THE ABILITY OF RANDOMLY SELECTED HIGH SCHOOL SENIORS TO JUDGE SEVERITY OF ARTICULATION DEFECTIVENESS IN THE RECORDED SPEECH OF YOUNG CHILDREN

A Thesis

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by

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CHAPTER I

INTRODUCTION

History reveals that assistants to specialists have existed for centuries. Decades ago, parents of a young man arranged with a craftsman to supply the boy with room and board and to train him in the trade. In return the master received the services of the apprentice. As early as the sixteenth century and when effective anesthetics were non-existent, the dentist, more appropriately called the extractor, employed the assistance of a person whose physique resembled the brawn of a contemporary gridiron lineman. The sole job of this helper was to restrain the patient during the extraction of an infected tooth. This "dental assistant" lost his job gradually after 1844 when Horace Wells developed nitrous oxide anesthetic.[1]

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[1]Elizabeth Ulrich, "Report on the Use of Supportive Personnel in the Field of Nursing," in Institute on the Utilization of Supportive Personnel in School Speech and Hearing Programs, sponsored by the American Speech and Hearing Association (Washington, D.C., 1967), p. 49.

The Bible records the account of a leader of the Israelites by the name of Moses. In an attempt to guide his people well, he established a judgment bench where he would decide upon various matters which the people brought to him. The task became so time consuming that Moses was exhausted physically. Finally, upon the suggestion of his father-in-

law, he established a panel of aides and instructed them in "the way wherein they must walk and the work that they must do." These men who performed the work of supportive personnel were called judges. "The hard causes they brought unto Moses, but every small matter they judged themselves."

In recent years, numerous disciplines have employed the untrained or minimally trained individual to aid those with formal training. A critical shortage of professionally trained individuals in such fields as medicine, education, rehabilitation and other related fields has resulted in a demand for minimally trained persons as supportive personnel. To study the potential of supportive personnel in the field of speech pathology and audiology is of interest to national, state and local health service agencies. This chapter will present the details of current investigations and also the specific purposes of the present study.

The Ohio Department of Health has recently sponsored two such investigations, one in the area of speech pathology and the other in the area of audiology. The projects were recommended by William Grimm, Ph.D., Chief, Vision and Hearing Unit, Ohio Department of Health and were funded by the United States Children's Bureau.

One study attempted to determine the usefulness of high school graduates as aides to speech and hearing clinicians and was under the direction of Richard Ham, Ph.D., Chairman of the Department of Speech Pathology, Audiology and Speech Science at the Ohio University, Athens, Ohio. High school graduates were nominated by the staffs of eight

school systems and a hospital center as candidates to participate in the project. The ten speech aides that were selected completed an intensive five-week pre-job training course during July and August, 1967. Ham stated that the basic questions being investigated in the project were the following:

1. Can supportive persons, as defined in this study, function efficiently in screening large populations for speech disorders?

2. Can supportive persons, as defined in this study, function efficiently in the habilitation of specified speech problems?[2]

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[2]Ohio University School of Communication, Department of Speech Pathology, Audiology, and Speech Science, "Research-Demonstration Project in the Training and Utilization of Aides in Speech Therapy - Initial Report," Athens, Ohio, 1967, p. 2. (Mimeographed.)

In September the aides were placed in school and clinical settings and were assigned to children with mild articulation problems. Each child with defective articulation who was selected to receive therapy was matched with a counterpart who received no therapy during this period of time.

Prior to the start of therapy both groups of children were administered the Carter-Buck Articulation Test. The test was administered again in January, 1968. An interim report in February, 1968 revealed that, according to Ham, test-retest scores for the control group who received no therapy and the experimental group who received therapy from the speech aides indicated the following results:

> Thus far the results tend to indicate that these aides can, with mild articulation problems, take responsibility for the detection of speech problems. Further, under supervision, they can initiate therapy, plan constructively and originally with goal orientations, and carry out their plans. They have done this under close supervision with extensive critical feedback.[3]

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[3]Ohio University School of Communication, Department of Speech Pathology, Audiology, and Speech Science, "Research-Demonstration Project in the Training and Utilization of Aides in Speech Therapy - Interim Report," Athens, Ohio, 1968, p. 6. (Mimeographed.)

A second project sponsored by the Ohio Department of Health was concerned with training high school graduates to administer hearing tests. Five girls were selected from the Columbus, Ohio area. Following a short initial training period in skills such as audiometric screening and testing at the Ohio Department of Health, the girls were sent to the Ohio State University for approximately ten days where they received further instructions in audiometry. Additional training was provided by the Montgomery County Health Department in the testing of pre-school children. Assigned alternately between Richland Speech and Hearing Center in Mansfield, Ohio and the Speech and Hearing Clinic of Franklin County, Columbus, Ohio, the aides practiced speech audiometry and Bekesy techniques. Simultaneously with the training they worked in the Pediatric-Otological-Diagnostic Clinic programs under the supervision of personnel of the Ohio Department of Health, Division of Hearing and Vision. The results of this project have not been evaluated.

Statement of the Problem

The present investigation was concerned with the training of supportive personnel in the field of speech pathology and audiology. The results of previous studies were neither conclusive nor entirely completed and there continues to be a need for more information concerning the role of the aide to the clinicians.

The specific purpose of this study was to determine if randomly selected high school seniors can be trained to make judgments of severity of the articulation defectiveness from tape recordings of the continuous speech of young children. Answers to two experimental questions were sought.

1. Is there a significant difference between the judgments of randomly selected high school seniors before and after a brief period of training?

2. Is there a significant difference in the judgments made by randomly selected high school seniors after training and those by graduate students in speech obtained from a previous study?

The psychological scaling method of equal-appearing intervals as advocated by Thurstone and Chave was employed to measure defective articulation.[4] The samples were con-

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[4] L. L. Thurstone and E. J. Chave, The Measurement of Attitude (Chicago: University of Chicago Press, 1929), p. 12.

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tinuous speech and presented the variety and complexities expected such as vocal inflection, rhythm, voice quality, and general articulation and language.

The present investigation employed the nine-point continuum in the manner of Morrison who trained ten graduate students in speech pathology to rate the relative defectiveness of the recorded speech of fifty young children, five to ten years of age. The recorded speech possessed varying degrees of articulation defectiveness ranging from normal to severely defective. These children were from Columbus, Ohio grade schools and the Ohio State University Speech and Hearing Clinic. The speech consisted of one-minute samples of conversation elicited from the children while relating stories and personal experiences.

The present study differs from those conducted by the Ohio Department of Health. The Ohio Department of Health were concerned with assessing articulation errors and hearing deviations by means of formal established tests and assessment techniques. Both studies involved participants who were selected by professional individuals.

Seventy high school students served as subjects in the present study and represented a random, rather than a selected sample. One purpose was to determine whether the students, selected in this manner, could be trained with an established procedure. It was an attempt to discover if they could aid a professional in screening a group of children by listening to samples of recorded conversational speech. This is likely to be one area in which aides will be required to assist. It would also appear helpful to know if aides can assess the degree of difference or improvement on the basis of such samples of connected speech.

The stimuli were presented to the subjects, first under conditions of no training and then following a brief training period.

The data were analyzed statistically using the following techniques to determine the degrees of significance. The mean values of the responses for the experimental group of high school seniors before training were compared to the corresponding mean values following the training period by using a triple analysis of variance. The mean scores of this experimental group after training were then compared with the corresponding scores of a group of graduate students in speech who performed a similar task in an earlier study by Morrison.

Some writings concerning the need for and use of supportive personnel in various assessment techniques are discussed in Chapter II as recent developments and related problems are discussed. This background leads up to Chapter III in which the methodology for the present investigation is explained. Chapter IV presents the results and conclusions of the study and Chapter V, the summary of the study and implications for further investigations.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this chapter was to present some current thinking concerning the need for and use of supportive personnel in specialized fields such as education, medicine, and speech pathology and audiology.

Harold Howe II, United States Commissioner of Education recognized the man power shortage. He stated that the full use of supportive personnel enhanced the potential of those whom they assisted. It is then possible to make "the best use of the people we have and it forces us to pull out of each fully trained person's daily activities those things that can be legitimately performed by someone with substantially less training."[5]

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[5]Harold Howe, II, "The Manpower Deficit," School Management, X (August, 1966), 57.

Although the basic concept of teacher aides has been developing over the last fifteen years, the use of such supportive personnel in education is on the increase. In September, 1966, the Educational Research Service sent a questionnaire to 217 school systems which were presently using a total of 44,351 teacher aides, at all school levels.[6]

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[6]"Teacher Aides in Public Schools," NEA Research Bulletin, XLV (May, 1967), 37.

The requirements imposed upon the selection of these aides ranged from no educational requirements to that of a college degree. Over one-third of the school systems began supportive personnel programs after 1960.

Teachers as a whole welcome supportive personnel as assistants and Howe stated,"I happen to think that there are real possibilities for the schools in totally new patterns of use of nonprofessional people."[7]

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[7]Howe, op. cit., p. 58.

The use of aides also has been evident in areas of special education. In Maryland the use of nonprofessionals has improved services to children by encouraging more effective use of teacher skills. Staff morale was also improved. College students from Arizona State University, high school juniors and seniors, as well as lay people have also been effectively employed with considerable success in the Head Start Program in a disadvantaged "inner city" district of Phoenix, Arizona.

The medical profession today faces the manpower shortage probably more critically than any other group. Robert E. Kinsinger quoted from the words of the Surgeon General of the United States at the 1965 White House Conference on Health.

> Once it took only one doctor to resign himself and the child's parents to the inevitable death of a 'blue baby'. It now takes a team of medical specialists and auxiliary personnel to correct the

> congenital abnormality of a baby's heart to insure the child a normal life span. At least 15 persons, including four surgeons, are needed in the operating room for the repair of a congenital lesion of the heart. More than 100 medical specialists, nurses, and skilled technicians are involved in preparations for, and performance of, the operation and in the post-surgical care of the patient.[8]

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[8]Robert E. Kinsinger, "Education and Training for Technicians in the Health Field," in Selection, Training and Utilization of Supportive Personnel in Rehabilitation Facilities, sponsored by Arkansas Rehabilitation, Research and Training Center (Hot Springs, Arkansas, 1966), p. 6.

The need for supportive personnel was recognized and the use of the potential skills of persons not trained as professionals was urged.

> Year by year, our top professional personnel are being trained to perform still more complex tasks. How long can each profession afford to hang onto its simpler functions - the routine filling of a tooth, for example, or the several easily automated steps in a medical examination? How can we train the physician or dentist to make full use of the skills available in other people, freeing himself to perform only those duties for which he is uniquely qualified?[9]

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[9]Ibid., p. 6.

James Gallagher stated in 1967, "I remember talking with a psychiatrist who said that 90% of what he did during the day could be done by any reasonably intelligent human being. It was that other 10% when his professional skills were really needed that made him the professional he was."[10]

[10]James Gallagher, "The Development of Professional Teams in Education and Services for the Handicapped," in Institute on the Utilization of Supportive Personnel in School Speech and Hearing Programs, sponsored by the American Speech and Hearing Association (Washington, D.C., 1967), p. 24.

The medical team concept has developed to reduce the demands on any one professional specialist.[11] As the top

[11]Frederick K. Erickson, "Fulfilling the Health Team Concept," in Seminar on the Use of Supportive Personnel in Speech Pathology and Audiology, sponsored by the American Speech and Hearing Association (Houston, Texas, 1967), pp. 18-25.

level of the profession becomes increasingly specialized, each lower level moves into more specialized work, and the necessity arises to add a sub-professional level to fill the gap. Hence, in the field of nursing, some of the former duties of the registered nurse are performed by another very competent individual, the licensed practical nurse. Many of her duties, in turn, are taken over by the nurses' aide. The progression is evident when it is noted that former programs of instruction for the practical nurse were short and less sophisticated than the present-day courses are for the nurses' aides. In fact, at the turn of the century, the counterpart to the modern practical nurse was the rather dull title of "Attendant for the Sick". That course lasted eight weeks and included cooking and other household duties.

Today assistants in nursing fields take many forms, from the pediatric assistant who measures and weighs the

baby and gives the mother feeding instructions to the Red Cross Volunteer Gray Lady who delivers the "get well" cards and writes letters for the incapacitated amputee. The American Nurses Association expressed the opinion that technical advances will continue to necessitate more concise and significant training for supportive personnel.

> ...these workers, with adequate training and supervision, can occupy a significant place in a well-organized and efficient nursing service, rendering supportive assistance to registered nurses and licensed practical nurses, contributing substantially to the welfare and comfort of patients wherever they may be.[12]

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[12]Louise A. Meyer, "The Selection, Training and Utilization of Personnel Supportive to Nursing in Rehabilitation Facilities as Viewed by the American Nurses' Association," in op. cit., (Hot Springs, Arkansas, 1966), p. 42.

A hospital in Lexington, Kentucky undertook an experiment of two years duration in the children's ward. Better and continuous care at lower costs of hospitalization for the parents were the results of employing the mothers as assistants. "Live-in" wards are provided for the mother and she becomes the child's full-time nurse, thus reducing costs by as much as sixty per cent.[13]

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[13]"The Hospital That Depends on Mothers," Good Housekeeping, August, 1968, p. 34.

Similiar problems of personnel shortage also exist in the field of occupational therapy. As early as 1944, the American Physical Therapy Association developed a

syllabus for training volunteer physical therapy assistants. Currently extensive training programs for such supportive personnel are in existance.

Acute manpower shortage is evident also in speech pathology and audiology. The American Speech and Hearing Association recently sent a questionnaire to the presidents of the respective state speech and hearing associations. Inquiries were concerned with the number of budgeted but unfilled speech and hearing positions existing in their respective states at that time. The thirty-four state organizations which responded indicated a total of 5000 such positions. Although the projected need for professional personnel in 1970 is over 27,000, the estimates in 1965 indicated a total of 15,000 people presently working in this field.[14] Another report revealed a more critical picture

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[14]John V. Irwin, "Supportive Personnel in Speech Pathology and Audiology," Hearing and Speech News, XXV (July, 1967), 32-33.

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stating the current need as 40,000 for speech and hearing personnel with only 6200 presently engaged in rendering services to the public.[15]

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[15]John P. Moncur, "Current Use of Supportive Personnel in Speech Pathology and Audiology," in Supportive Personnel in Rehabilitation Centers, ed. by G. Robert Leslie (Pittsburgh, Pa. and Colorado Springs, Colo., 1967), p. 102.

Various solutions such as improved recruitment procedures, more selective use of existing personnel, and

salary increases to interest new people have been tried, although these attempts have been of limited effect in alleviating the current need. As stated by John Irwin in a recent publication, "Clearly, the real supply has not met the real, and cannot meet the potential demand."[16]

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[16]Irwin, op. cit., p. 33.

Release of the professional person from duties which could be performed by someone with considerably less training is an issue that is precipitating much discussion in current literature. Valid arguments of those who are hesitant to use subprofessionals include lack of time for adequate supervision, and insufficient personnel to do the training. "While the demand for personnel may be critical, caution must be exercised in the utilization of expedient measures to meet an 'emergency' situation."[17]

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[17]Morton H. Bregman, "The Utilization of Rehabilitation Counseling Support Personnel," in op. cit., (Hot Springs, Colorado, 1966), p. 76.

The threat to the public image with the confusion of roles is one of the most critical problems. James H. Scheuer when addressing the Washington Institute concerning the Utilization of Supportive Personnel in School Speech and Hearing Programs, stated of professionals,

> They come to realize, I think, that the orchestra conductor doesn't feel threatened by the first violinist. It is through the first violinist that

> he exercises his greatest talent; without the first violinist, the tympany and the drums, and the brass, the orchestra conductor isn't much of a creative agent. He expresses himself through the people whom he guides, controls, directs, stimulates, and inspires... He's the catalytic agent that works that magic. I think that from all over the country, we're getting reports that professionals now feel that they are enhanced and dignified by the availability of supportive personnel whom they guide, whom they direct, whom they orchestrate, and whom they inspire.[18]

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[18]James H. Scheuer, "Supportive Personnel: Current Legislation," in op cit., (Washington, D.C., 1967), p. 72.

One controversy which is frequently in the literature deals with those difficulties related to training the subprofessional. Professionals in the field express concern and feel that much investigation and evaluation is needed in light of current trends. Some have attempted a partial solution to this problem by dividing subprofessionals into those requiring academic training of a concentrated nature with practicum and those receiving their training on the job.

In a recent article by John V. Irwin, the use of subprofessionals is divided into contact and non-contact categories.[19] They correspond, respectively, to those who work

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[19]Irwin, op. cit., p. 38.

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directly with the patient and those who are trained in

duties of a clerical nature. A basic problem lies in the fact that often professional activities are not clearly defined and, thus, difficult to share with others. Further problems are evident regarding the extent of the job potential. Is the subprofessional in a cul-de-sac position or does he have possibilities for advancement in the field?

One solution is the special certificate awarded to the subprofessional as evidence of completion of a concentrated core program. There is concern that this may be interpreted by those in other fields as a Certificate of Clinical Competence. It has been suggested that the American Speech and Hearing Association establish a Professional Services Board and develop a separate code of ethics adaptable to the subprofessional level. It was of the general opinion at the Houston Conference that the American Speech and Hearing Association should take immediate action in the form of "a master study over a period of time covering all aspects of the problem, and a decision-making conference for setting up the rules and regulations governing the use of supportive personnel."[20]

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[20]John P. Moncur, "Current Use of Supportive Personnel in Speech Pathology and Audiology," in op. cit., ed. by G. Robert Leslie (Pittsburgh, Pa. and Colorado Springs, Colo., 1967), p. 104.

The Houston Conference made some general recommendations concerning the supervision of supportive personnel. It was generally agreed that the professional have the responsibility of the client with whom the subprofessional

works, that the aide be responsible to only one professional at a time and that the tasks assigned be up to the judgment of the professional based upon his personal assessment of the aide and the client.

> The seminar members attempted to determine what the future holds if our profession uses supportive personnel in rendering professional services to the public. Again, several important questions were raised: 'What will the use of supportive personnel do to our public image?' 'What economic changes will be made in our budgeting?' 'Will we be able to retain control over the supportive personnel?' 'Will we substantially alleviate the problem of not being able to meet the demand for our services by the public?' 'What will the impact be upon the clients we serve?' 'What steps should ASHA take in the near future to study and promote the use of supportive personnel in speech pathology and audiology?'[21]

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[21]John P. Moncur, "Introduction," in op. cit., (Houston, Texas, 1967), p. 15.

Obviously some of these questions can be answered only after much experimentation and investigation. The essential criteria for determining an adequate answer seems to lie in first determining what specific tasks are to be performed. A few examples of programs now operating in various fields illustrate the wide variety of possibilities.

One speech and hearing center has undertaken a program with aphasics. The speech pathologist has several supportive personnel working with her, and they are given specific tasks to perform during the session. The supervisor circulates and evaluates their work. Intensive

therapy is given and more patients are accommodated.[22]

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[22]John P. Moncur, "Current Use of Supportive Personnel in Speech Pathology and Audiology," in op. cit., ed. by G. Robert Leslie (Pittsburgh, Pa. and Colorado Springs, Colo., 1967), p. 104.

Another center has developed a language and speech program for groups of students. As the aides instruct in the various work areas, the professional makes periodic checks.[23]

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[23]Ibid., p. 104.

John P. Moncur of Callier Hearing and Speech Center hired two college students to see what tasks supportive personnel can perform. Success was demonstrated in fabrication of clinical materials, reinforcement of objectives initiated by teachers of the deaf, and specific tasks in articulation therapy.[24]

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[24]Ibid., p. 105.

An experimental program in the Denver, Colorado area hospitals of screening the hearing of newborn infants has proved successful and inexpensive through the use of trained volunteers. As a result of the program, similar studies have been started from San Francisco, California to Providence, Rhode Island. Teams of housewives have undertaken this project in Denver.[25]

[25]Marion P. Downs, "Hunt to Catch a Handicap," Today's Health, January, 1968, p. 51.

For many years the public health nurses in Ohio and other states have been trained to screen hearing in public schools, as needs were evident for an adequate hearing conservation program.[26]

[26]Ohio Department of Health, "Steps in the Development of a Conservation of Hearing Program," n.d., (Pamphlet.)

The literature indicates that further investigation is needed to assess this possibility of alleviating the manpower shortage. The next chapter will present the methodology used in a study to evaluate one portion of this problem. This study is concerned with the possibility of using high school seniors to fill such positions as assistants.

CHAPTER III

PROCEDURES

The purpose of this study was to determine if randomly selected listeners can be trained to judge accurately the degree of severity of misarticulations from the recorded samples of the speech of young children. This chapter discusses the subjects, stimulus material, experimental procedures employed, equipment and conditions of playback, and tabulation of the resulting data.

Subjects

The subjects employed in this study as observers were seventy randomly selected high school seniors enrolled at Madison Local Senior High School in Richland County, Ohio. Most of these students were from suburban and rural backgrounds. There were thirty-four females and thirty-six males. None of the students reported hearing loss. Examination of school records yielded information concerning grades and personal interests.

Grade-point averages for the seventy experimental subjects ranged from .93 to 4.00, based on a cumulative average. Thirteen of these subjects accumulated averages ranging from .9 to 1.8; thirty-four from 1.9 to 2.8; and twenty-three from 2.9 to 4.0. Fourteen of the subjects indicated musical ability through participation in choral and instrumental groups.

Although eighty-two students were available originally for participation in the study, twelve were eliminated because of unavoidable absence from part of the study, indication of a possible hearing impairment and discovery following the study of incorrect classification (Appendix A).

Selection of Subjects

The subjects were obtained from three afternoon American Government classes (Appendix B). The scheduling procedure at the school required all double-period and elective courses to be scheduled first; thus, classes in American Government and other required subjects were arranged wherever they fit conveniently into the schedule of each individual student. This complexity of scheduling resulted in a heterogenious grouping of students and a wide variety of abilities and interests.

Preparation of Subjects

The subjects were informed that they were about to participate in an experiment which would measure their ability to judge severity of the articulation errors of young children. Motivation for the task was provided by informing them concerning potential career opportunities available as clinicians or as supportive personnel in the field of speech pathology and audiology.

Stimulus Material

The stimulus material was a tape recording consisting of 300 ten-second segments of the recorded continuous speech of young children ages five to ten. There

were six segments for each of fifty children with no two segments of speech of any one child placed adjacent to another.

Original Application

The experimental tape had been prepared previously by Morrison who applied the psychological scaling method of equal-appearing intervals to defective articulation in children.[27] She stated that "the problems associated with obtaining quantitative measures of the severity of defective articulation are relative to the complex nature of speech behavior...Quantifying the psychological effect upon the listener may be important and useful."[28] She presented the experimental tape to ten graduate students in speech pathology and audiology, following a period of listening to special training tapes. The ten graduate students had been asked to judge the 300 segments by employing an equal-appearing intervals scale of severity of articulation defectiveness. The results yielded a mean scale value for each of the fifty children whose speech was represented on the experimental tape. The continuum ranged from one to nine, with one representing least defective articulation and nine, most defective articulation.

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[27]Sheila Morrison, "A Study of the Reliability of Psychological Scaling of Defective Articulation in Children" (Unpublished Ph.D. dissertation, Ohio State University, 1955).

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[28]Sheila Morrison, "Measuring the Severity of Articulation Defectiveness," Journal of Speech and Hearing Disorders, XX (December, 1955), 348.

Experimental Procedures

In the present study the stimulus material was presented twice. After the first presentation the subjects were trained with four sets of previously rated samples of defective articulation. After training the stimulus tape was presented a second time and all subjects rated again each of the 300 ten-second segments.

Instructions

The subjects were instructed that 300 ten-second segments of the continuous speech of children were to be presented by tape recording. They were to judge these segments relative to a nine-point scale of severity of articulation defectiveness with one representing least defective articulation and nine, the most defective. Thus, a rating of five was halfway between one and nine with respect to severity of articulation defectiveness with the other points falling on the scale equal distances apart.

The subjects were cautioned to judge each segment as a whole unit and not to base their ratings on one portion of the total segment. They were further instructed to avoid placing segments between any two of the points on the nine-point continuum and to avoid rating excessively at the extreme upper or lower ends of the scale. Emphasis was placed upon determining the exact location of each segment of the equal-appearing interval scale (Appendix C).

Prior to the presentation of the tapes, three ten-second segments were played to give the subjects a general

frame of reference and opinions of possible ratings were discussed. The actual values of the segments, however, were not disclosed. After the three samples were played, the 300 segments were presented and rated on prepared answer sheets (Appendix D).

Training

After the 300 segments of speech samples had been rated, the subjects were exposed to a training period prior to the second presentation of the stimulus material. Training was conducted in the manner of Morrison. Four sets of nine ten-second segments each were presented to the group. Each tape progressed from level one to level nine. Following the four training tapes, answer sheets were distributed (Appendix E) and the same thirty-six segments from these four tapes were presented in random order. The randomized segments were presented again, preceded by the announcement of the numerical value assigned. Each listener checked his responses.

Following the completion of the training tapes, the subjects were informed that the 300 segments would be replicated in the same manner as before. They were to rate these samples of speech using the same scale previously applied.

Equipment and Conditions of Playback

The experimental tapes and the training tapes were presented from an Ampex Model 620 speaker-amplifier combination and a Wollensak model T-1500 tape recorder. The

equipment was placed on tables upon a stage which was elevated three feet, nine inches above room level. The room was constructed in such a manner that there were two elevations, each one eight inches above the preceding level. The first level contained four rows; the second, two rows; and the third, two rows. The dimensions of the room were twenty-nine by forty-eight feet and the distance of the observers from the speakers varied from twelve to thirty-six feet. The level was adjusted so that students in all sections of the room could hear adequately.

Tabulation of the Data

The ratings by the seventy subjects before and after training were the raw scores recorded for each of the 300 segments. There were six segments representing each of the fifty children. The raw scores were tabulated in 300 double columns on a matrix of the fifty children and seventy subjects. Each double column of this matrix contained the ratings for a particular speech segment before and after training. The 300 columns were separated and rearranged in groups of six double columns each, with one group representing the six segments for each child as rated by the seventy subjects before and after training. The six ratings for each child before training were added and divided by six, yielding a mean scale value for each child by each of the seventy subjects. The procedure was repeated for the six ratings for each child after training. The tabulation of the mean scale values before training resulted in 3500 mean scale value ratings. The replication of the

procedure after training resulted in another 3500 mean scale value ratings. A total of 7000 mean scale values were the criterion measures to be subjected to statistical analyses (Appendix F).

Summary

A group of randomly selected high school seniors rated the degree of defectiveness of articulation from recorded samples of the continuous speech of young children. The stimulus material consisted of 300 ten-second segments of continuous speech which had been employed in a previous study. The subjects in the present study rated the segments on a psychological continuum of a nine-point equal-appearing interval scale representing varying degrees of articulation defectiveness.

Following a period of training, the procedure was repeated and the resulting 7000 mean values were submitted to statistical analyses which will be discussed in the next chapter.

CHAPTER IV

RESULTS AND DISCUSSION

A randomly selected group of seventy high school seniors listened to ten-second segments of the recorded speech of fifty young children and made judgments with respect to the degree of severity of misarticulations. The psychological scaling method of equal-appearing intervals was employed to arrange each segment on a continuum of one to nine, with one representing the least defective speech and nine representing the most defective. The subjects rated 300 ten-second segments of conversational speech before training. After training they rated again the same 300 segments. The experimental stimuli had been presented previously to ten graduate students in speech pathology by Morrison. The segments of speech were taken from one-minute samples of the connected speech of the children. Thus, each child was represented six times throughout the experimental tape.

Criterion Measures

The criterion measures consisted of the mean scale values for each child as rated by each listener. The mean scale values were obtained for the six segments representing each child by averaging the ratings by each of the seventy listeners. Seventy mean scale values for each child were obtained from the subjects before training, and the same

number from the same subjects after training. The computation yielded a total of 7000 mean scale values for the two conditions of training. Table 1 gives an average mean scale value of all seventy subjects for each child before and after training.

Hypotheses

The following null hypotheses were formulated:

Hypothesis I. There is no significant difference in the mean scale values of the severity of articulation defectiveness of children obtained from seventy randomly selected high school seniors before and after a period of training.

Hypothesis II. There is no significant difference between the mean scale values of the severity of articulation defectiveness of children obtained from seventy randomly selected high school seniors and of the previously obtained mean scale values of ten graduate students in speech pathology.

Statistical Analyses

Hypothesis I. Seven thousand mean scale values were subjected to a triple analysis of variance, Treatments x Treatments x Subjects in the manner of Lindquist.[29] The

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[29]E. F. Lindquist, Design and Analysis of Experiments in Psychology and Education (Boston, Mass.: Houghton Mifflin Co., 1953), pp. 237-238.

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variables were the seventy subjects, the fifty children and the conditions of before and after training. Because of

TABLE 1

AVERAGE MEAN VALUES OF FIFTY SAMPLES OF THE SPEECH OF CHILDREN AS RATED BY SEVENTY RANDOMLY SELECTED HIGH SCHOOL SENIORS BEFORE AND AFTER TRAINING SHOWING THE AMOUNT AND DIRECTION OF THE DIFFERENCE

Before	After	Difference	Before	After	Difference
4.49	4.45	-.04	6.91	6.49	-.42
8.05	8.17	+.12	5.42	4.91	-.51
2.14	1.76	-.38	2.22	1.72	-.50
6.95	6.93	-.02	4.35	4.21	-.14
3.21	3.26	+.05	4.67	4.43	-.24
6.09	5.69	-.40	5.96	5.75	-.21
3.33	3.37	+.04	3.99	3.82	-.17
6.17	5.81	-.36	5.12	5.04	-.08
5.91	5.82	-.09	4.46	4.18	-.28
1.75	1.39	-.36	4.70	4.27	-.43
3.02	2.81	-.21	3.58	3.12	-.46
7.22	6.64	-.58	3.41	3.00	-.41
8.52	8.45	-.07	6.55	6.03	-.52
2.39	2.29	-.10	7.83	7.76	-.07
4.67	4.06	-.61	5.87	5.58	-.29
5.43	4.82	-.61	7.48	7.22	-.26
1.88	1.75	-.13	7.63	7.27	-.36
4.52	4.26	-.26	5.29	5.01	-.28
4.38	4.06	-.32	5.08	4.84	-.24
7.08	6.81	-.27	8.15	8.03	-.12
3.72	3.65	-.07	7.79	7.50	-.29
5.97	5.69	-.28	2.02	1.70	-.32
7.17	6.86	-.31	4.50	3.73	-.77
3.36	2.55	-.81	5.06	4.83	-.23
3.80	3.36	-.44	8.04	7.90	-.14

the large number of means involved, the sum of the squares and the mean square values were obtained through a computer program.[30] The resulting F ratios were computed and are

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[30]The data were processed through the Ohio State University Computer Center in Robinson Laboratory, Columbus, Ohio, July, 1968.

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given in Table 2.

The purpose of the triple analysis of variance was to determine if there was a significant difference in the ratings of the subjects as a result of the conditions of training. The mean square value for the condition of before and after training yielded an F-value of 17.28 which was found to be significant at the .01 level of confidence and indicated a significant difference in the responses of the subjects after a period of training.[31]

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[31] $$F = \frac{\text{ms for Before - After}}{\text{ms for Subjects x Before - After}}$$

The mean square value for the fifty children was computed and yielded an F-value of 920.86 which was significant beyond the .01 level of confidence, as can be seen in Table 2. These results indicated that the speech samples of the fifty children were significantly different. Such a result was expected in view of the wide variety of speech defectiveness demonstrated on the experimental tape.[32]

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[32] $$F = \frac{\text{ms for Children}}{\text{ms for Listeners x Children}}$$

TABLE 2

RESULTS OF A TRIPLE ANALYSIS OF VARIANCE TESTING THE DIFFERENCE BETWEEN THE MEAN SCALE VALUES OF SEVENTY HIGH SCHOOL SENIORS BEFORE AND AFTER TRAINING

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUMS OF SQUARES	MEAN SQUARES	F-VALUES	.05	.01
Subjects	69	1160.30	16.82			
Children	49	24868.55	507.52	920.86	1.35	1.52
Before - After	1	144.85	144.85	17.28	3.98	7.01
Subjects x Children	3381	1863.41	.55			
Subjects x Before-After	69	578.52	8.38			
Children x Before-After	49	68.01	1.39	4.62	1.35	1.52
Residual	3381	1016.43	.30			
TOTAL	6999	29700.060				

The mean square value for the interaction of the before and after training conditions yielded an F-value of 4.62. This value was significant at the .01 level of confidence as can be observed in Table 2. These results demonstrated a significantly different reaction to the stimulus material by the subjects following the period of training and indicated that the subjects differed in varying degrees from their responses to the first presentation of the stimulus material.[33]

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[33] $F = \frac{\text{ms for Children x Before - After}}{\text{ms for Residual}}$

Hypothesis II. A Type I Mixed Design in the manner of Lindquist[34] was applied to the 500 mean scale values by

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[34] Lindquist, op. cit., pp. 267-273.

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the ten graduate students used in the Morrison study and 3500 mean scale values for the seventy randomly selected high school students after training. The mean square values yielded an F-value of 9.09 which was significant at the .01 level of confidence. The results of this analysis are seen in Table 3 and indicate a significant difference between the judgments of the two groups of subjects.[35]

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[35] $F = \frac{\text{ms for Groups of Judges}}{\text{ms for error (Between Subjects)}}$

TABLE 3

RESULTS OF A TYPE I MIXED DESIGN TO TEST THE DIFFERENCE BETWEEN THE MEAN SCALE VALUES OF TEN GRADUATE STUDENTS IN SPEECH EMPLOYED IN A PREVIOUS STUDY BY MORRISON AND THE MEAN SCALE VALUES OF SEVENTY HIGH SCHOOL SENIORS FOLLOWING A BRIEF PERIOD OF TRAINING

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUMS OF SQUARES	MEAN SQUARES	F-VALUES	.05	.01
Between subjects	79	713.09				
Groups of subjects	1	74.47	74.47	9.09	3.96	6.96
Error (between subjects)	78	638.62	8.19			
Within subjects	3920	16438.31				
Samples of recorded speech of children	49	11512.71	234.95	559.40	1.44	1.68
Groups of judges x samples of recorded speech of children	49	3310.62	67.56	160.86	1.44	1.68
Error (within subjects)	3822	1614.98	.42			
TOTAL	3999	17151.40				

Another analysis was applied to test the hypothesis. The rating by ten subjects were selected randomly from the seventy. The mean scale values by these ten subjects for each of the fifty speech samples were placed in one column. The corresponding values for the ten graduate students in speech from the previous study were placed in another column. Table 4 gives the average mean scale value for each child as rated by the graduate students and the ten randomly selected high school students. A t-test for related measures was applied to test the difference between the ratings by the graduate students and the ratings by the high school students before training.[36] The procedure was repeated with

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[36]George A. Ferguson, Statistical Analysis in Psychology and Education (New York: McGraw-Hill Book Co., 1966), pp. 169-171.

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the ratings for the condition of after training for high school students. The tests yielded t-values of .514 and .522 respectively, neither of which were significant when compared with a table of t-values. The results indicated that the ten high school students were not representative of the total group of seventy subjects because these ten students showed no significant difference from the graduate students in speech.

One further observation regarded the average mean value for these twenty graduate and high school students when considering all ratings for the fifty children. This value for the graduate students was 4.45 while the high

TABLE 4

AVERAGE MEAN VALUES FOR THE FIFTY SPEECH SAMPLES AS RATED BY TEN GRADUATE STUDENTS IN SPEECH FROM A PREVIOUS STUDY AND TEN RANDOMLY SELECTED HIGH SCHOOL SENIORS BEFORE AND AFTER TRAINING

	GRADS	H.S. BEF.	H.S. AFT.		GRADS	H.S. BEF.	H.S. AFT.
1	3.03	4.37	5.20	26	8.30	6.80	6.65
2	1.15	8.10	8.20	27	4.85	5.62	5.43
3	1.53	1.77	1.80	28	3.58	2.12	1.90
4	2.77	6.88	7.25	29	4.78	4.13	4.47
5	7.08	3.18	3.47	30	6.60	4.68	4.67
6	6.67	6.38	5.76	31	5.72	5.65	6.05
7	2.07	2.98	3.70	32	2.13	4.07	4.42
8	2.90	6.20	6.10	33	2.53	5.12	5.32
9	2.57	5.84	5.90	34	2.65	4.12	4.45
10	6.34	1.83	1.35	35	4.75	4.67	4.78
11	3.47	3.17	3.20	36	4.77	3.22	3.57
12	2.33	7.13	6.73	37	3.55	3.28	3.02
13	3.33	8.37	8.37	38	5.13	6.57	6.18
14	1.98	2.53	2.62	39	3.83	7.82	7.73
15	5.20	4.50	5.10	40	3.33	5.53	5.68
16	3.65	5.67	5.30	41	4.12	7.48	7.23
17	4.82	1.88	2.10	42	7.20	7.36	7.32
18	3.33	4.38	4.50	43	8.43	5.38	5.25
19	4.17	4.07	4.22	44	2.95	4.92	5.07
20	4.37	6.40	6.97	45	7.75	8.43	8.05
21	7.67	3.82	4.15	46	5.53	7.60	7.66
22	4.78	5.80	5.85	47	2.33	1.97	1.88
23	8.48	7.27	6.88	48	6.70	4.37	4.12
24	6.47	3.43	2.80	49	1.32	5.28	5.32
25	7.78	3.85	3.55	50	1.47	7.93	7.82

school students recorded a corresponding value of 5.08 prior to training and 5.10 following training.

The next chapter will evaluate the results of the analyses of the data which were gathered. Tentative conclusions will be drawn and suggestions will be made concerning other investigations which might be pursued in the future.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of the study was to test the ability of randomly selected high school seniors to rate the degree of articulation defectiveness from recorded samples of the continuous speech of young children. The speech samples were 300 ten-second segments taken from the continuous speech of children with varying degrees of articulation defectiveness and were presented by tape recording to seventy high school seniors who were untrained in speech pathology and audiology. Following a brief period of training, the procedure was replicated.

The speech samples were rated on a nine-point continuum employing the psychological scaling method of equal-appearing intervals. Two sets of mean scale values were computed for the 300 ten-second segments from the responses of each of the seventy observers resulting in a total of 7000 mean scale values. One set of mean scale values consisted of the ratings before training and the other represented the ratings following the training period.

The 7000 mean values were subjected to a triple analysis of variance, Treatments x Treatments x Subjects in the manner of Lindquist to test the difference in the ratings by seventy subjects before and after training.

The difference was tested between the 500 mean scale values obtained from ten graduate students in speech pathology

employed by Morrison in a previous study and the 3500 mean scale values obtained from the seventy subjects in the present study after the period of training. The analysis to which these data were subjected was a Type I Mixed Design in the manner of Lindquist.

A t-test for related measures was applied as a further test of the difference between the ratings of the ten graduate students in speech pathology and the ratings of the ten subjects randomly selected from the high school students.

Conclusions

The first hypothesis stated that there is no significant difference in the mean ratings of the severity of articulation defectiveness of children obtained from seventy randomly selected high school seniors before and after training. Based on the F-values obtained from the triple analysis of variance, it was possible to reject the first hypothesis and draw the following conclusions:

1. There is a difference in the ratings of samples of the continuous speech of children obtained from randomly selected subjects following a brief period of training.

2. As a group the seventy subjects were less critical in rating the speech samples of the fifty children following the period of training.

3. The mean scale values of the high school students following the period of training more closely approximate the mean scale values of the ten graduate students in speech pathology.

The second hypothesis stated that there is no significant difference between the mean ratings of the severity of articulation defectiveness of children previously obtained from the ratings of ten graduate students in speech pathology and those obtained from seventy randomly selected high school seniors after training.

The F-value obtained from the Type I Mixed Design Statistical Analysis indicated a significant difference between the two groups of subjects. Thus, the second hypothesis was rejected. However, when treating the mean ratings of the ten graduate students in speech pathology and the mean ratings of ten high school students randomly selected from seventy through the application of the t-test for related measures, no significant difference was obtained between the two groups. The disagreement of the above findings might suggest the following conclusions:

1. Random selection of subjects to make accurate judgments of articulation defectiveness may not be a reliable criterion. More specific methods of selection may be indicated.

2. The group of seventy randomly selected subjects employed in the present study may have consisted of smaller groups of individuals who possessed the ability to make judgments of articulation defectiveness which did not vary significantly from the ratings of graduate students in speech pathology.

3. The group of ten subjects randomly selected from the seventy and subjected to the *t*-test for related measures may not have been a representative sample of the larger group.

Other studies which might be derived from the collected data would include comparison of male and female listeners, comparison of listeners on the basis of grade-point average, and an analysis of the effect of musical background on the accuracy of the judgments. Further study may be indicated to discover the amount of influence each one of these variables has upon the judgment made by subjects like the ones from the present study. These are but a few of the factors which may need to be more accurately defined and measured.

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APPENDICES

APPENDIX A

SUMMARY OF REASONS FOR ELIMINATING SUBJECTS FROM THE PRESENT STUDY

Reason for removal	Number of students
1. Absence from all or part of the first or second session of the study being conducted.	7
2. Discovery that the student was a junior enrolled in a senior subject.	1
3. Indication that a physician or other competent person had discovered a possible hearing impairment.	4

APPENDIX B

THE FOLLOWING IS A COPY OF THE NOTICE SENT TO MADISON SENIOR HIGH SCHOOL ADMINISTRATION CONCERNING THE STUDY TO BE CONDUCTED WITH SENIORS IN THEIR BUILDING RELATIVE TO THE FIELD OF SPEECH AND HEARING THERAPY.

March 18, 1968

Arrangements have been made to use a group of seniors from some of your afternoon classes in a research project to be conducted relative to the field of speech and hearing correction. This experiment is to be held the 7th, 8th and 9th periods on Wednesday, March 20th and Thursday, March 21st. A list of these students will be in your mail boxes on Tuesday morning.

This involves the eventual possibility of using high school graduates as speech aides to professionally trained therapists, as well as channeling interested college-bound students into a promising career opportunity.

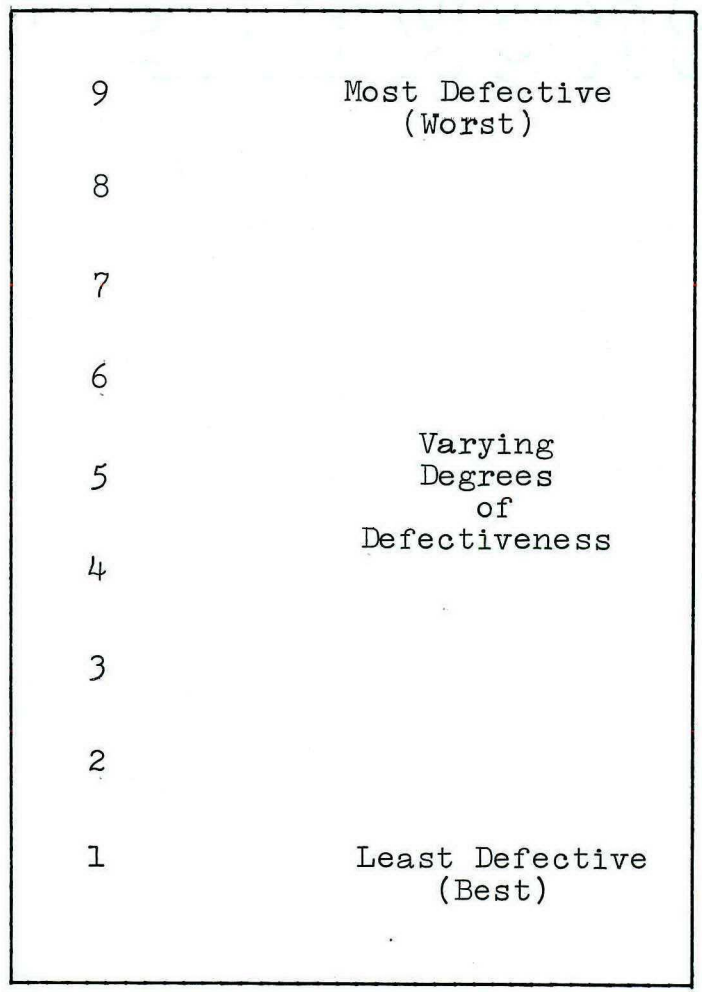
I wish to express my appreciation for the cooperation of each of you whose schedule this will affect.

Sincerely,

James Brundage

APPENDIX C

REPRODUCTION OF THE CHART PLACED IN FRONT OF THE SUBJECTS DURING BOTH LISTENING SESSIONS AND THE PERIOD OF TRAINING



APPENDIX D

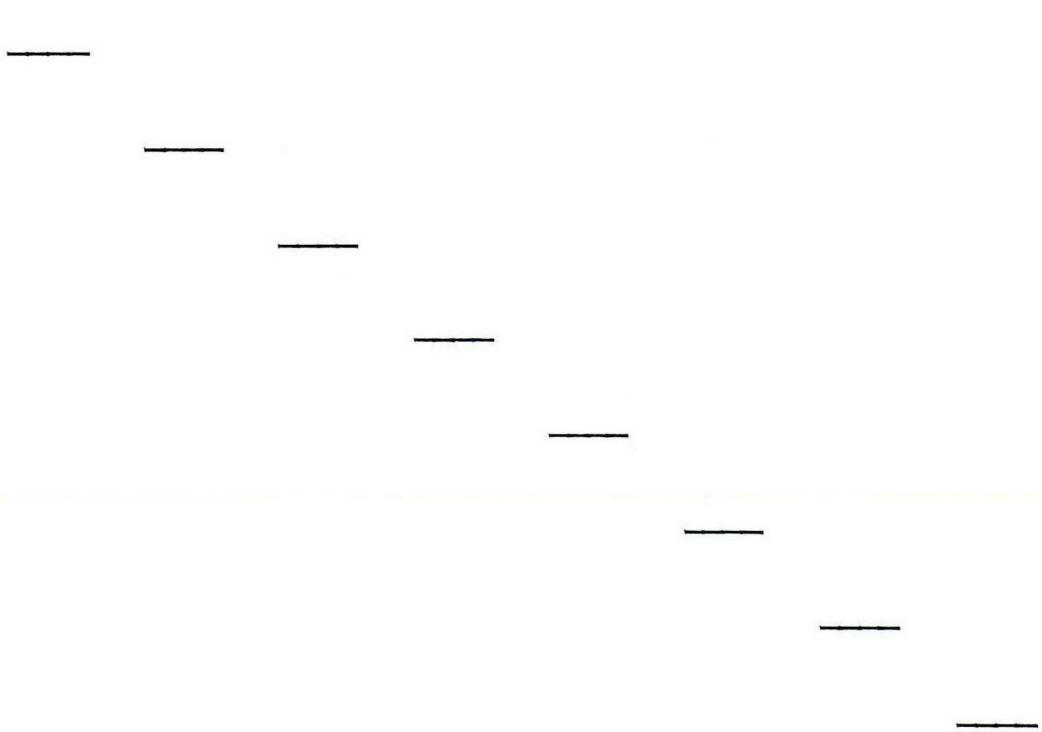
SAMPLE SECTION FROM THE ANSWER SHEET USED FOR THE RECORDING OF RESPONSES TO THE 300 TEN-SECOND SEGMENTS OF RECORDED SPEECH

Name _____

Ratings of defectiveness of articulation on a 9 point scale, with 1 representing the least defective and 9 representing the most defective.

1___ 2___ 3___ 4___ 5___ 6___ 7___ 8___

9___ 10___ 11___ 12___ 13___ 14___ 15___ 16___



289___ 290___ 291___ 292___ 293___ 294___ 295___ 296___

297___ 298___ 299___ 300___

APPENDIX E

SAMPLE ANSWER SHEET USED DURING THE RECORDING OF RESPONSES FOR THE THIRTY-SIX SEGMENTS EMPLOYED DURING THE PERIOD OF TRAINING

Name _____

Ratings of defectiveness of articulation on a 9 point scale, with 1 representing least defective and 9 representing the most defective.

1____	2____	3____	4____	5____	6____
7____	8____	9____	10____	11____	12____
13____	14____	15____	16____	17____	18____
19____	20____	21____	22____	23____	24____
25____	26____	27____	28____	29____	30____
31____	32____	33____	34____	35____	36____

APPENDIX F

SAMPLE PORTION OF A MATRIX OF FIFTY CHILDREN AND SEVENTY SUBJECTS WITH THE TOTAL FOR EACH SET OF SIX SEGMENTS BEFORE AND AFTER TRAINING AND THE CORRESPONDING MEAN SCALE VALUE RATINGS DERIVED FROM EACH TOTAL.

	CHILD 9				CHILD 10				CHILD 11			
	T	MEAN	T	MEAN	T	MEAN	T	MEAN	T	MEAN	T	MEAN
Subject 1	31	5.17	38	6.33	12	2.00	8	1.33	18	3.00	17	2.83
Subject 2	35	5.83	35	5.83	9	1.50	7	1.17	14	2.33	13	2.17
Subject 3	40	6.67	37	6.17	11	1.83	8	1.33	17	2.83	21	3.50
Subject 4	37	6.17	31	5.17	7	1.17	6	1.00	15	2.50	12	2.00
- - -	- - - - - - -				- - - - - - -				- - - - - - -			
Subject 69	33	5.50	35	5.83	10	1.67	6	1.00	16	2.67	18	3.00
Subject 70	39	6.50	40	6.67	16	2.67	16	2.67	22	3.67	16	2.67