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A Validation Study of the Predictive Screening Test of Articulation

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A VALIDATION STUDY OF THE PREDICTIVE SCREENING TEST OF ARTICULATION

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CHAPTER I

INTRODUCTION

Several researchers--including Roe and Milisen (1942), Snow and Milisen (1954), Carter and Buck (1958), Steer and Drexler (1960)--have addressed themselves to the questions of the maturation factor in acquisition of correct articulation and the prognostication or prediction of need for speech therapy in functional articulation disorders. Results of such research, although illuminating, have not solved the problem of accurate prediction of need. However, the recent research by Van Riper (1966) and Van Riper and Erickson (1968a) leading to the development and cross-validation of the Predictive Screening Test of Articulation (PSTA) provides the possibility that an instrument is now available which will make an accurate prognostication about a first grader's need for speech therapy.

Statement of the Purpose

The primary purpose of this study will be to conduct a test of the validity of the Predictive Screening Test of Articulation. Does the PSTA identify first grade children who will master their articulation errors without speech therapy by the time they enter third grade?

Conversely, does the PSTA identify first grade children who will not master their articulation errors without speech therapy by the time they enter third grade? In short, does the PSTA predict as expected?

Secondary purposes of this study include the assessment of the possible effects of sex, age, intellectual functioning and socio-economic status on the predictive value of the PSTA.

Need for the Study

An annually recurring dilemma of the public school speech therapist is the selection of cases to be included in active therapy. Decisions about the inclusion of the more serious varieties of speech defects, e.g., cleft palate, hearing impaired, dysphasia, stuttering or cerebral palsied speech, present little problem; nor do the defects of functional articulation which are clearly beyond the bounds of maturational significance, for example, a frontal lisper in the fourth grade. However, the majority of problems brought to the attention of the public school speech therapist center on first graders with functional articulation defects or deviations. Which of these children are to be selected for therapy? How is the choice to be made? How can the therapist know which children will correct their articulatory errors, presumably through a process of maturation, and which children will need the help of a professional to solve the problem?

Van Riper and Erickson (1968a, p. 3) discuss this dilemma:

> While it generally is recognized, then, that children's articulation skills often are not matured until age eight or later, it also has been reported that 75 per cent of the children enrolled in the caseloads of public school speech clinicians are in the kindergarten or the first or second grades and that 81 per cent of these children possess functionally defective articulation. This situation in combination with usually excessively large caseloads and concomitant scheduling problems, makes it difficult for the clinician to provide the intensive and individual help often required by the more severely handicapped child. The school speech clinician, as well as the children he serves, could profit in a number of ways if it were possible to differentiate, efficiently and reliably, primary grade children who will master their articulation errors without speech therapy from those who, without therapy, will persist in their errors.

Van Riper and Erickson go on to state the advantage of eliminating those children from therapy who will master their speech sounds without help so that more time could be available for others with more serious speech handicaps, the concomitant advantage being the early identification and treatment of those children who will need help in developing articulation skills before their errors are strongly habituated. Through the Predictive Screening Test of Articulation (See Appendix A.) they propose a "standardized technique for the differentiation of primary grade children who will master their articulation errors without speech therapy from those who will not" (Van Riper and Erickson, 1968a, p. 3).

In 1967, the author, along with the elementary school speech therapists of the Tacoma Public Schools, provided test data on over

2,000 kindergarten and first grade children to the research team developing the PSTA. This information was utilized and later reported by Van Riper and Erickson as normative data in their final report on the Predictive Screening Test of Articulation published by the Office of Education, U. S. Department of Health, Education, and Welfare (1968a).

Approximately 1,000 boys and girls at the first grade level were tested in the fall of 1967. These youngsters entered the third grade in the fall of 1969 and provided a rich resource for continued research with the PSTA. They form the base population for this study and the reason for its being.

CHAPTER II

REVIEW OF THE LITERATURE

Prognostic testing promises to allow the speech therapist to identify the children who will not improve without speech therapy. In the context of articulation therapy, specifically functional articulation therapy, prognostication refers to a forecast of the articulatory skills of a child at some later date.

Numerous studies have shown that children improve their articulation skills as they grow older, without the aid of speech therapy services. According to Carter and Buck (1958), when a speech therapist makes the initial school survey, the heaviest concentration of speech defects will be found in the first grade. It would seem to be axiomatic that if all these children are accepted for therapy the caseload becomes so great that children with more serious problems or children in the upper grades become neglected.

In a study reported in 1942, Roe and Milisen attempted to determine the effect of maturation upon defective articulation in the elementary grades. They tested 1,989 children in grades one through six. All children in a grade level were included. Results showed that

the mean number of speech errors decreased as the grade level increased. A large number of distorted sounds were found in all grades, and the authors felt that while maturation eliminates some errors a significant number of children continue to have articulation difficulties. They recommended that sound discrimination and speech improvement procedures are needed in all grades in order to improve the speech of the majority of children. Further, the authors felt their study could serve as a standard of maturation for speech sounds according to grade levels, advising speech therapists to determine a subject's level of speech sound achievement to demonstrate amount of retardation shown and to a lesser degree the amount of improvement to be expected with no speech training.

One solution to the problem of difficulty in accurately predicting which primary children should receive speech therapy would be to limit speech therapy services for functional articulation errors to only those children in grades above the primary level thereby waiting for maturation to take full effect. Studies by Nichols (1964) and Jordan (1960) help explain why this solution has not proven acceptable to many professionals in the field of speech therapy.

Based on learning theory and child development, Nichols argues that therapy should begin as early as possible, for children may learning defective articulation by practicing it daily thereby habituating faulty speech patterns. Some children, it would seem, not only do not

grow out of their immature articulations, but more firmly grow into them. Nichols also points out that the longer faulty speech is used, the more habituated it becomes and the more difficult it will be to remediate.

Jordan emphasizes the need for early initiation of speech therapy from a psychological viewpoint, maintaining that defective articulation is likely to produce an adverse effect on the personality caused in the main by emotional reactions of listeners. Therapy, therefore, is recommended as soon as possible to reduce misarticulations in the shortest time possible in order to minimize the possibility of damage to the individual's self-esteen.

Snow and Milisen (1954a) reported information of relevance to prognostication, concerning the direction of progress toward correction of a defective sound. They noted that, although a sound does not necessarily go through each step, the general trend is from omission to substitution to indistinctness. It could be inferred, then, that the type of articulatory error made might reflect a stage of development relevant to unassisted correction and have predictive implication.

In another study, Snow and Milisen (1954b) established the importance of stimulation in regard to both evaluation of articulation and predictive testing. The study compared responses first and

second grade children made to spontaneous pictorial tests and oral stimulation-type tests. Noting the difference between a child's responses to a spontaneous (picture) test and a stimulation (oral) test could have very good predictive value; that is, a better result with stimulation indicated a greater chance of unassisted improvement in speech at a time of later testing.

Carter and Buck (1958) attempted to devise a prognostic articulation test for first grade children with defective speech. Testing was three-fold, including spontaneous responses, stimulation, and nonsense syllable forms of articulation evaluation. Results included a high degree of relationship between the percentage of correction made on the nonsense syllables test with accuracy of prediction of overcoming articulation deficiency. The authors suggest the ability to correct articulation errors instantaneously is indicative of the degree of speech maturation.

Tests were devised by Steer and Drexler (1960) and used in their longitudinal study of the effect of maturation on young speech defective children. At the kindergarten level they found the measurement of several variables as having predictive value: (1) the total number of errors in all positions within words, (2) errors in the final position, (3) errors of omission in the final position, and (4) errors in certain consonant groups. This study concluded by suggesting that by

testing children at the beginning of the kindergarten year and again in the spring, a clinician could determine which children to choose for inclusion in therapy by noting which children showed little or no improvement during that period of time.

In an effort to determine the relationship of articulatory skill to a child's auditory discrimination ability, Farquhar (1961) conducted research to investigate the prognostic implications of such. Tests of auditory discrimination included ability of the child to discriminate the correct form of the misarticulated sound among vowels, among acoustically dissimilar sounds, and among acoustically similar sounds. Imitative articulation testing consisted of the child's ability to reproduce after the examiner the correct form of his misarticulated sound in isolation, in nonsense syllables, and in words. The study showed that auditory discrimination tests did not indicate prognostic significance, but imitative tests did indicate prognostic significance, suggesting the speech clinician may utilize the imitation of words and nonsense syllables as prognostic tools.

Dickson (1962) also found that the predictive value of speech sound discrimination appears to be minimal in a study which concluded that there might be a positive relationship between gross motor ability and production of complex sound patterns and that a motor deficit may be related to functional articulation errors.

Agreeing with Nichols (1964), Valeska (1966) concludes, in a paper dealing with prognostication, that two factors appear to have predictive value: phonemes in error and correction of errors on nonsense syllable tests. A formula which takes into account both factors could result in a higher validity of prediction.

Dallman (1968) conducted an experimental study of the effect of stimulation in the prognosis of defective articulation. This study was successful in predicting which first grade children would show spontaneous improvement in their defective articulation over a six-month period. Those children showing responsiveness to an auditory and visual stimulation test, that is, improvement between standard articulation testing and stimulation testing tended to show more spontaneous improvement in speech.

Aided by the findings of many of the studies previously reported here, Van Riper (1966) followed by Van Riper and Erickson (1968a, 1968b, 1969) engaged in research over a period of several years in the development, standardization and cross-validation of their prognostic test, the Predictive Screening Test of Articulation (PSTA).

According to Van Riper (1966), the 47-item PSTA was refined from an original pool of items numbering 500, which were obtained from a survey of available literature plus interviews with experienced speech therapists. A large number of these original items

were eliminated as being inappropriate for use with first graders, too time consuming or difficult to score simply and objectively. Further refinements occurred after experimental testing in 1962 and 1964, eliminating all but those items which differentiated or prognosticated well between first grade children who would require speech therapy and those who would not; finally, only those items requiring no special materials for their administration were selected for inclusion in the PSTA.

The final form of the PSTA, described by Van Riper and Erickson (1969), contains a majority of items, 38 out of 47, which involve evaluation of the subject's imitative responses to stimulus words that are commonly found in typical articulation tests; the subject is also required to imitate isolated phonemes and nonsense syllables, repeat a six-word sentence, recognize the misarticulation of a consonant in a word, and demonstrate ability to clap hands in replication of a simple rhythm pattern. The PSTA can readily be given in a standardized way, involves only pass-fail judgments for each item, and requires between five and ten minutes to give and score.

In discussing the interpretation of the PSTA score result, Van Riper and Erickson (1968b, p. 4) state:

> A cut-off score of 34 minimizes both types of errors: those due to children predicted as being able to overcome their errors without therapy but who actually do not (false

> negative errors), and those due to children predicted as still having errors on third grade entrance who instead will be error free (false positive errors).

They go on to point out that the final selection of a cut-off score may vary with the needs and orientation of individual therapists and the nature of their speech and hearing programs. Higher or lower cut-offs result in an increase or decrease in the number of children included in speech therapy. They counsel that the recommended cut-off score of 34 should be regarded as tentative until it is demonstrated as an optimal one in a given therapy situation. The subjects of the final cross-validation study, which established the cut-off score, numbered 144.

In their final report of the cross-validation of the PSTA, Van Riper and Erickson (1968a, p. 22) conclude:

> From the results of this study it can be concluded that the predictive validity of the Predictive Screening Test of Articulation has been demonstrated . . . Through the use of this instrument and the appropriate cut-off score the clinician can expect to identify approximately 63 per cent of those first-graders who will not require therapy in order to be free of articulation errors in two years and 70 per cent of those first-graders who will continue to have misarticulations for at least two years.
>
> It is no longer necessary to regard the PSTA as an experimental instrument, for evidence of its clinical applicability has been presented in this cross-validation study. The PSTA, of course, is not a perfect predictor; nor should any technique for predicting human behavior be expected to be perfect. Out of every 100 children with misarticulations who are subsequently classified on the basis of PSTA scores,

it can be expected that 15 whose misarticulations will persist for two years and 18 whose errors will be overcome spontaneously may be misclassified. This margin of error, though, is quite tolerable; it is, in fact, a remarkably small error when one considers the ease, economy, reliability and convenience afforded by a standardized test. . . . Clearly, then, the PSTA can be viewed as a useful addition to the clinician's diagnostic armamentarium.

CHAPTER III

PROCEDURES

Selection of Subjects

The base population for this study was that segment of all third grade children enrolled in September of 1969 in the public schools of Tacoma, Washington, who had been previously tested with the Predictive Screening Test of Articulation as first graders in September of 1967. This segment potentially numbered 971 (487 girls and 484 boys). This base population of nearly 1,000 was the first grade portion of the total kindergarten and first grade group that Van Riper and Erickson (1968) utilized as "normative" data in their research leading to the publication of the Predictive Screening Test of Articulation.

Every effort was made to locate all of the 971 children tested in 1967 who remained in the Tacoma Public Schools in 1969. A total of 612 were located and identified for the follow-up purposes of this study. Seven of these were eventually eliminated because of the unavailability of complete data, leaving a sample of 605 (303 girls and 302 boys) for this study.

In relationship to the selection and utilization of subjects, it is important to emphasize that the 1969 sample was derived from the 1967 base population which was essentially a normal population, excluding only those children with a known hearing loss, obvious organic disorders, and/or current or previous speech therapy services; these exclusions were made at the request of the authors of the PSTA. The 605 subjects of this study (62% of the 971 first grade children tested in 1967) differ from Van Riper's and Erickson's cross-validation subjects in that the subjects of this study can be considered representative of a large cross-section of children normally to be found in first grade classrooms. This difference must be stressed, since the cross-validation of the PSTA by Van Riper and Erickson (1968a) was not based on a normal population, that is, the articulation of the children included in their study had been previously judged by a "state certified speech clinician" to be sufficiently defective to warrant enrollment in a "state reimbursed therapy program."

Administration of Tests

The central factor to be examined for each of the 605 children in the study was the presence or absence of an articulation defect as of the fall of 1969. To ascertain this, a three-fold diagnostic procedure was employed as needed: (1) the PSTA was re-administered as an initial indicator of articulatory defect, (2) clinical evaluation by the

examining speech therapist, and (3) administration of the Photo Articulation Test (PAT) by Pendergast, Dickey, Selmar, and Soder (1969) for substantiation of therapist judgment. It was assumed that trained speech therapists were competent to readily diagnost the presence or absence in a third grade pupil of an articulation problem.

All testing was accomplished by the elementary school speech therapists of the Tacoma Public Schools under the direction and supervision of the writer. Training sessions were held to insure consistency in the administration, scoring and interpretation of test instruments, as well as judgments pertaining to articulatory defects. (See Appendix B.) Testing was completed during a two-week period in September of 1969.

Obtaining Supplementary Data

In order to fulfill the secondary purposes of this study, data in several areas were collected. These included (1) sex, (2) age, (3) intellectual functioning, and (4) socio-economic status.

In addition, another question was deemed critical to answer in regard to each subject: Had the child been included in speech therapy since the fall of 1967? The knowledge of the influence of this factor became necessary since the 1967 base population had not been excluded from consideration for inclusion in speech therapy classes during the two-year interval.

The elementary school speech therapists of the Tacoma Public Schools served as collectors of all supplementary data used in this study under the direction and supervision of the writer.

Sex. Information relative to the subject's sex was available from the records of the base population; however, a careful check was made to insure that no clerical errors had been made and to eliminate any possible error due to given names commonly used by both sexes.

Age. Chronological age of the subject was recorded in months, figured to the nearest month, and computed as of the 1967 administration of the PSTA to the base population. The 1967 testing date was selected simply because that age is more relevant to the prognostic intent of the PSTA, though use of the 1969 testing date would have uniformly added twenty-four months to each subject's age with similar relative values obtained for comparison purposes.

Intellectual Functioning. The Lorge-Thorndike Intelligence Test (1962), a standardized group test of intellectual functioning, is given annually to all first graders in the Tacoma Public Schools. The raw score and several derived score results are entered in each child's permanent record. The raw score result of the Lorge-Thorndike was selected for use in this study.

Socio-economic Status. A single rating from one through seven denoting socio-economic status (SES) was obtained on each subject, using occupation of head of the household for classification, according to Warner, et al. (1960). In Warner's Scale a rating of one denotes the highest socio-economic level, and seven the lowest socio-economic level. To insure as high a degree of accuracy of rating as possible in this sensitive area, special training for the data collectors was provided by the Director of Research for the Tacoma Public Schools and the writer.

Therapy. The question of whether or not a child had been included in speech therapy services for the period of September, 1967, through September, 1969, was relatively easy to accurately answer. First, most examiners had personal knowledge of the therapy status of the children they tested, and, second, permanent records including annual speech and hearing services' reports were used for verification.

CHAPTER IV

ANALYSIS OF DATA

The major purpose of the present study was to conduct a test of the validity of the Predictive Screening Test of Articulation. Does the PSTA identify those first grade children who will master their articulation errors by the time they enter the third grade? And, conversely, does the PSTA identify those first grade children who will not master their articulation errors, without speech therapy, by the time they enter the third grade? Or, to re-phrase the thesis question and its corollary in one question: Does the PSTA predict as expected?

Secondary purposes of the study included assessment of the possible effects of sex, age, intellectual functioning, and socio-economic status on the predictive value of the PSTA.

In order to achieve these purposes, the study sample was identified (605 third grade children who had been tested with the PSTA as first graders) and these procedures followed: (1) each child was evaluated to determine if an articulatory error persisted at the third grade level, with care taken to determine if the child had received

speech therapy services in the intervening two-year period, and (2) data was gathered on each child relative to sex, age, intellectual functioning and socio-economic status.

Treatment of Data

After all factors had been determined on each of the 605 subjects, the data was coded for computer analysis by the Data Processing Service of the Tacoma Public Schools. Coding was as follows: field or variable (1), sex, male = 1, female = 2; variable (2), chronological age, in months at the time of the 1967 PSTA administration, 6 years 2 months = 74; variable (3) 1967 PSTA score, 0 - 47; variable (4), 1969 PSTA score, 0 - 47; variable (5), speech therapy service intervening since 1967, No = 1, Yes = 2; variable (6), defective articulation as of 1969?, No = 1, Yes = 2; variable (7), intellectual functioning, two digit raw score result of the Lorge-Thorndike; variable (8), socio-economic status, 1 - 7; plus an identifying number for each child, yielding name, school, teacher, and name of examiner. (See Appendix C.)

Information in eight fields or variables was presented for computer analysis. Basically, one multi-faceted computer analysis procedure was employed for the purposes of this thesis: Step-Wise Multiple Regression, a statistical process outlined by Ferguson (1966, pp. 390-396). From this procedure the following were

obtained: (1) means and standard deviations of the eight variables (See Appendix D.), (2) a correlation matrix (See Tables 1 and 6.), and (3) regression coefficients of correlation and other statistics for each step of regression (See Table 7.). The latter is the end purpose of Step-Wise Multiple Regression, performing an analysis for a dependent variable (variable 6, the question of defective articulation as of the third grade) and a set of independent variables (variables 3, 2, 7, 8, and 1, defined previously); at each step the variable entered into the regression equation is that which explains the greatest amount of variance between it and the dependent variable; in other words, the variable with the highest partial correlation with the dependent variable.

Voluminous amounts of additional statistical information were obtained through computer analysis, but are not reported here due to factors of time, immediate applicability, and relative importance. These data are available to any serious researcher from the author.

The facilities of data processing were also used to obtain information relative to frequency distribution of data on several variables and variables in combination and relationship to each other. This information is reported principally in the several Tables of Expectancy and in Appendix E. For purposes of interpretation of the

Tables of Expectancy, it must be emphasized that Van Riper and Erickson's recommended cut-off score of 34 was employed in their development. That is, a child scoring 34 or more on the PSTA in the first grade is expected to master his articulation errors by the third grade, without speech therapy, while a child scoring 33 or less on the PSTA in the first grade is not expected to master his articulation errors by the third grade without speech therapy.

Analysis of the Validity of the PSTA

Intercorrelations of Variables. Table 1 presents the intercorrelations of three variables, variable (3), PSTA score of 1967; variable (5), speech therapy since 1967; and variable (6), defective articulation as of 1969, one of which may have the greatest relevance to the thesis question: Does the PSTA predict as expected? All correlations in Table 1 are significant beyond the .001 level of confidence.

The correlation between 1967 PSTA score and defective articulation in 1969 of - 0.50 is the clearest indication from the correlations derived from this study of the validity of the PSTA as measured by this study. This negative correlation, showing an inverse relationship, indicates that a high score on the PSTA will result in a low probability of defective articulation, and, conversely, a low score on the PSTA will result in a high probability of defective speech. In

TABLE 1

INTERCORRELATIONS OF 1967 PSTA SCORE, DEFECTIVE SPEECH IN 1969, AND INTERVENING SPEECH THERAPY

	P '67	Th.	D '69
P '67	1.00	-0.71	-0.50
Th.		1.00	0.56
D '69			1.00

(All significant beyond the .001 level of confidence.)

both instances the probability is predicated on a two-year interval after test administration, the intent of the PSTA and the actuality of this research project.

Although the correlation of - 0.71 between the 1967 PSTA score and the factor of intervening speech therapy (the question of inclusion of the child in speech therapy classes during the two-year interval between 1967 testing and 1969 evaluation) may not strictly be considered statistical evidence of the validity of the Predictive Screening Test of Articulation, it is a significant result of the study. The correlation is a negative one, implying an inverse relationship, which means that a high score on the PSTA will result in a low probability of the child having been placed in active speech therapy, and, conversely, a low score on the PSTA will result in a high probability of the child having been placed in active speech therapy. This - 0.71 correlation demonstrates the degree of agreement between therapist judgment of the need for speech therapy of children in the study sample and the prediction of the PSTA of the need for such. This correlation assumes more interest, perhaps significance, when the two following factors are taken into consideration: (1) therapist judgments of the need for speech therapy took place at any time during a two-year period through usual screening and referral procedures without knowledge that any comparison was ever to be made and without reference

in any way to a PSTA score, and (2) the therapists of the Tacoma Public Schools, as well as the writer, were unaware of the cut-off score of the PSTA; in fact, knowledge that the cut-off score for the PSTA had been determined to be 34 was not received by the author until nearly a year after the 1967 testing.

Frequency Distribution of Critical Data. A comparison of the score result of the 1967 PSTA administration with the determination of whether or not the child had defective articulation in 1969 is critical in the process of answering the primary question of the study: Does the PSTA predict as expected? Do children who score 34 or more on the PSTA in the first grade tend to have acceptable articulation by the time they enter the third grade? Do children who score 33 or less on the PSTA in the first grade still have defective articulation by the time they enter the third grade?

In this study, the factor of intervening speech therapy is also critical in determining if the PSTA predicts as expected. To exclude nearly a thousand children from all possibility of receiving speech therapy assistance for a period of two years might have been scientifically desirable, but could hardly be considered other than unthinkable; therefore, this uncontrolled intervening variable can only be dealt with and reported as objectively as possible.

The three variables--1967 PSTA score, intervening speech therapy, and the question of articulatory defect in 1969--are recorded

in the frequency distribution tables (See Tables 2 and 4). The same three variables were used to determine the Tables of Expectancy contained herein.

In Table 2 the data is presented with the 1967 PSTA score reported only in terms of whether it was "34 or more" or "33 or less," then the PSTA score is related to variables of intervening speech therapy and the question of defective speech in 1969; the numerical frequency of children in each category is given, plus the per cent of the total study population they represent. The questions of "therapy" and "defective" are answered yes or no as the case may be, and it should be noted that for a PSTA score of "34 or more" (or "33 or less") there are four possible patterns resulting from combination with the other two variables: Yes-Yes, Yes-No, No-Yes, and No-No. For example, at the PSTA score of "34 or more" with a No-No pattern (No speech therapy, No defective speech in 1969), 479 children fell in this category, representing 79.17% of N = 605.

For purposes of answering more definitively whether the PSTA predicts as expected, an expectancy table was computed from the information in the frequency table described above. Table 3 is constructed with a two score division (34 or more, 33 or less) to the 1967 PSTA administration; "Yes" or "No" designations having reference to accurate or inaccurate prediction by the PSTA of need for speech therapy by the third grade. "Yes" and "No" designations

TABLE 2

FREQUENCY DISTRIBUTION OF STUDY SAMPLE ACCORDING TO 1967 PSTA SCORE, COMBINED WITH THE QUESTIONS OF INTERVENING SPEECH THERAPY AND DEFECTIVE ARTICULATION IN 1969 (TWO SCORE GROUPS)

	'67 PSTA	Th	D '69	f	%
(1)	34 or more	Yes	Yes	8	1.32
(2)	34 or more	Yes	No	19	3.14
(3)	34 or more	No	Yes	8	1.32
(4)	34 or more	No	No	479	79.17
(5)	33 or less	Yes	Yes	37	6.12
(6)	33 or less	Yes	No	36	5.95
(7)	33 or less	No	Yes	2	.33
(8)	33 or less	No	No	16	2.64
				605	100.00

'67 PSTA = Score on 1967 PSTA administration.
Th = Question of intervening speech therapy.
D '69 = Question of defective articulation.
f = Number of children falling in classification.
% = Per cent of study population represented.

TABLE 3

EXPECTANCY TABLE

1967 PSTA	DOES THE PSTA PREDICT AS EXPECTED? Yes	No
34 or more	479	35
N = 514	93.19	6.81
33 or less	75	16
N = 91	82.42	17.58
Total	554	51
N = 605	91.57	8.43

for this expectancy table, and for all other expectancy tables contained in this study, were determined from the frequency table in the following manner: (1) 34 or more -- Yes-Yes from the frequency table (Table 2), that is, subjects who scored 34 or more on the 1967 PSTA and who had received intervening speech therapy and whose speech had been judged defective in 1969, were considered as not fulfilling the expectancy of the test and were placed in the "No" column of the expectancy table; therapy had intervened, but speech was still defective, tending to indicate therapist judgment was correct and without therapy the subject's articulation would have been considered defective; a reasonably clear indication the PSTA was not predicting as expected in this instance. (2) 34 or more -- Yes-No from the frequency table, that is, subjects who scored 34 or more on the 1967 PSTA and who had received intervening speech therapy and whose speech had not been judged defective in 1969, were considered as not fulfilling the expectancy of the test and were placed in the "No" column of the expectancy table; therapy had intervened, but speech was no longer defective and since it was impossible to weigh in the balance with statistical preciseness whether or not therapeutic intervention was justified, therapist judgment was given additional weight, and a margin of error was introduced with the mark of the PSTA being measured stringently; a fairly clear indication the PSTA was not predicting as expected in this instance. (3) 34 or more -- No-Yes from the frequency table, that is, subjects who

score 34 or more on the 1967 PSTA and who had not received intervening speech therapy and whose speech had been judged defective in 1969, were considered as not fulfilling the expectancy of the test and were placed in the "No" column of the expectancy table; a very clear indication the PSTA was not predicting as expected in this instance, since a score of 34 or more predicts normal articulation at the beginning of the third grade. (4) 34 or more -- No-No from the frequency table, that is, subjects who scored 34 or more on the 1967 PSTA and who had not received intervening speech therapy and whose speech had been judged as not defective in 1969, were considered as fulfilling the expectancy of the test and were placed in the "Yes" column of the expectancy table; a very clear indication the PSTA was, indeed, predicting as expected in this instance. (5) 33 or less -- Yes-Yes from the frequency table, that is, subjects who scored 33 or less on the 1967 PSTA and who had received intervening speech therapy and whose speech had been judged defective in 1969, were considered as fulfilling the expectancy of the test and were placed in the "Yes" column of the expectancy table; therapy had intervened and speech was still defective, tending to indicate therapist judgment was correct and without therapy the subjects' articulation would have been considered defective; a reasonably clear indication the PSTA was predicting as expected in this instance, since a score of 33 or less on the PSTA purports to predict articulation will remain defective without therapy.

(6) 33 or less -- Yes-No from the frequency table, that is, subjects who scored 33 or less on the 1967 PSTA and who had received intervening speech therapy and whose speech had been judged not defective in 1969, were considered as fulfilling the expectancy of the test and were placed in the "Yes" column of the expectancy table; therapist judgment and the general score level were given consideration with the proposition accepted that without speech therapy articulation would have been judged defective; a fairly clear indication that the PSTA was predicting as expected in this instance. (7) 33 or less -- No-Yes, from the frequency table, that is, subjects who scored 33 or below on the 1967 PSTA and who had not had intervening therapy and whose speech had been judged defective in 1969, were considered as fulfilling the expectancy of the test and were placed in the "Yes" column of the expectancy table; at this score level, a very clear indication the PSTA was predicting as expected in this instance. (8) 33 or less -- No-No from the frequency table, that is, subjects who scored 33 or below on the 1967 PSTA and who had not received intervening speech therapy and whose speech had been judged not defective in 1969, were considered as not fulfilling the expectancy of the test and were placed in the "No" column of the expectancy table; a very clear indication the PSTA was, indeed, not predicting as expected in this instance, since a score of 33 or less on the PSTA purports to predict the need for speech therapy to overcome defective articulation.

With the process of construction of the expectancy table in mind, including the inherent strengths and weaknesses of that process, Table 3 provides clinically usable information about the validity of the PSTA by answering the question of whether the PSTA predicts as it is expected to predict. Over-all, for the total study sample (N = 605), the PSTA predicts as expected for 554 (91.57%) and not as expected for 51 (8.43%). For those subjects scoring 33 or less (N = 91) the PSTA predicts as expected for 75 (82.42%) and not as expected for 16 (17.58%). For those subjects scoring 34 or more (N = 514) the PSTA predicts as expected for 479 (93.19%) and not as expected for 35 (6.81%).

Tables 4 and 5, a frequency and expectancy table respectively, present the same basic information contained in Tables 2 and 3, with the refinement of the 1967 PSTA score divided into eight sections (27 or less, 28-29, 30-31, 32-33, 34-35, 36-37, 38-39, and 40 or more) rather than the previous dichotomous sections (34 or more; 33 or less). The distribution of subjects according to their PSTA score level can be seen more definitively in these tables and the relative accuracy of the PSTA at different score levels can be assessed. For example in Table 4, 9 subjects with a 1967 PSTA score of 34-35, who had not received intervening speech therapy and whose speech was not judged defective in 1969, represent 1.48% of the sample, while 431 subjects with a 1967 PSTA score of 40 or more (with the same pattern

TABLE 4

FREQUENCY DISTRIBUTION OF STUDY SAMPLE ACCORDING TO 1967 PSTA SCORE, COMBINED WITH THE QUESTIONS OF INTERVENING SPEECH THERAPY AND DEFECTIVE ARTICULATION IN 1969

'67 PSTA	Th	D '69	f	%
40 or more	Yes	Yes	1	.17
40 or more	Yes	No	10	1.65
40 or more	No	Yes	4	.66
40 or more	No	No	431	71.24
38 - 39	Yes	Yes	4	.66
38 - 39	Yes	No	3	.50
38 - 39	No	Yes	2	.33
38 - 39	No	No	23	3.80
36 - 37	Yes	Yes	2	.33
36 - 37	Yes	No	1	.17
36 - 37	No	Yes	1	.17
36 - 37	No	No	16	2.64
34 - 35	Yes	Yes	1	.17
34 - 35	Yes	No	5	.83
34 - 35	No	Yes	1	.17
34 - 35	No	No	9	1.48

TABLE 4 (Continued)

'67 PSTA	Th	D '69	f	%
33 - 32	Yes	Yes	7	1.16
33 - 32	Yes	No	6	.99
33 - 32	No	Yes	0	0.0
33 - 32	No	No	6	.99
31 - 30	Yes	Yes	5	.83
31 - 30	Yes	No	8	1.32
31 - 30	No	Yes	1	.17
31 - 30	No	No	6	.99
29 - 28	Yes	Yes	7	1.16
29 - 28	Yes	No	6	.99
29 - 28	No	Yes	0	0.0
29 - 28	No	No	1	.17
27 or less	Yes	Yes	18	2.98
27 or less	Yes	No	16	2.64
27 or less	No	Yes	1	.17
27 or less	No	No	3	.50
			605	100.00

TABLE 5

EXPECTANCY TABLE

1967 PSTA	DOES THE PSTA PREDICT AS EXPECTED? Yes	No
40 or more	431	15
N = 446	96.6	3.4
38 - 39	23	9
N = 32	71.9	28.1
36 - 37	16	4
N = 20	80.0	20.0
34 - 35	9	7
N = 16	56.2	43.8
32 - 33	13	6
N = 19	68.4	31.6
30 - 31	14	6
N = 20	70.0	30.0
28 - 29	13	1
N = 14	92.9	7.1
27 or less	35	3
N = 38	92.1	7.9
Total	554	51
N = 605	91.6	8.4

of therapy and defective speech) represent 71.24% of the sample. In Table 5, an expectancy table, the predictive accuracy of the PSTA is measured at each of eight levels of 1967 test score. For example, at the 34-35 score level the PSTA appears to predict as expected 56.2% and to predict not as expected 43.8%, while at the 38-39 score level the PSTA appears to predict as expected 71.9% and to predict not as expected 28.1%. Continuing, but below the cut-off score of 34 in this example, at the 32-33 score level the PSTA appears to predict as expected 68.4% and to predict not as expected 31.6%, while at the 28-29 score level the PSTA appears to predict as expected 92.9% with prediction not as expected reduced to 7.1%.

Two separate frequency distribution of subjects according to 1967 PSTA score in relationship to the question of defective articulation in 1969, one including only those children who had received intervening speech therapy and one including only those children who had not received intervening speech therapy, were also prepared to show more clearly the effect of intervening speech therapy on the study sample. This information is presented in Appendices F and G.

Relationship of Other Factors to the PSTA

Correlation Matrix. The possible effects of sex, age, intellectual functioning and socio-economic status on the predictive functioning of the Predictive Screening Test of Articulation have been

delineated as the secondary purposes of this study. Correlations of all eight variables in the study are presented in Table 6. The following correlations with the 1967 PSTA score are noted:

Sex. Correlation of .10 (significant at the .01 level of confidence) indicating a tendency of females to score high on the PSTA.

Age. Correlation of .01, indicating appreciably nothing; of course, the age range was small since all subjects were beginning first graders.

Intellectual Functioning. Correlation of .14 (significant at the .001 level of confidence), indicating a tendency for children with high Lorge-Thorndike raw scores to score high on the PSTA.

Socio-economic Status (SES). Correlation of -.07, indicating a slight inverse relationship, that is, those who have low scores on SES (high socio-economic status) tend to score high on the PSTA.

A total of 28 inter-correlations are shown in the correlation matrix, some of which have been previously discussed in this chapter, all of which have varying degrees of relevance to the study, but which are mostly minor or of secondary interest and will not be discussed. However, one factor merits consideration; the 1969 administration of

TABLE 6

CORRELATION MATRIX OF STUDY VARIABLES

	Sex	C. A.	P '67	P'69	Th	D '69	L-T	SES
Sex	1.00	-0.05	0.10	0.12	-0.07	-0.04	-0.01	0.01
C. A.	-0.05	1.00	0.01	-0.04	0.03	0.07	0.03	0.13
P '67	0.10	0.01	1.00	0.51	-0.71	-0.50	0.14	-0.07
P '69	0.12	-0.04	0.51	1.00	-0.44	-0.70	0.19	-0.09
Th	-0.07	0.03	-0.71	-0.44	1.00	0.56	-0.06	0.01
D '69	-0.04	0.07	-0.50	-0.70	0.56	1.00	-0.12	0.04
L - T	-0.01	0.03	0.14	0.19	-0.06	-0.12	1.00	-0.23
SES	0.01	0.13	-0.07	-0.09	0.01	0.04	-0.23	1.00

Correlations at or above .08 are Significant at .05 Level of Confidence.

Correlations at or above .10 are Significant at .01 Level of Confidence.

Correlations at or above .132 are Significant at .001 Level of Confidence.

the PSTA correlated with the 1967 administration of the PSTA with a correlation of .51 (significant at the .001 level of confidence), reflecting a reliability measure of the PSTA which is noteworthy when an elapsed period of two years between test administrations is emphasized.

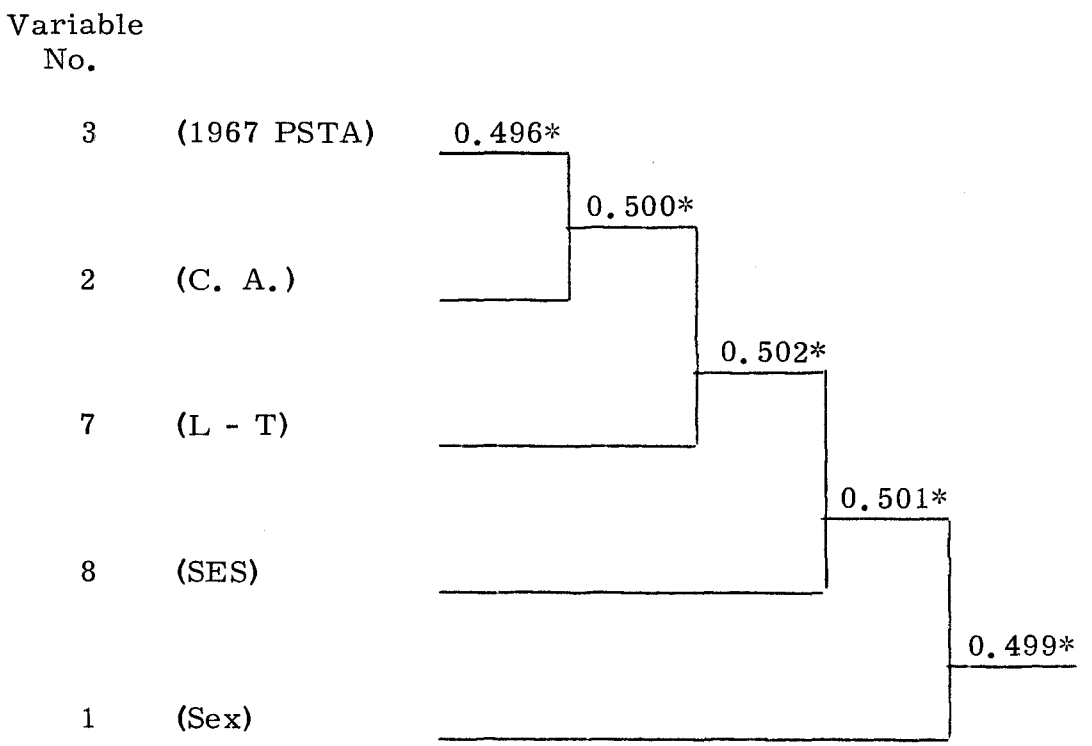
Multiple Regression Coefficients. In Table 7 is presented the data obtained from the Step-Wise Multiple Regression, described on page 20, showing the multiple correlations of independent variables (1967 PSTA score, age, Lorge-Thorndike score, socio-economic status rating, and sex) with the dependent variable (the question of defective speech as of 1969). The independent variable 3 (1967 PSTA) has the greatest relationship to the dependent variable (defective or non-defective speech in 1969), a correlation of .496, and was thus selected first. In an additive way, multiple-variable correlations in regressive relationship are shown: (1) 1967 PSTA plus age correlated with the question of defective or non-defective speech in 1969 (D '69) equals .500; (2) 1967 PSTA plus age plus Lorge-Thorndike score (L - T) correlated with D '69 equals .502; (3) 1967 PSTA plus age plus L - T plus socio-economic status (SES) correlated with D '69 equals .501; (4) 1967 PSTA plus age plus L - T plus SES plus sex correlated with D '69 equals .499. The correlations were given here in three decimal places only to emphasize the relative lack of effect of the variables of

TABLE 7

MULTIPLE CORRELATION OF SELECTED INDEPENDENT VARIABLES WITH THE DEPENDENT VARIABLE: DEFECTIVE SPEECH AS OF 1969

SELECTION SEQUENCE FOR THE INDEPENDENT VARIABLES THAT RELATE, IN COMBINATION, TO THE FOLLOWING DEPENDENT VARIABLE:

DEFECTIVE SPEECH AS OF SEPTEMBER, 1969
N = 605 (303 Girls, 302 Boys)



* Coefficient of Multiple Correlation adjusted for degrees of freedom.

age, Lorge-Thorndike score, socio-economic status and sex on the determination (in combination with the 1967 PSTA) of defective or non-defective speech in 1969. Each correlation if rounded to two decimal places would have equaled .50, which is the rounded correlation of 1967 PSTA to D '69.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The major purpose of the study was to conduct a validation assessment of the Predictive Screening Test of Articulation (PSTA). Does the PSTA predict as it is expected to predict? Specifically: Does the PSTA predict accurately which first graders will have acceptable articulation skills at the beginning of third grade? Does the PSTA predict accurately which first graders will not have acceptable articulation skills at the beginning of third grade?

Secondary purposes of the study included assessing the possible effects of sex, age, intellectual functioning, and socio-economic status upon the PSTA and its subsequent predictive value.

The subjects of this study were 605 (303 girls and 302 boys) beginning third grade children in 1969 of a base population of 971 who had been tested with the PSTA in 1967 as beginning first grade pupils. All subjects were evaluated by the elementary speech therapists of the Tacoma Public Schools to determine the presence or absence of defective articulation as of the fall of 1969. The same examiners

gathered data relative to age, sex, intellectual functioning level, and socio-economic status of each subject, plus information as to whether or not the subject had been included in speech therapy services during the intervening two years.

The factor of possible speech therapy service to any of the subjects reflects the principal limitation of the study. To eliminate the base population from any consideration of inclusion in speech therapy for a period of two years was not considered possible or desirable; therefore, this intervening variable was dealt with in a reasonable manner in judging whether the PSTA was in these instances predicting as expected. Briefly, three factors were given varying weights in the decision process: (1) score of the 1967 administration of the PSTA, (2) whether or not speech was considered defective in 1969, and (3) speech therapist judgment in scheduling the subject for therapy sometime during the two-year period, 1967-69. For a full discussion of this process, see Chapter III, Analysis of Data.

Conclusions

After the completion of testing and the accumulation of secondary information, the data were analyzed and the following conclusions appear warranted:

1. Within the limitation of the study design, and for the study sample, the Predictive Screening Test of Articulation has been

demonstrated to be a valid test. Using the test authors' recommended cut-off score, the PSTA does predict as it purports to predict within tolerable limits of error. This study provides additional evidence of the usefulness of the PSTA as a valuable clinical tool in prognostics and in make-up of therapy caseloads at the first grade level. Moreover, the PSTA has now been validated on an essentially normal population, representative of children usually to be found in first grade classrooms; the study sample used by the authors of the test was not a normal population, their subjects having been previously judged as having articulatory defects. Specifically, the PSTA predicts as expected for 91.57% of the entire study sample; for that portion of the study sample falling at or above the cut-off score of 34 (predicting no need for speech therapy by third grade), the PSTA predicted as expected for 93.19%; and, for that portion of the study sample falling below the cut-off score of 34 (predicting need for speech therapy), the PSTA predicted as expected for 82.42%.

2. The factors of sex, age, intellectual functioning level, and socio-economic status, as measured in this study, had negligible effect on the predictive value of the PSTA. Certain of these variables in correlation with the 1967 PSTA score (or in correlation with the question of defective speech in 1969) resulted in information of some interest from a clinical point of view. However, in multiple correlation with the 1967 PSTA result against the dependent variable of

defective speech in 1969 there were no significant differences, as the rounded multiple correlations remained the same in each instance (.50) as the rounded correlation of the 1967 PSTA with defective speech in 1969.

Recommendations

On the basis of the findings of this study, the following recommendations appear reasonable:

1. The study should be replicated with intervening speech therapy controlled. A school district which does not have speech therapy services, and is not likely to initiate such within a two-year period, would be an ideal site for PSTA research purposes.

2. A similar study should be undertaken using a kindergarten population to determine the possible effectiveness of the PSTA at this grade level.

3. The feasibility of utilizing para-professionals or paid volunteers, e.g., college students or housewives, in the administration and scoring of the PSTA should be investigated. Speech therapists could readily instruct such assistants in the standardized procedures and simple value judgments necessary for PSTA interpretation; interpretation would remain the province of the professional. Much time now spent in large-scale speech screening could be utilized elsewhere in the speech therapy program.

4. The usefulness of the PSTA could be extended by careful qualitative analysis of the subject's responses to each item. This analysis should be done not only in such obvious areas as lateral emission of a sibilant, but also in (1) patterns of sound errors, individual and cumulative; (2) types of sound errors, such as omission or substitution or indistinctness; (3) intelligibility of speech in words, as compared to sentences, as compared to elicited language while establishing rapport; and (4) comparison of responses to word repetition items with the other tasks of the test. From a qualitative analysis, valuable diagnostic information could be obtained as well as a possible indication of approaches to therapy or an index of expected rate of improvement in therapy.

5. Individual speech therapists will be more or less selective in regard to the numbers of first grade children included in speech therapy as a result of using the PSTA cut-off score employed in this study. Three alternatives are presented for consideration:

Table 8 is an expectancy table (constructed in the same manner as other expectancy tables in this study), revised for a cut-off score of 36 (instead of 34). Use of such a guideline would result in a greater number of first graders being enrolled in speech therapy, with a smaller chance of missing children who will need therapy and a larger chance of including children who might prove not to have needed therapy.

TABLE 8

EXPECTANCY TABLE
(Revised for Cut-off Score of 36)

1967 PSTA	DOES THE PSTA PREDICT AS EXPECTED? Yes	No
40 or more	431	15
N = 446	96.6	3.4
38 - 39	23	9
N = 32	71.9	28.1
36 - 37	16	4
N = 20	80.0	20.0
36 or more	470	28
N = 498	94.4	5.6
34 - 35	7	9
N = 16	43.8	56.2
32 - 33	13	6
N = 19	68.4	31.6
30 - 31	14	6
N = 20	70.0	30.0
28 - 29	13	1
N = 14	92.9	7.1
27 or less	35	3
N = 38	92.1	7.9
35 or less	82	25
N = 107	76.7	23.3
Total	552	53
N = 605	91.2	8.8

Table 9 is an expectancy table revised for a cut-off score of 32. Use of such a guideline would result in a smaller number of first graders being enrolled in speech therapy, with a larger chance of missing children who will need therapy and a smaller chance of including children who might prove not to have needed therapy.

Table 10 is an expectancy table revised for a band concept of cut-off score and is the author's recommendation for a useful, practical, and yet sensitive application of the PSTA to most individual therapist situations and most speech and hearing programs. Use of such a guideline would minimize the immediate chance of including in therapy ch ldren who might not need it, by eliminating from consideration all who score 36 or more; and minimize the immediate chance of excluding from therapy those children who need it, by including all children who score 31 or less. Those children scoring in the band, 32-35, would be held for a decision whether to be included in therapy until subsequent follow-up proved the presence or absence of need. Follow-up should involve consideration of factors affecting communication competency, other than response to a standardized test of articulation alone. Recommended minimal intervals of follow-up for subjects scoring in the band include re-evaluations of the child's articulatory skills by a speech therapist at the end of the first semester of grade one and again at the beginning of second and third grades.

Regardless of what method of determining a first grade therapy caseload may seem desirable for use in a given situation, no

TABLE 9

EXPECTANCY TABLE
(Revised for Cut-off Score of 32)

1967 PSTA	DOES THE PSTA PREDICT AS EXPECTED? Yes	No
40 or more	431	15
N = 446	96.6	3.4
38 - 39	23	9
N = 32	71.9	28.1
36 - 37	16	4
N = 20	80.0	20.0
34 - 35	9	7
N = 16	56.2	43.8
32 - 33	6	13
N = 19	31.6	68.4
32 or more	485	48
N = 533	91.0	9.0
30 - 31	14	6
N = 20	70.0	30.0
28 - 29	13	1
N = 14	92.9	7.1
27 or less	35	3
N = 38	92.1	7.9
31 or less	62	10
N = 72	86.1	13.9
Total	547	58
N = 605	90.4	9.6

TABLE 10

EXPECTANCY TABLE
(Revised for Band Concept of Cut-off)

1967 PSTA	DOES THE PSTA PREDICT AS EXPECTED? Yes	No
40 or more	431	15
N = 446	96.6	3.4
38 - 39	23	9
N = 32	71.9	28.1
36 - 37	16	4
N = 20	80.0	20.0
36 or more	470	28
N = 498	94.4	5.6
34 - 35	9	7
N = 16	56.2	43.8
32 - 33	13	6
N = 19	68.4	31.6
32 - 35	35	
N = 35	5.8 of 605	
30 - 31	14	6
N = 20	70.0	30.0
28 - 29	13	1
N = 14	92.9	7.1
27 or less	35	3
N = 38	92.1	7.9
31 or less	62	10
N = 72	86.1	13.9
Total N = 605		

single criterion--including a PSTA score--should be used as an absolute in determining whether a child should or should not receive speech therapy services. At the very least, the child's level of intelligibility, emotional reactions of the child and others concerned, general language competency of the child, and even pressures exerted by school staff as well as parents, should all be considered before a professionally sound judgment can be reached.

BIBLIOGRAPHY

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Carter, E. T., and M. Buck, Prognostic Testing for Functional Articulation Disorders Among Children in the First Grade. Journal of Speech and Hearing Disorders, 23, 124-133 (1958).

Dallman, J. E., An Experimental Study of the Effect of Stimulation in the Prognosis of Defective Articulation. Unpublished Master's thesis, Central Washington State College, Ellensburg, Washington (1968).

Dickson, S., On Outgrowing Functional Articulation Errors. Journal of Speech and Hearing Disorders, 5, 263-271 (1962).

Farquhar, M., Prognostic Value of Imitative and Auditory Discrimination Tests. Journal of Speech and Hearing Disorders, 26, 343-347 (1961).

Ferguson, G. A., Statistical Analysis in Psychology and Education. New York: McGraw-Hill (1966).

Jordan, E. P., Articulation Test Measures and Listener Ratings of Articulation Defectiveness. Journal of Speech and Hearing Research, 3, 303-319 (1960).

Lorge, I., and Thorndike, R. L., The Lorge-Thorndike Intelligence Tests. Boston: Houghton Mifflin (1954).

Nichols, A. C., Allocation of Time in the Articulation Program: Applications of Research. Asha, 6, 13-17 (1964).

Roe, V., and R. Milisen, The Effect of Maturation Upon Defective Articulation in Elementary Grades. Journal of Speech Disorders, 7, 37-50 (1942).

Snow, K., and R. Milisen, The Influence of Oral Versus Pictorial Presentation upon Articulation Testing Results. Journal of Speech and Hearing Disorders, Monograph Supplement No. 4, 30-36 (1954a).

Snow, K., and R. Milisen, Spontaneous Improvement in Articulation as Related to Differential Responses to Oral and Picture Articulation Tests. Journal of Speech and Hearing Disorders, Monograph Supplement 4, 45-49 (1954b).

Steer, M., and H. Drexler, Predicting Later Articulation Abilities from Kindergarten Tests. Journal of Speech and Hearing Disorders, 25, 391-397 (1960).

Valeska, D. R., Prognostication in Functional Articulation Disorders. Unpublished paper, University of Utah, (1966).

Van Riper, C., A Predictive Screening Test for Children with Articulatory Speech Defects. Cooperative Research Project No. OE-1538, Office of Education, U. S. Department of Health, Education and Welfare (1966).

_____, and R. Erickson, Cross-validation of a Predictive Screening Test for Children with Articulatory Speech Defects. Project No. 6-8717, Office of Education, U. S. Department of Health, Education, and Welfare (1968a).

_____ ___ _____, Predictive Screening Test of Articulation: Manual. Kalamazoo: Continuing Education Office, Western Michigan University (1968b).

_____ ___ _____, A Predictive Screening Test of Articulation. Journal of Speech and Hearing Disorders, 34, 214-219 (1969).

Warner, W. L., Meeker, M., and Eells, K., Social Class in America: A Manual of Procedure for the Measurement of Social Status. Chicago: Science Research Associates, 1949. Republished, New York: Harper (1960).

APPENDIX A

PREDICTIVE SCREENING TEST

OF ARTICULATION:

RESPONSE RECORD SHEET

PREDICTIVE SCREENING TEST OF ARTICULATION: RESPONSE RECORD SHEET

Child's Name _____ Sex ___ Birthdate _____ Total Score _____

Grade ___ School _____ Examiner _____

Record the child's response to each item of the PSTA by circling the 1 if his response is correct or by circling the 0 if his response is incorrect (or if no response is made). Compute the child's "Total Score" by counting the number of items where 1 has been circled. Enter this score in the appropriate space at the top of the response sheet.

Item	Response	Item	Response	Item	Response
Part I		Part III			
1. RABBIT	1 0	18. PRESENTS	1 0	36. SLED	1 0
2. SOAP	1 0	19. BREAD	1 0	37. SPLASH	1 0
3. LEAF	1 0	20. CRAYONS	1 0	38. STRING	1 0
4. ZIPPER	1 0	21. GRASS	1 0	Part IV	
Part II		22. FROG	1 0	39. Sentence	1 0
5. MUSIC	1 0	23. THREE	1 0	Part V	
6. VALENTINE	1 0	24. CLOWN	1 0	40. / s /	1 0
7. TEETH	1 0	25. FLOWER	1 0	41. / θ /	1 0
8. SMOOTH	1 0	26. SMOKE	1 0	Part VI	
9. ARROW	1 0	27. SNAKE	1 0	42. SEESEESEE	1 0
10. BATHTUB	1 0	28. SPIDER	1 0	43. ZOOZOOZOO	1 0
11. SHEEP	1 0	29. STAIRS	1 0	44. PUHTUHKUH	1 0
12. DISHES	1 0	30. SKY	1 0	Part VII	
13. CHAIR	1 0	31. SWEEPING	1 0	45. LA-LA-LA	1 0
14. MATCHES	1 0	32. PLANT	1 0	Part VIII	
15. WATCH	1 0	33. SHREDDED WHEAT	1 0	46. / ʃ / Recognition	1 0
16. JAR	1 0	34. TREE	1 0	Part IX	
17. ENGINE	1 0	35. DRESS	1 0	47. Clapping rhythm	1 0

APPENDIX B

OUTLINE OF CONTENT FOR TRAINING SESSIONS

OUTLINE OF CONTENT FOR TRAINING SESSIONS

I. Test Protocol (PSTA).
   - A. Brief conversation to put subject at ease.
   - B. Use exact words given in manual for examiner.
   - C. Subject may be asked to repeat responses.
   - D. Examiner may not repeat stimulus word unless it is clear some distraction prevented subject from hearing.
   - E. Review of test administration, item by item.

II. Scoring Procedures (PSTA).
   - A. Pass-Fail criterion for each item.
   - B. Score only single consonant or consonant blends in stimulus words.
   - C. Review of instructions for scoring items of test other than word repetition.
   - D. Review of scoring instructions, item by item.
   - E. Review of PSTA response record sheet.

III. Use of the Photo Articulation Test (PAT).
   - A. Review of the PAT manual.
     1. Administering test.
     2. Recording responses.
     3. Scoring the test.
   - B. Interpretation of the PAT.

IV. Discussion of Judgment of Articulatory Defect
   - A. Judge on articulation exclusively.
   - B. Eliminate question of isolated error.
   - C. Establish error pattern in several contexts, including language sample.
   - D. Define error pattern(s) precisely.

APPENDIX C

SAMPLE OF DATA CODED FOR COMPUTER ANALYSIS

SAMPLE OF DATA CODED FOR COMPUTER ANALYSIS

(SPEECH) STEP-WISE MULTIPLE REGRESSION, 1969-70

SEX	AGE	'67P	'69P	Th	D'69	L - T	SES	STUDENT #
1	73	46	47	1	1	45	4	304
1	83	47	47	1	1	56	4	305
1	73	35	47	1	1	50	4	306
1	80	45	46	1	1	44	5	307
1	82	45	47	1	1	53	3	308
1	76	30	44	1	1	48	4	309
1	73	25	46	2	1	48	3	310
2	79	46	47	1	1	49	4	311
2	77	47	47	1	1	42	1	312
2	80	40	47	1	1	42	4	313
2	81	47	47	1	1	45	6	314
2	80	40	47	1	1	49	5	315
2	83	45	47	1	1	45	4	316
2	84	47	47	1	1	54	7	317
2	77	43	46	1	1	51	4	318
2	83	46	47	1	1	57	4	319
2	73	46	47	1	1	46	5	320
1	73	47	43	1	1	43	4	321
1	74	45	45	1	1	44	3	322
1	75	25	45	2	1	39	6	323
1	76	23	26	2	2	47	7	324
1	82	31	47	2	1	56	6	325
2	77	36	41	2	2	44	6	326
2	78	47	47	1	1	39	1	327

APPENDIX D

MEANS, STANDARD DEVIATIONS OF STUDY VARIABLES

MEANS, STANDARD DEVIATIONS OF STUDY VARIABLES

Variable No.	Mean	Standard Deviation
1	1.50578	0.51021
2	78.86610	4.71369
3	41.37189	7.28345
4	45.48428	3.28026
5	1.16529	0.37175
6	1.09091	0.28772
7	45.81982	6.50972
8	4.42810	1.60510

Variable No.	Factor
1	Sex
2	Chronological Age
3	PSTA Score, 1967
4	PSTA Score, 1969
5	Intervening Therapy
6	Defective Speech, 1969
7	Lorge-Thorndike Raw Score
8	Socio-Economic Status

APPENDIX E

DISTRIBUTION OF SCORES AND PER CENT REPRESENTED FOR STUDY SAMPLE OF 1967 AND 1969 PSTA ADMINISTRATION

DISTRIBUTION OF SCORES AND PER CENT REPRESENTED FOR STUDY SAMPLE OF 1967 AND 1969 PSTA ADMINISTRATIONS

'67 PSTA			'69 PSTA		
Score	f	%	Score	f	%
47	121	20.00	47	322	53.22
46	104	17.19	46	129	21.32
45	86	14.21	45	62	10.25
44	40	6.61	44	23	3.80
43	31	5.12	43	18	2.98
42	27	4.46	42	9	1.48
41	25	4.13	41	9	1.48
40	12	1.98	40	5	.83
39	16	2.64	39	3	.50
38	16	2.64	38	4	.66
37	11	1.82	37	3	.50
36	9	1.48	36	3	.50
35	9	1.48	35	2	.33
34	7	1.16	34	1	.17
33	8	1.32	33	1	.17
32	11	1.82	32	3	.50
31	15	2.48	30	1	.17
30	5	.83	29	2	.33
29	9	1.48	27	1	.17
28	5	.83	26	1	.17
27	8	1.32	24	1	.17
26	4	.66	22	1	.17
25	5	.83	19	1	.17
24	1	.17		605	100.04
23	6	.99			
22	2	.33			
21	1	.17			
19	1	.17			
18	2	.33			
17	1	.17			
15	1	.17			
11	3	.50			
7	1	.17			
5	2	.33			
	605	99.99			

Mean = 41.37
Standard Deviation = 7.28

Mean = 45.48
Standard Deviation = 3.28

APPENDIX F

DEFECTIVE SPEECH IN RELATION TO 1967 PSTA SCORE FOR PORTION OF STUDY SAMPLE RECEIVING SPEECH THERAPY

DEFECTIVE SPEECH IN RELATION TO 1967 PSTA SCORE
FOR PORTION OF STUDY SAMPLE
RECEIVING SPEECH THERAPY

'67 PSTA	D '69	f	%
40 or more	Yes	1	.17
40 or more	No	10	1.65
38 - 39	Yes	4	.66
38 - 39	No	3	.50
36 - 37	Yes	2	.33
36 - 37	No	1	.17
34 - 35	Yes	1	.17
34 - 35	No	5	.83
- - - -	- - - -	- - - -	- - - -
32 - 33	Yes	7	1.16
32 - 33	No	6	.99
30 - 31	Yes	5	.83
30 - 31	No	8	1.32
28 - 29	Yes	7	1.16
28 - 29	No	6	.99
27 or less	Yes	18	2.98
27 or less	No	16	2.64
		100	16.53 (of N = 605)

APPENDIX G

DEFECTIVE SPEECH IN RELATION TO 1967 PSTA SCORE FOR PORTION OF STUDY SAMPLE NOT RECEIVING SPEECH THERAPY

DEFECTIVE SPEECH IN RELATION TO 1967 PSTA SCORE
FOR PORTION OF STUDY SAMPLE
NOT RECEIVING SPEECH THERAPY

'67 PSTA	D '69	f	%
40 or more	Yes	4	.66
40 or move	No	431	71.24
38 - 39	Yes	2	.33
38 - 39	No	23	3.80
36 - 37	Yes	1	.17
36 - 37	No	16	2.64
34 - 35	Yes	1	.17
34 - 35	No	9	1.48
- - - - - - - - - - - - - - - - - - - -			
32 - 33	Yes	0	0.0
32 - 33	No	6	.99
30 - 31	Yes	1	.17
30 - 31	No	6	.99
28 - 29	Yes	0	0.0
28 - 29	No	1	.17
27 or less	Yes	1	.17
27 or less	No	3	.50
		505	83.47
			(of N = 605)