did normal children. They also concluded that children with minimal cerebral dysfunction were deficient in short term retention and reordering of sequential stimuli which was revealed in the backwards-digit task and scrambled sentence arrangement. These results support the theories that perception, storage and reproduction of sequential stimuli are disturbed as a result of cerebral dysfunction.

McNeill (1966) discussed three memory spans of different capacities involved in linguistic performance; one for phonological production, one for grammatical comprehension, and one for grammatical production. He stated:

> If a sentence is shorter than a given span, the corresponding performance can occur, if a sentence is longer than the memory span, the corresponding performance cannot occur with complete accuracy (McNeill, 1966, p. 79).

According to Graham (1968), short term memory plays a large role in language; therefore, if the short term memory is disturbed, language functioning will be disturbed. That is, the ability to process sentences into meaningful units will be disturbed. Graham appears to be referring to a memory span for grammatical production. Children who misarticulate also display under developed syntactical structures (Shriner, Holloway, Daniloff, 1969). The ITPA may reveal deficiencies in both groups of the children who misarticulate and the children with minimal cerebral dysfunction. If the children with omission type misarticulations have learning disabilities, their language profiles may be similar to the profiles of the children with minimal cerebral dysfunction.

The Illinois Test of Psycholinguistic Abilities

The Illinois Test of Psycholinguistic Abilities was originally devised to measure various aspects of language in children according to a theory of communication postulated by Osgood. Osgood theorized three processes of language:

1. Decoding is the way in which stimuli or signs are interpreted by the receiver.
2. Encoding is a process whereby intentions are encoded into skilled movements which are put into messages (expression).

3. Association occurs when certain processes at all three levels are elicited by the decoding process and in turn elicit other processes which eventuate in other language or motor behavior (Sievers, 1963).

In Osgood's theory three levels of organization were present:

1. The Integrational Level, which is the lowest level where sequential activities are integrated automatically and carried on as sensorimotor skills.
2. Grammatical Level where anticipational (decoding) and dispositional (encoding) mechanisms are developed.
3. Semantic Level is the highest level where representational mechanisms are developed for the conception of meaning.

In this theory there are two channels of transmission:

1. Perceptuomotor, which are events received visually and expression is on the motor level, and
2. Auditory vocal, which are events received aurally and expression is on the vocal level.

Osgood's theory devised eighteen facilities necessary for language behavior, each containing one process, one level, and one channel of transmission (Sievers, 1963).

From this theory Sievers devised the Differential Language Facilities Test which contained eleven subtests approaching Osgood's eighteen facilities. The subtests were: (1) Labeling; (2) Object Association; (3) Word Association; (4) Mutilated Pictures; (5) Visual Form Tracing; (6) Gesture Sequence Matching; (7) Speech Sound Mimicry; (8) Nonsense Grammatical Mimicry; (9) Gestural Conversation; (10) Picture Series Description; and (11) Vocal 'Cloze,' which is a sentence completion

test. She used this test on 228 normal appearing children from two years to five years and eleven months. She concluded that the subtests were measuring separate functions. She also stated that a subtest is valuable if it has a high correlation with a criterion and has a low correlation with the other subtests. High correlations with age were found for the subtests. The ones that correlated highly with chronological age and had high split-half reliability coefficients were: (1) Labeling; (2) Mutilated Pictures; (3) Nonsense Grammatical Mimicry; (4) Form Tracing; (5) Picture Series; and (6) Vocal 'Cloze.' Word Association had good split-half reliability, but it correlated negatively with age (Sievers, 1963).

James J. McCarthy (1963) also conducted a study using the Differential Language Facilities Test. He speculated that adequate language use requires receptive, inner, and expressive use of language symbols. He stated that language included psychological foundations for behavior, structure of language and the relationship between the two. He used the Differential Language Facilities Test to find any differences between spastic and athetoid classes of Cerebral Palsy in overall language ability and specific language abilities. The Language Quotient was found to be significantly higher for spastic subjects than athetoid subjects. The spastic group was significantly superior to the athetoid group on Visual Form Tracing, Speech Sound Mimicry, Nonsense Grammatical Mimicry, and Grammatical and Meaning Aspects of Vocal 'Cloze.' He categorized the subtests according to receptive, expressive, and inner language functioning.

He stated:

> If differentially brain-injured children can be distinguished on the basis of linguistic behavior, there is reason to believe the instrument employed may have differential diagnostic value (McCarthy, 1963, p. 42).

J. J. McCarthy and S. A. Kirk (1961) refined the test of psycholinguistic abilities. This became the Illinois Test of Psycholinguistic Abilities. Up to this point the authors felt that language testing had been confined to labeling a child as having a language disorder; that is, it consisted of classification testing. They desired to devise a test battery which would detect specific abilities and disabilities within a subject so that a remedial program could be initiated based on these findings. The test was constructed to examine each psycholinguistic ability, defined as a "given process at a given level via a given channel" (McCarthy, and Kirk, 1963, p. 3).

Three levels over four channels and three processes yielded a test battery of forty-eight subtests which would have been unmanageable. They reduced the channels to visual and auditory, and dropped the projection level which dealt primarily with innate physiological processes. This was Osgood's grammatical level. Since this level could not be altered in remediation, it was dropped from the battery. This produced a possible test battery of eighteen subtests. The final model included six tests at the representational level and two tests, one at each sublevel of the integrative level. They had abandoned whole level tests at this point. This resulted in a test battery of ten tests. Since they did not have a test for visual-motor automatic, the battery was reduced to nine subtests (McCarthy and Kirk, 1963).

The six subtests on the representational level were: (1) Auditory Decoding; (2) Visual Decoding; (3) Auditory-Vocal Association;

(4) Visual-Motor Association; (5) Vocal Encoding; and (6) Motor Encoding. The three tests on the automatic-sequential level, formerly known as the integrative level, were: (1) Auditory-Vocal Automatic; (2) Auditory-Vocal Sequencing, and (3) Visual-Motor Sequencing (McCarthy and Kirk, 1961).

One thousand and one hundred children ages two years to nine years were tested from November, 1959, to June, 1960. They were administered Form L of Stanford Binet Intelligence Test. The final sample included 700 white children with no sensory or physical handicaps, having Intelligent Quotients from 80 to 120. Language Age norms were obtained by constructing a graph which had as its vertical axis, the raw scores, and as its horizontal axis the chronological age. The mean of each age level was plotted on the graph. Split-half correlations were obtained for each subtest to determine internal consistency. This indicated that the two extreme age levels were not as reliable as the middle age levels (McCarthy and Kirk, 1961).

Validity studies were conducted by McCarthy and Olson (1964). Concurrent validity was tested by administering the following criterion tests after the administration of the ITPA. The criterion tests were Form L of Stanford-Binet, Durrell-Sullivan, Stanford Achievement, Raven's Matrices, WISC Similarities, Language Sample, Draw-A-Man, Knox Cube, Random Word Test, Peabody Picture Vocabulary Test, Perceptual Speed, Sentence Memory, Peg Test, Visual Clozure Test, Auditory Clozure, Probability Test, and Maze Test. After a three month interval, the criterion tests were re-administered for predictive validity (McCarthy and Olson, 1964).

Content validity was assessed by logical examination of the test and the method of construction. Five objective indices were sought:

1. An attempt to assure a certain "statistical universality" of item content through the use of the standard error range,
2. an attempt to show that items within given ITPA subtests are homogeneous,
3. that the subtests within the battery are heterogeneous,
4. that the subtests collectively sample all crucial linguistic abilities, and finally,
5. a discussion of the "single ability" character of the ITPA subtests (McCarthy and Olson, 1964, p. 23).

Construct validity was determined by examining the extent of the influence of various factors on ITPA performance; that is, the effect of mental age, social class, birth order, number of siblings, sex and the effect of time for test administration for normal children, mentally retarded, and children with Cerebral Palsy on the ITPA performance. The effect of certain factors on specific subtests, such as visual discrimination on Visual-Motor Sequencing, were examined. Correlations were made between intra-channel, intra-level, and intra-process (McCarthy and Olson, 1964).

Diagnostic validity was determined by correlating teachers' ranking language ability for a given child with ITPA scores, and by determining the degree of success gained by those who have identified types of exceptional children by profile inspection alone (McCarthy and Olson, 1964).

From these validity studies, it was found that the following subtests demonstrate concurrent and predictive validity: (1) Visual Decoding, with a confidence level of .01 for concurrent validity and .04 for predictive validity; (2) Visual-Motor Association with a confidence level of .01 for both concurrent and predictive validity; and (3) Auditory-Vocal Sequencing, with a confidence level of .01 for

both concurrent validity and predictive validity. Auditory Decoding, Auditory-Vocal Association, and Visual-Motor Sequencing appeared to test more than intended. Vocal and Motor Encoding and Auditory-Vocal Automatic revealed doubtful validity due to the failure to correlate with Binet Vocabulary, Draw-A-Man, and Sentence Complexity Score, respectively (McCarthy and Olson, 1964).

Content validity revealed the ITPA's subtests to be quantitatively homogeneous but heterogeneous to a fair degree. That is, from the intercorrelation tables presented by McCarthy and Kirk (1963) consistently low to moderate subtest intercorrelations were indicated. Construct validity revealed that mental age was positively correlated to ITPA scores. Small negative correlations were found to exist between ITPA scores and social class, birth order, and number of siblings. Sex and the time of day appeared to have no influence on the ITPA (McCarthy and Olson, 1964).

Since there were no significant correlations between teachers' rankings of language ability and ITPA scores, it was concluded that teachers' rankings could not serve as criterion for the diagnostic validity of the test scores (McCarthy and Olson, 1964). However, all four ITPA experts were able to identify types of exceptional children beyond chance level by profile inspection alone. The most frequent errors were in distinguishing between normal children and those with articulation defects. Therefore, they controlled for children who omitted the final /s/ in the Auditory-Vocal Automatic subtest by omitting specific items and adjusting the total score. The ability of the instrument to differentiate between one condition and another was shown by a study by Olson (1963) who was able to correctly identify 91 percent

of deaf, 70 percent of receptive asphasics and 33 percent of expressive asphasics.

In 1968, the revised edition of the Illinois Test of Psycholinguistic Abilities was published by S. A. Kirk, J. J. McCarthy, and W. D. Kirk. The ITPA provides a framework within which subtests delineate specific abilities and disabilities in children and a base for developing remediation for children. In view of this, it has been used as a diagnostic and a teaching model for children with minimal cerebral dysfunction (Kirk, McCarthy, and Kirk, 1968).

To the experimental edition of the ITPA were added three subtests: Visual Closure Test which examines visual-motor automatic function, and two supplementary tests, Auditory Closure and Sound Blending which supplement Grammatic Closure by assessing an auditory vocal automatic function. In the new revision, the terms, decoding and encoding, were replaced by reception and expression, respectively (McCarthy, Kirk, and Kirk, 1968).

The present model attempts to interrelate the processes of receiving a message, interpreting it, and expressing a message. It deals with the psychological functions which operate in communication. The present model postulates three dimensions of cognitive abilities: (1) Channels of Communication; (2) Psycholinguistic Processes; and (3) Level of Organization.

Channels of Communication are "modalities through which sense impressions are received and forms of expression through which a response is made" (McCarthy, Kirk, and Kirk, 1968, p. 7). The major modes of input are visual and auditory, and the major modes of output

are vocal and motor. While there are many combinations possible, this model only uses visual-motor and auditory-vocal.

Psycholinguistic processes are the acquisition and the use of the habits required for normal language usage. Three main processes are considered: (1) receptive process; (2) expressive process; and (3) organizing process. The receptive process is the "ability necessary to recognize and/or understand what is seen and heard" (McCarthy, Kirk, and Kirk, 1968, p. 7). The expressive process involves the skills necessary to express ideas by either responding vocally, by gesture, or by movement. The organizing process involves "internal manipulation of percepts, concepts, and linguistic symbols" (McCarthy, Kirk, and Kirk, p. 7). It is a central mediating process which is elicited by the receptive process and evokes the expressive process.

The Levels of Organization represent the level of functioning which is determined by the "degree to which habits of communication are organized within an individual" (McCarthy, Kirk, and Kirk, 1968, p. 7). There are two levels: (1) representational level which requires more complex mediating process of utilizing symbols; and (2) automatic level which represents habits of functioning that are less voluntary but highly organized and integrated. This level includes visual and auditory closure, rote learning, synthesizing isolated sounds into a word, and utilizing redundancies of experiences (McCarthy, Kirk, and Kirk, 1968). Two abilities are measured: (1) closure, and (2) sequential memory. Closure is the ability to recognize a common unit of experience when only part is presented. The second is the ability to reproduce a sequence presented auditorally and visually (McCarthy, Kirk, and Kirk, 1968).

The Revised Edition of the Illinois Test of Psycholinguistic Abilities includes ten subtests and two supplementary tests. These are divided into two levels of organization which are the representational and automatic levels. The six subtests at the representational level include the three processes, and the two channels of language input and output. There are two subtests which assess the receptive process: (1) Auditory Reception and (2) Visual Reception. Two subtests assess the organizing process: (1) Auditory-Vocal Association and (2) Visual-Motor Association. Two subtests are included to assess the expressive process which are: (1) Verbal Expression and (2) Manual Expression.

The automatic level includes four tests which assess the ability of closure and two tests which assess the ability of sequential memory. The four tests of closure are: (1) Grammatic Closure; (2) Auditory Closure; (3) Sound Blending; and (4) Visual Closure. The two tests of sequential memory are: (1) Auditory Sequential Memory and (2) Visual Sequential Memory. Further description of these subtests will be found in the Appendix.

These subtests have been constructed to differentiate defects of the three processes of communication, the levels of organization, and the channels of language input and output. Poor performance on these tests should identify specific psycholinguistic deficits.

ITPA as a Tool for Identifying Children with Learning Disabilities

As was mentioned before, the ITPA can be used for identifying children with learning disabilities, and it can be used for identifying the specific abilities and disabilities of these children. These

abilities and disabilities can be shown in terms of a language age score and a standard score for each test.

Channel disabilities may be seen as in a case in which auditory reception was superior to visual reception, auditory-vocal association was superior to visual-motor association, and auditory sequential memory was superior to visual sequential memory. This profile revealed a visual channel disability. Another case revealed a completely opposite profile indicating an auditory channel deficit. Manual expression and verbal expression may be associated with channel deficits (Kirk, 1966).

There can be receptive disabilities, such as auditory reception which may be accompanied by verbal expression deficit. The child also may have a disability in visual reception. Association disabilities are seen in which both auditory-vocal association and visual-motor association or/either of these alone may be affected.

Expressive disabilities may be seen in which three categories have been found: (1) disability in verbal expression and manual expression; (2) disability in verbal expression alone; and (3) disability in manual expression alone.

Level disabilities may be seen in which disabilities are found in all tests of the representational level or automatic level. It is less common to find disabilities in the representational level than in the automatic level (Kirk, 1966).

Discrepant abilities serve as a basis for clinical determination of presence of a disability. Standard scores for each test may be computed. If a standard score is ± 1 standard deviation or ten points from the mean, this constitutes a discrepancy. Standard scores are based on the standardization population, thus a mentally retarded child, age twelve

years, could be tested, but the standard scores could not be used (Kirk, 1966). A discrepancy can be determined if a child is one and one-half years above or below his total language score.

Barbara Bateman (1965) summarized the literature on the ITPA which reveals patterns of disabilities. Mentally Retarded children appear to be more defective at the automatic sequential level than at the representational level. Athetoid Cerebral Palsied children are more defective at the automatic sequential level than at the representational level. Spastic Cerebral Palsied children show opposite trends. Children with reading difficulties and articulation disorders are more defective in the automatic sequential level than in the representational level. Although these trends were found, one must be careful not to generalize to all children in these various categories. For example, the children with articulation disorders were not separated as to specific types of disorders such as omission, substitution and distortion.

Barbara Bateman (1968) found a pattern of children who manifested the "Strauss" syndrome or perceptual problems. This profile consisted of deficits in visual reception and manual expression and lower scores in automatic sequential tests. However, she noted that if the scores revealed unreliably low scores in the sequential area, this may be a result of distractibility and/or attention problems. She also noted that this profile was very similar to that of a highly intelligent child except for the relationship of the chronological age to the profile.

The ITPA has been used in conjunction with other tools in diagnosing and planning a remediation program for children with learning disabilities who have been diagnosed by a pediatric neurologist as

having minimal cerebral dysfunction. The ITPA will be used in this study to compare the profiles of children with omission type misarticulations, substitutions and distortions, and normal speaking children.

Summary of the Review

Some researchers in the field of Speech and Hearing are becoming increasingly concerned with the need for classification of various types of misarticulations. They are finding indications that there may be differences between children with omissions and those with substitutions and/or distortions. Children with omission type misarticulations often show behavioral symptoms such as hyperactivity, short attention span, short auditory memory span, and case history information with presumptive evidence of brain injury. These factors imply that these children may have minimal cerebral dysfunction or learning disabilities.

As a result of the research which has been conducted on the child with minimal cerebral dysfunction, the ITPA has become a useful part of the diagnostic battery. Through the use of the ITPA one is able to identify specific abilities and disabilities of these children on which remediation may be focused.

Considering the fact that the ITPA has become such a useful tool for planning a remediation program for children with minimal cerebral dysfunction, it may be just as useful for children with omission type misarticulations. If these children do exhibit learning disabilities, they may show the same type of disabilities and abilities as the children with minimal cerebral dysfunction. The purpose of this study is to discover if the children with omission type misarticulations and the

children with diagnosed minimal cerebral dysfunction evidence similar psycholinguistic abilities and disabilities as revealed by the ITPA.

CHAPTER III

METHODS AND PROCEDURES

Selection of Subjects

Thirty children, ranging in ages from five years four months to eight years, served as subjects. All children were from public schools in Stillwater, Crescent, Ponca City, Ripley, Perkins, and Oklahoma City.

All subjects were found to have:

1. Hearing within normal limits, as indicated by a hearing screening test at 25 dB HL ISO 1964 at 500 Hz and 20 dB at 1000 Hz, 2000 Hz, and 4000 Hz;
2. A Peabody Picture Vocabulary Test, "I.Q." score of 90 or above (used as an estimate of the intellectual functioning);
3. An oral mechanism adequate for speech as evaluated by a peripheral-oral examination performed by the investigator.

The following groups of children were formed:

GROUP I: NORMAL-SPEAKING CHILDREN

1. Nine children from Perkins, Oklahoma;
2. No misarticulations of sounds which should have been correctly produced by the chronological age of the child, according to Hejna (1959);
3. No diagnosis of minimal cerebral dysfunction. (This does not rule out the possibility of minimal cerebral dysfunction.)

GROUP II: CHILDREN WITH MINIMAL CEREBRAL DYSFUNCTION

1. Five children from Stillwater, Oklahoma;
2. No misarticulations of sounds which should have been correctly produced by the chronological age of the child, according to Hejna (1959);
3. Had been referred to a pediatric neurologist for an examination and diagnosed as having "minimal cerebral dysfunction."

GROUP III: CHILDREN WHO OMITTED CONSONANT PHONEMES

1. Eight children from Ripley, Crescent, and Oklahoma City, Oklahoma;
2. Nine or more omissions of consonant phonemes which normally should have been acquired by their chronological age (Hejna, 1959);
3. No diagnosis of minimal cerebral dysfunction. (This does not rule out the possibility of minimal cerebral dysfunction.)

GROUP IV: CHILDREN WHO SUBSTITUTED AND/OR DISTORTED CONSONANT PHONEMES

1. Eight children from Perkins, Ponca City, Ripley, Crescent, Stillwater, and Oklahoma City, Oklahoma;
2. Nine or more substitutions and/or distortions and five or fewer omissions that normally should have been acquired by their chronological age (Hejna, 1959);

3. No diagnosis of minimal cerebral dysfunction. (This does not rule out the possibility of minimal cerebral dysfunction.)

Instrumentation

1. Articulation was assessed by the Developmental Articulation Test (Hejna, 1959);
2. A Beltone Model 9c portable audiometer was used to screen hearing;
3. The Peabody Picture Vocabulary Test (Form A) (Dunn, 1959) was used as a screening test for intelligence;
4. The Illinois Test of Psycholinguistic Abilities (McCarthy, Kirk, and Kirk, 1968) was administered to delineate the specific psycholinguistic abilities and disabilities.

Procedures

All testing was administered by the investigator except for one hearing test which was administered by a speech therapist. The Developmental Articulation Test (Hejna, 1959) was administered to all children who had shown severe speech difficulty during screening or who had been referred for severe speech problems. Each child was then assigned to Group III or IV depending on his type of speech problem. Hearing, Peabody Picture Vocabulary Test scores (intelligence indicator), and oral structures and functions of all children were examined by the investigator. Any children who failed to meet the criteria listed above were eliminated from the study.

The Illinois Test of Psycholinguistic Abilities (McCarthy, Kirk, and Kirk, 1968) was administered to all four groups and was scored according to the instructions in the Examiner's Manual (McCarthy, Kirk, and Kirk, 1968, pp. 15-107).

The test scores were compiled and statistically analyzed to ascertain any differences between groups. Analysis of Variance (Adler and Roessler, 1968), Discriminant Analysis, and Chi Square (Adler and Roessler, 1968) were used.

CHAPTER IV

RESULTS

This chapter is concerned with presentation of the data accumulated in this study. The Illinois Test of Psycholinguistic Abilities was administered to each child in four groups of subjects. The scaled scores for each group were recorded and analyzed, and statistical tests were employed to test for differences between the ITPA profiles of the four groups of subjects. The data will be presented and the statistical computations and findings will be discussed in this chapter.

The Illinois Test of Psycholinguistic Abilities was administered to four groups of children: (1) nine normal-speaking children; (2) five children who evidenced minimal cerebral dysfunction; (3) eight children who omitted consonant phonemes, and; (4) eight children who substituted and/or distorted consonant phonemes. The scaled scores for each of the ten ITPA subtests were analyzed. Kirk, McCarthy, and Kirk (1968) have indicated that a scaled score of an ITPA subtest which is ten points below an individual's mean of scaled scores constitutes a psycholinguistic disability. It was found that 22.2 percent of normal-speaking children, 60 percent of children with minimal cerebral dys-function, 50 percent of children who omitted consonants, and 62.5 percent of children who substituted and/or distorted consonants evidenced one or more disabilities. The number of psycholinguistic

disabilities found for each group for the ten subtests is reported in Table I.

The mean of the scaled scores for each group of subjects was computed for each ITPA subtest. These scores are reported in Table II. The Analysis of Variance (Adler and Roessler, 1968) was employed to find if any differences existed between the scaled scores of the four groups of subjects. This Analysis of Variance was applied to each of the ten ITPA subtests. The two supplementary tests of the ITPA, "Auditory Closure" and "Sound Blending," were not analyzed due to the fact that the authors of the ITPA suggest that these tests be excluded in the computation of an individual's mean of scaled scores.

The statistic "F" (Adler and Roessler, 1968) was calculated for each of the ten comparisons. The groups were significantly different at the .05 level of confidence on the Auditory Reception, Visual Association, and Grammatic Closure subtests. The calculated "F" for the Auditory Association subtest was not significant but was approaching the necessary level. There were no significant differences between groups on the subtests: (1) Auditory Association; (2) Visual Reception; (3) Verbal Expression; (4) Visual Closure; (5) Auditory Memory; and (6) Visual Memory.

The Bio-Medical computer program (Oklahoma State University, Statistics Department) entitled "Discriminant Analysis-Several Groups" was employed to test the following questions:

1. Is there a difference between the ITPA profiles of the children who omitted consonant phonemes and the children with minimal cerebral dysfunction?

TABLE I

PSYCHOLINGUISTIC DISABILITIES* FOR ITPA SUBTESTS

Subtest	Group I (normals)	Group II (minimal cerebral dysfunction)	Group III (omission of consonants)	Group IV (substitution distortion of consonants)
Auditory Reception	0	0	0	1
Visual Reception	0	0	1	1
Auditory Association	1	1	3	2
Visual Association	0	2	0	0
Verbal Expression	0	0	0	1
Manual Expression	0	0	0	0
Grammatic Closure	0	0	2	1
Visual Closure	0	0	0	0
Auditory Memory	1	0	0	0
Visual Memory	0	0	1	0
Total	2	3	7	6
Ratio of subjects with one or more disabilities.	2/9	3/5	4/8	5/8
Percent of subjects with one or more disabilities.	22.2%	60%	50%	62.5%

*A disability refers to an ITPA scaled score which is ten points below an individual's mean of scaled scores.

TABLE II

GROUP MEANS OF THE ITPA SUBTEST SCALED SCORES AND THE RESULTS OF THE ANALYSIS OF VARIANCE

	Means				
Subtests	Group I (normals)	Group II (minimal cerebral dysfunction)	Group III (omission of consonants)	Group IV (substitution distortion of consonants)	Calculated "F"
Auditory Reception	36.78	34.4	31.75	29.125	3.02
Visual Reception	38.22	35.2	35.75	30.625	1.387
Auditory Association	36.6	30	28.625	29.33	2.578
Visual Association	36.77	28.2	36.38	34.13	3.044
Verbal Expression	34.88	30.6	30.75	30.88	1.09
Manual Expression	36.88	40.8	38.88	37.88	.727
Grammatic Closure	37.88	34.2	26	30.5	3.617
Visual Closure	38.33	40.2	37.25	35.38	.426
Auditory Memory	38.67	33	31.88	34.63	1.494
Visual Memory	37.33	36.4	36.63	35.13	.093

Source: Calculated F greater than 2.99 is significant at the .05 level of confidence. Calculated F greater than 4.68, is significant at the .01 level of confidence (Adler and Roessler, 1968).

2. Is there a difference between the ITPA profiles of children who omitted consonant phonemes and children who substituted and/or distorted consonant phonemes?
3. Is there a difference between the ITPA profiles of children who substituted and/or distorted consonant phonemes and children with cerebral dysfunction?
4. Is there a difference between the ITPA profiles of children who omitted consonant phonemes and normal-speaking children?
5. Is there a difference between the ITPA profiles of children who substituted and/or distorted consonant phonemes and normal-speaking children?
6. Is there a difference between the ITPA profiles of children with minimal cerebral dysfunction and normal-speaking children?

A discriminant function was calculated for each of the four groups of subjects. The functions were of the form: $\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_{10} x_{10}$. The x's denote the ten subtest scaled scores, β_0 denotes the constant, and the β's denote the coefficients. The coefficients were calculated for each subtest in each of the four groups.

Each subject received four numbers, one for each of the four functions. These functions refer to the four group assignments. Each subject was classified into the group having the largest function number which is shown in Table III. For example, subject one of Group I was classified into this group as a result of the articulation test administered to him which indicated that he was a normal-speaking child. This subject's largest function number was of function I. Therefore, he was properly classified into Group I.

TABLE III

CLASSIFICATION OF EACH SUBJECT INTO ONE OF FOUR GROUP ASSIGNMENTS BASED ON ITPA SUBTEST SCORES

Group (Behavioral Classification)	Group Assignment Probability Based on Discriminant Analysis				Group Assignment
	I	II	III	IV	
I					
Case 1	0.95757	0.01237	0.00903	0.02103	1
Case 2	0.51444	0.35611	0.07198	0.05747	1
Case 3	0.08505	0.69942	0.01607	0.19946	2
Case 4	0.95874	0.00049	0.01936	0.03141	1
Case 5	0.74536	0.00461	0.20375	0.04628	1
Case 6	0.06895	0.00001	0.50360	0.42743	3
Case 7	0.83884	0.00090	0.06942	0.09085	1
Case 8	0.83702	0.00034	0.15160	0.01104	1
Case 9	0.81106	0.03504	0.09953	0.05438	1
II					
Case 1	0.00262	0.99535	0.00002	0.00002	2
Case 2	0106177	0.85803	0.03764	0.04256	2
Case 3	0.00036	0.99277	0.00063	0.00625	2
Case 4	0.00471	0.99213	0.00296	0.00020	2
Case 5	0.11758	0.41758	0.15438	0.31046	2
III					
Case 1	0.53297	0.00144	0.29032	0.17527	1
Case 2	0.01529	0.00042	0.89827	0.08602	3
Case 3	0.21362	0.00013	0.14854	0.63771	4
Case 4	0.01850	0.00106	0.90199	0.07845	3
Case 5	0.12244	0.01772	0.46300	0.39685	3
Case 6	0.20632	0.00397	0.56212	0.22759	3
Case 7	0.02192	0.00040	0.89711	0.08056	3
Case 8	0.05112	0.07283	0.83490	0.04115	3
IV					
Case 1	0.10031	0.00537	0.01039	0.88392	4
Case 2	0.01591	0.00182	0.09612	0.88615	4
Case 3	0.07519	0.00010	0.11566	0.80906	4
Case 4	0.01756	0.38987	0.47783	0.21474	3
Case 5	0.01111	0.00007	0.30946	0.67936	4
Case 6	0.04413	0.00174	0.23605	0.71808	4
Case 7	0.76034	0.00059	0.17450	0.06458	1
Case 8	0.15196	0.00872	0.14112	0.69820	4

In other words, each subject in the study was reclassified on the basis of the discriminant functions that were calculated from relevant characteristics of the group's scores on the ITPA subtests.

Two out of nine subjects in the group of normal-speaking children were classified into a group other than the one into which the investigator had placed them. No classification differences occurred in the group of children evidencing minimal cerebral dysfunction. Two out of eight possible differences occurred in the group of children who omitted consonant phonemes and two out of eight possible differences occurred in the group of children who substituted and/or distorted consonant phonemes. A matrix of this agreement and disagreement is presented in Table IV.

TABLE IV

CLASSIFICATION OF SUBJECTS FROM EACH GROUP INTO ONE OF FOUR GROUP ASSIGNMENTS BASED ON ITPA SCORES

Group (Behavioral Classification)	Group Assignment Based on Discriminant Analysis			
	I	II	III	IV
I	7	1	1	0
II	0	5	0	0
III	1	0	6	1
IV	1	0	1	6

The Chi Square test was applied to the results of the Discriminant Analysis and indicated that the four groups of subjects were significantly different and distinct at the .001 level of confidence.

In summary, the results of the Analysis of Variance indicated that there are no significant differences between normal-speaking children, children who evidenced minimal cerebral dysfunction, children who omitted consonants, and children who substituted and/or distorted consonants on the following ITPA subtests: (1) Auditory Association; (2) Visual Reception; (3) Verbal Expression; (4) Manual Expression; (5) Visual Closure; (6) Auditory Memory; and (7) Visual Memory. There were significant differences at the .05 level of confidence between the four groups of subjects on the subtests for: (1) Auditory Reception; (2) Visual Association; and (3) Grammatic Closure.

The results of Chi Square applied to the Discriminant Analysis indicate that on the basis of the ten ITPA subtests, the four groups of subjects were properly classified into: (1) normal-speaking children; (2) children with minimal cerebral dysfunction; (3) children who omitted consonants; and (4) children who substituted and/or distorted consonants. The four groups of children were significantly different at the .001 level of confidence based on these ten ITPA subtests.

CHAPTER V

DISCUSSION AND CONCLUSIONS

Restatement of the Problem

The purpose of this study was to investigate the ITPA profiles of: (1) children with minimal cerebral dysfunction; (2) children who omitted consonant phonemes; (3) children who substituted and/or distorted consonant phonemes; and (4) normal-speaking children to see if any differences existed between the four groups. It had been found that children with minimal cerebral dysfunction evidenced psycholinguistic disabilities as tested by the ITPA. Silverstein (1967) suggested that children who omitted consonant phonemes may evidence minimal cerebral dysfunction. In this study, the ITPA was administered to children with minimal cerebral dysfunction and children who omitted consonant phonemes in an attempt to see if the scores of these two groups were similar.

Discussion of Results

Significant differences at the .05 level of confidence were found between the four groups of subjects on the ITPA subtests: (1) Auditory Reception; (2) Visual Association; and (3) Grammatic Closure. On the Auditory Reception subtest, the order of the scaled scores of the groups were as follows:

1. Children who substituted and/or distorted consonant phonemes (lowest);

2. Children who omitted consonant phonemes;

3. Children with minimal cerebral dysfunction;

4. Normal-speaking children (highest).

On the Visual Association subtest, the order of the scaled scores of the groups were as follows:

1. Children with minimal cerebral dysfunction (lowest);

2. Children who substituted and/or distorted consonant phonemes;

3. Children who omitted consonant phonemes;

4. Normal-speaking children (highest).

The latter three groups of children were within one to two points of each other while the children with minimal cerebral dysfunction received a score six to eight points below the other three groups.

On the Grammatic Closure subtest, the order of the scaled scores of the groups were as follows:

1. Children who omitted consonant phonemes (lowest);

2. Children who substituted and/or distorted consonant phonemes;

3. Children with minimal cerebral dysfunction;

4. Normal-speaking children (highest).

The means of the scaled scores for children who omitted consonants were five to eleven points below that of the other groups.

Of the three subtests for which significant differences were found between the groups, a different group of subjects scored the lowest on each subtest.

1. Children with minimal cerebral dysfunction scored lowest on Visual Association;

2. Children who substituted and/or distorted consonants scored lowest on Auditory Reception;

3. Children who omitted consonants scored lowest on Grammatic Closure.

The subtests on which children with articulation problems scored lowest were ones which assessed the auditory-vocal channel and the subtest on which the children with minimal cerebral dysfunction scored lowest was one which assessed the visual channel.

No significant differences were found between the four groups of subjects on the other seven subtests. Within a group, if an individual exhibited a psycholinguistic ability (a scaled score of ten points higher than his mean of scaled scores) this might have caused the differences between the groups. This might have affected the negative findings for these seven subtests.

Although there were no statistically significant differences in these seven subtests, the scaled scores did indicate some potentially interesting trends. For example, children who omitted consonant phonemes scored lowest on the subtests for: (1) Auditory Association; (2) Grammatic Closure; and (3) Auditory Memory. Children who substituted and distorted consonant phonemes scored lowest on the subtests for: (1) Auditory Reception; (2) Visual Reception; (3) Visual Closure; and (4) Visual Memory. Children evidencing minimal cerebral dysfunction scored lowest on the subtests for: (1) Visual Reception; (2) Visual Association; and (3) Verbal Expression. The normal-speaking groups scored highest on all of the ITPA subtests except Manual Expression and Visual Closure. They scored lower than the other three groups on the Manual Expression subtest. Perhaps these results would have been more definitive if more subjects had been used.

These data seem to indicate that children with omission type misarticulations tend to score lower on ITPA subtests which assess the auditory-vocal channel and that children with minimal cerebral dysfunction tend to score lower on ITPA subtests which assess the visual channel. It is possible, therefore, that children who omit consonant phonemes might have difficulty in auditory perception and many children with diagnosed minimal cerebral dysfunction may have difficulty in visual perception.

The Discriminant Analysis was employed to test the six questions posed in this study:

1. Is there a difference between the ITPA profiles of Group II, children with minimal cerebral dysfunction, and Group III, children who omitted consonant phonemes?

A significant difference at the .001 level of confidence was found to exist between these groups. None of the children with minimal cerebral dysfunction were placed in new groups as a result of the Discriminant Analysis. Two of the children who omitted consonants were placed in new groups; one into Group I and one into Group IV. Thus, there were no intermingling between Groups II and III.

The fact that these two groups of children were selected on the basis of two separate sets of behavioral symptoms must be considered. Children with minimal cerebral dysfunction were selected from a perceptual training class which was formed on the basis of behavioral checklists from teachers and a battery of tests. Children who omitted consonants were selected on the basis of their articulation profiles. This factor might have influenced the fact that these children were found to be different based on the ITPA scores.

However, both of these groups of children were found to have psycholinguistic disabilities. Sixty percent (three of five children) who evidenced minimal cerebral dysfunction and 50 percent (four of eight children) who omitted consonants were found to have psycholinguistic disabilities. Although, a smaller percentage of children who omitted consonants had disabilities, they evidenced a larger number of disabilities. That is, seven disabilities were found to exist in the group of children who omitted consonants and three disabilities were found to exist in the group of children with minimal cerebral dysfunction. The children who omitted consonants and evidenced disabilities had more than one disability while each child with minimal cerebral dysfunction who evidenced a disability had only one disability.

The group of children with minimal cerebral dysfunction and the group of children who omitted consonants scored lower than the normal-speaking children on the Auditory Memory subtest. This supports the findings of earlier research. Aten and Davis (1968) found that children with minimal cerebral dysfunction were deficient in short term retention and reordering of sequential information. Silverstein (1967) found that children evidencing omission type misarticulations tended to have short auditory memory spans. Therefore, the performances on the Auditory Memory subtest of the ITPA of the children with minimal cerebral dysfunction and children who omitted consonants were similar, as predicted.

2. Is there a difference between the ITPA profiles of Group III, children who omitted consonant phonemes, and Group IV, children who substituted and/or distorted consonant phonemes?

A significant difference at the .001 level of confidence was found to exist between these groups. However, two children in each group were placed in new groups as a result of the Discriminant Analysis. One of the children who omitted consonants was placed in Group IV and one of the children who substituted and/or distorted consonants was placed in Group III. Therefore, there is a possibility that these two groups of children represent a continuum of articulation difficulties.

3. Is there a difference between the ITPA profiles of Group IV, children who substituted and/or distorted consonant phonemes, and Group II, children who evidenced minimal cerebral dysfunction?

A significant difference at the .001 level of confidence was found to exist between these groups. However, more children who substituted and/or distorted consonants evidenced psycholinguistic disabilities than children evidencing minimal cerebral dysfunction. All children evidencing minimal cerebral dysfunction were properly placed in this group. The two children in Group IV who were placed in a new group were not placed in Group II. Thus, there was no intermingling between these groups.

4. Is there a difference between ITPA profiles of Group III, children who omitted consonant phonemes, and Group I, normal-speaking children?

These two groups of children were found to be significantly different at the .001 level of confidence. However, one of the two normal-speaking children was placed in Group III, and one of the children in Group III was placed in Group I. In spite of the fact that this normal-speaking child had no misarticulations for his age level, he had

difficulties on the ITPA that resulted in classifying him with the group of children who omitted consonants. Two of the normal-speaking children evidenced psycholinguistic disabilities which might have affected the fact that two children were placed in new groups. The fact that the child in Group III omitted consonants did not affect his ITPA score which placed him in the group of normal-speaking children.

5. Is there a difference between the ITPA profiles of Group IV, children who substituted and/or distorted consonants, and Group I, normal-speaking children?

A significant difference at the .001 level of confidence was found to exist between these two groups. One of the children who substituted and/or distorted consonants was placed in Group I. The fact that he had misarticulations did not seem to affect his ITPA score.

6. Is there a difference between the ITPA profiles of Group II, children with minimal cerebral dysfunction, and Group I, normal-speaking children?

There was a significant difference between these groups of children at the .001 level of confidence. Both of these groups of children were normal-speaking children. The performances on the ITPA of the children who were selected from the perceptual training class were similar, and none of these children with minimal cerebral dysfunction were placed in new groups as a result of the Discriminant Analysis. One of the normal-speaking children was placed in the group of children with minimal cerebral dysfunction. Perhaps, this child is perceptually handicapped or has minimal cerebral dysfunction, but he has not been diagnosed by a pediatric neurologist.

Conclusions

The Analysis of Variance (Adler and Roessler, 1968) indicated significant differences between the performance of the groups on the Auditory Reception, Visual Association, and Grammatic Closure subtests. Chi Square applied to the results of the Discriminant Analysis indicated that the four groups of subjects were significantly different and distinct based on the ten ITPA subtest scores.

As a result of the Discriminant Analysis, all of the children evidencing minimal cerebral dysfunction were properly classified into this group. It is interesting to note that these children were initially placed in this group on the basis of a behavioral checklist filled out by the teachers. This might indicate that the behavioral checklist is a good screening device. The fact that the children were properly classified might indicate that the testing procedures employed to diagnose these children are efficient.

Children who omitted consonant phonemes evidenced some psycholinguistic disabilities as did children who substituted and/or distorted consonant phonemes and children with minimal cerebral dysfunction. Normal-speaking children evidenced two disabilities. The fact that these groups were different does not eliminate the possibility that children who omit consonant phonemes may have minimal cerebral dysfunction. The area of the brain damage for children who omit sounds may differ from the area of brain damage for children with diagnosed minimal cerebral dysfunction or learning disabilities.

The nature of the psycholinguistic disability of children who omit consonants may provide rationale for a specific approach to remediation for these children. For example, since these children appear to have

auditory disturbances, articulation therapy might emphasize other channels of communication (sensory avenues) in order to provide a more efficient means of learning.

Recommendations for Further Research

If this study is replicated, it is recommended that a larger sample of children be used. This would increase the statistical degrees of freedom and make the results more meaningful. It might also clarify matters if children who omit consonant phonemes received a neurological examination to reveal whether or not they had detectable minimal cerebral dysfunction.

Children with central auditory problems are often diagnosed on the basis of the fact that auditory discrimination scores are depressed while pure tone test results are normal. The children with omission type misarticulation errors in this study exhibited primary difficulties on the auditory subtests of the ITPA. This might lead to the deduction that the scores of these children might have been affected by some sort of lesion in the auditory areas of the Central Nervous System. A study in which children with these types of ITPA profiles were further diagnosed on the basis of auditory discrimination scores and pure tone thresholds might substantiate or eliminate the possibility of auditory Central Nervous System lesions.

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APPENDIX

DESCRIPTION OF THE ITPA SUBTESTS

The Illinois Test of Psycholinguistic Abilities includes six subtests at the Representational Level. Two of these subtests assess the receptive process: (1) Auditory Reception and (2) Visual Reception. Auditory Reception is a test to assess the child's ability to receive meaning from verbally presented material. It would be almost impossible to isolate the receptive process completely from the expressive process; however, to account for this, the response at the expressive level is kept to a minimum, an answer of yes or no. The vocabulary presented through the receptive process becomes increasingly more difficult, while the response remains at a simple level. The test contains fifty short, direct questions (McCarthy, Kirk, and Kirk, 1968). Visual Reception is a test to measure a child's ability to derive meaning from visual symbols. It contains forty picture items, each consisting of a stimulus picture on one page and four response pictures on the second page. The child is asked to find a picture on the second page similar to the picture on the first page. The incorrect choices include pictures of structural similarity.

Two subtests assess the organizing process: (1) Auditory-Vocal Association and (2) Visual-Motor Association. The Auditory-Vocal Association Test assesses the child's ability to relate concepts presented orally. In order to tap this ability, the auditory receptive

process and vocal expressive process are kept at a minimum, while "the Organizing Process of manipulating linguistic symbols in a meaningful way is tested by verbal analogies of increasing difficulty" (McCarty, Kirk, and Kirk, 1968, p. 10). The child is asked to listen to one statement followed by an open-ended, analogous statement which he is to complete. The test includes forty-two orally presented analogies.

The Visual-Motor Association test assesses the child's ability to relate concepts presented visually. The child is presented with a stimulus picture surrounded by four response pictures. The child is asked to associate one of these pictures with the stimulus picture. A more difficult task is included which involves verbal analogies in addition to visual analogies. That is, two stimulus pictures presented are associated with each other in the same manner that the central stimulus picture is associated with the surrounding response picture (McCarthy, Kirk, and Kirk, 1968).

Two subtests are included to assess the expressive process which are: (1) Verbal Expression and (2) Manual Expression. The Verbal Expression test taps the child's ability to express his own concepts verbally. The child is shown four objects about which he is asked to tell all there is. The score is the number of "discrete, relevant, and approximately factual concepts expressed" (McCarthy, Kirk, and Kirk, 1968, p. 11).

Manual Expression assessed the child's ability to express his ideas manually. Fifteen pictures of common objects are presented, and he is asked to show what we do with the object. He is required to pantomine the action.

The Automatic Level includes four tests which assess the ability of closure and two tests which assess the ability of sequential memory. The four tests of closure are: (1) Grammatic Closure; (2) Auditory Closure; (3) Sound Blending; and (4) Visual Closure.

Grammatic Closure "assesses the child's ability to make use of redundancies of oral language in acquiring automatic habits for handling syntax and grammatic inflections" (McCarthy, Kirk, and Kirk, 1968, p. 11). The test measures the form of the word rather than the content, for the content is supplied by the examiner. The stimulus involves two statements, the second being an incomplete statement to be supplied by the child.

There are two supplementary tests: (1) Auditory Closure and (2) Sound Blending. Auditory Closure is a test of the organizing process at the automatic level. It assesses the child's ability to say a complete word in response to an incomplete one such as tele / one.

Sound Blending also assesses the organizing process at the automatic level through the auditory vocal channel. The sounds of a word are presented separately to the child who is asked to synthesize them into a whole word.

Visual Closure assesses the child's ability to identify a common object from an incomplete visual presentation. The child is presented four scenes each containing fourteen or fifteen concealed objects. He is asked to point to these objects as quickly as he can within thirty seconds.

The two tests of sequential memory are: (1) Auditory Sequential Memory and (2) Visual Sequential Memory. Auditory Sequential Memory

assesses the child's ability to reproduce from memory sequences of digits increasing in number from two to eight.

Visual Sequential Memory assesses the child's ability to reproduce sequences of non-meaningful figures from memory. The child is shown a picture of figures in a sequence and is asked to place chips with figures on them in the same sequential order. The number of figures increases from two to eight (McCarthy, Kirk, and Kirk, 1968).

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