1983

An Investigation of the Effectiveness of Amplification as a Viable Method for Improvement of Language and Academic Achievement in a Noisy Environment

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AN INVESTIGATION OF THE EFFECTIVENESS OF AMPLIFICATION AS A VIABLE METHOD FOR IMPROVEMENT OF LANGUAGE AND ACADEMIC ACHIEVEMENT IN A NOISY ENVIRONMENT

by
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A Dissertation Submitted to the Faculty of the Graduate School of Education at Loyola University of Chicago in Partial Fulfillment of the Requirements for the Degree of Doctor of Education.

May, 1983

ABSTRACT

This field experiment was designed to investigate the effectiveness of amplification as a viable method for the improvement of language and achievement in a noisy environment.

Amplification techniques have been utilized successfully in Project MARRS (Mainstreaming Amplification Resource Room Study) for approximately six years for the purpose of remediating educational deficits in students with minimal hearing losses. In the present study, three classes (one fourth, one fifth, and one sixth grade class) were selected as intact experimental groups receiving the amplification treatment condition. In addition, three comparable classrooms (in terms of students at the same grade level) were carefully selected to serve as control groups receiving no amplification treatment. All students in both the experimental and control groups were individually administered the Clinical Evaluation of Language Functions (CELF) Test at the beginning and at the end of the school year. Subtest results of teacher administered group achievement tests (Stanford Achievement Test) for previous and present grade levels were also included as additional dependent variables. Results indicated that there was no statistically significant difference between the experimental and control groups performance scores on the language scale (Clinical Evaluation of Language Functions). Furthermore, there was no statistically significant difference between the experimental and control groups performance scores on the achievement scale (Stanford Achievement Test).

However, performance differences across grade levels was statistically significant in terms of language production and language total test scores on the Clinical Evaluation of Language Functions (CELF) Test and on the vocabulary, math, and listening subtests of the Stanford Achievement Test (SAT). The overall findings of this field experiment indicated that amplification was insufficient as a treatment effect in producing statistically significant differences across groups.

However, the negative findings reported here do appear to be powerful, indicating that amplification, utilized as a generalized treatment condition, does not appear to be a viable method for the improvement of language and achievement in a noisy environment.

Finally, an overall explanation related to increased arousal and habituation to noise utilizing a combination of components form three theoretical interpretations of an individual's adjustment to noise (Broadbent, Cohen and Poulton) was offered in support of the findings of this field experiment.

ACKNOWLEDGMENTS

The author is especially indebted to Doctor Ronald R. Morgan for his patience, assistance, and constructive criticism in bringing this present manuscript to its successful completion. The author also wishes to thank and acknowledge Doctor Jack Kavanagh and Doctor Carol Harding for their time in reading this manuscript and for their helpful suggestions.

A special thank you to the teachers and students of Des Plaines School District No. 62 whose participation and cooperation made this study possible. To Doctor Harry Eschel, another special thank you for allowing me the flexibility needed during my internship to gather the data for this study.

For his help with the computer related phase of this study, the author wishes to thank Doctor Joseph W. Fidler.

To my friend, Debbie Melinger for her hours of typing and correcting this manuscript, the author is extremely grateful and appreciative.

Finally, a very special thanks to my husband, Kenneth, for his unending support and encouragement and to my son, Foster, who in his youthful innocence was unaware of his mother's preoccupation.

VITA

The author, Renee Z. Lewin, is the daughter of Harold and Ida (Weiner) Zelac. She was born on February 7, 1948.

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CHAPTER I

INTRODUCTION

Since September 1977, investigators associated with Project MARRS (Mainstream Amplification Resource Room Study) have examined the effects of teacher voice amplification within the regular classroom and special small groups (resource room instruction) on the academic performance of intermediate grade students. Basically, the objectives of Project MARRS are two-fold. The first is to determine whether students with minimal hearing loss actually experience educational deficits. The second objective is to determine whether or not educational deficits related to minimal hearing loss can be remediated within the mainstream of regular school programs. Overall, the results of Project MARRS studies on children with mild hearing losses have indicated that the use of amplification appears to be educationally effective in relation to national normative data. That is to say, that teacher amplification within the classroom and in resource room instruction has reportedly resulted in significantly improved academic achievement test scores for target students. In addition, sound field amplification has been found to be more cost effective in staff utilization (requiring fewer personnel to achieve the same or academic gains) and lower initial and continuing instructional costs. Sound amplification was also found to be legally defensible when considered within the context of the least restrictive environment mandates of both the State and Federal governments (Sarff, 1981).

The present field experiment was designed to focus specifically on the second objective mentioned above (i.e., improvement of academic skills as determined by student's performance on standardized achievement tests of minimally hearing impaired students). In addition, the area of enhancement of language skills was also included as a variable of secondary interest. In each school selected for this study, one fourth, one fifth and one sixth grade classroom was chosen as an intact experimental group. These age levels were selected to permit comparisons across subjects similar to those subjects used in previous Project MARRS investigations. The experimental classrooms were equipped with electronic equipment to permit amplification of the teacher's voice without restricting mobility. During periods of oral instruction or direction, the teacher's voice was amplified via a uni-directional microphone, a wireless FM transmitter receiver unit, and two loud speakers positioned in the back of the three experimental classrooms. Periodically (approximately every two months) sound level readings were systematically recorded.

In addition to the three classrooms selected as intact experimental groups using the electronic equipment, comparable classrooms (in terms of students at the same grade level) at each of the two participating schools were carefully selected to serve as matched control groups. All students in both the experimental (n=63) and control (n=59) groups were administered a screening test (Clinical Evaluation of Language Functions) for an evaluation of language functioning at the beginning of the school year to serve as a pretest measure of verbal skills and the same test was administered at the end of the school year as a post-test language functioning measure. Results of student performance on a group administered achievement test (Stanford Achievement Test) for the present and previous grade levels were included as another dependent variable. All things considered, this field experiment was designed to determine if amplification is a viable method for the improvement of achievement and enhancement of verbal skills in fourth, fifth, and sixth grade students in a noisy environment.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

In Chapter one a brief background of Project MARRS (Mainstream Amplification Resource Room Study) was presented. The basic rationale behind the inception of MARRS projects is supported by findings from the MARRS literature which have indicated that hearing losses previously felt to be "non-significant" (usually regarded as 15 to 35 decibels in children) are now being reassessed and have been found to be particularly important to language development. Brooks (1973) reported that even slight hearing losses from 10 to 15 decibels may be sufficient to impair language skills in the young child and lead to possible educational retardation. This finding is also supported by Sweitzer (1977) who regards hearing losses in the 15 to 25 decibel range in school age children as possibly detrimental to the development of speech, language, and education, and suggests that these students may benefit from amplification.

The adequacy of present screening techniques (pure tone average (PTA), auditory discrimination tests, and speech reception) has been questioned by Gerwin and Glorig (1974) who point out that these conveniently used screening techniques often do not identify the child with a mild conductive loss. Without adequate identification, these children may be labeled as backward, inattentive, or learning disabled. Traits exhibited by a majority of students referred for learning disabilities presented in order of increasing incidence are: 1) gross expressive language deficits; 2) auditory discrimination difficulties; 3) minor deviant speech patterns; 4) auditory memory deficits; 5) poor auditory disclosure skills; and 6) standardized academic achievement test scores significantly below their peer group (Sarff, 1981). Downs (1976) has also expressed concern that our current definitions of handicapping hearing loss in terms of language acquisition and educational progress is woefully vague.

The present field experiment was carefully designed to furthre extend the data base of previous Project MARRS studies to include an achievement outcome evaluation of amplification procedures. Furthermore, due to the proximity of the experimental setting to O'Hare International Airport, another concern addressed in the present study was to focus on the possible detrimental effects of noise upon various aspects of the learning processes of the individuals involved. The selective review of the literature presented here includes the following subsections: the impact of hearing; listening; definition and process; and the impact of noise.

The Impact of Hearing

A Description of the Acoustic Process

An integral part of acoustic processes is the presence of sound. Sound can be considered as that quantity, which, when present, may give rise to the sensation of hearing (Small, 1973). In Small's schematic diagram of segments of a sound chain (see Figure 2-1) three separate processes are evident and important.

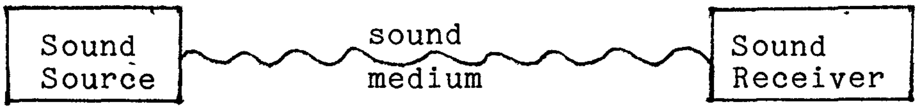


Fig. 2-1
Schematic Diagram of Segments of Sound Chain

In the present experiment, the focus was upon the sound receiver, a human individual, and his or her auditory system.

Schubert (1978) describes hearing, or audition, as facilitated by three auditory components, the first of which is the pinna (or outer ear) which is the chief element in the localization of sound. Roffler and Butler (1968) demonstrated that the pinna is involved in the judgment of the height of the source of the sound. The middle ear is in impedence-matching device which transfers energy (i.e., sound vibrations) from an air medium to a water medium. The final component in Schubert's paradigm is the cochlea, or inner ear, whose function is the most complex of all the physical mechanisms of audition. The cochlea might simplistically be described as a biological transducer.

The impact of severe hearing loss and social communication has been appreciated at least since bibilical times (Dirks, 1978). Early laws and regulations reflected misunderstanding of the deaf who were often denied legal rights or, in many instances, considered mentally incompetent. This negative historical perspective continued until the Renaissance period when the rehabilitation or training of these individuals first appeared.

Auditory Perception

The impact of hearing upon the learning process is reportedly influential in not only intellectual, but social and emotional development as well. Of the five senses man possesses hearing and vision are the most sophisticated (Sanders, 1977). The auditory system provides the organism with information related to environmental change. The hearing process as performed by the auditory perceptual system, is referred to as audition.

Audition, as it occurs in most people, enables the individual to do several things: 1) localization of acoustic sources; 2) echolocation; 3) identification and information about the nature of the acoustic source; and 4) communication (Bartley, 1972). Localization in humans is two dimensional in that it involves a horizontal plane (what lies above or below the acoustic source, "what makes the sound", is not well distinguished). Echolocation refers to the identification of the presence of objects which produce no sound of their own. The signals received in echolocation consist of the echos reflected from the surface of the object. The sonar systems man has developed for identifying objects is based on the principal of bouncing sound waves off these objects not conducive to visual interpretation alone. Echolocation or auditory navigation is used by subhumans; such as porpoises, birds, and rats for visual navigation (Riley and Rosenzweig, 1957; Novick, 1959; Kellogg, 1961). Audition broadens an individuals world by allowing them to passively monitor the environment which is external to their visual field and identify unseen entities. Information received through the auditory perceptual system allows the individual to indentify and react to relevant unseen environmental occurrences; such as an infants crying, a telephone ringing, or a neighbors argument. A direct relationship appears to exist between the sound and its source.

There is reason to assume that we perceive in terms of how we process what we receive (Sanders, 1977). Processing is determined by the fidelity of the sensory end-organs, in this case, the organ of hearing. This sensory system serves the function of intermediary between a person and the physical world of people, things, and events. If there is any malfunction or impairment in this system, it will result in reduced capacity of the individual to be influenced by occurrences that would normally stimulate him or her. It is this source which has resulted in the highest form of auditory perception. Sound and hearing serve as important tools for the social interaction of people. Men and women are influenced and influence others through the use of spoken language. It is this ultimate level of auditory perception which reportedly expands a person's perceptual environment to a limitless degree.

In summary, hearing appears to be one of the more complex of the primary senses of man. The physical capabilities of the organ of hearing itself can be compared to some of the most complex mechanical and electrical devices today. The connection of hearing to the brain which results in auditory perception is a complex process apparently related to a myriad of other functions.

Listening: Definition and Related Processes

Listening is defined as "the process by which spoken language is converted to meaning in the mind" (Lundsteen, 1979). Various components of listening are exemplified by this definition: 1) listening is distinguished from physiological hearing and from attention; 2) listening is a process made up of steps; 3) listening is a spoken language having various dimensions and different material; 4) there is meaning residing in the users; and 5) the mind is capable of intelligence far beyond the received message. Listening is the first language skill to appear in humans' followed by speaking, reading and writing. The ability to listen reportedly sets limits on the ability to learn. Specific links between learning and listening are: 1) receiving; 2) analogy features; 3) language vocabulary skills; and 4) the common skills of thinking and understanding. Only when listeners are able to perceive the occurrence of what is said are they free to move to the critical area of what is meant.

Communication is a process which includes the message, sender, receiver and in most cases a response. The process has occurred when the agent receives the data. Listening has occurred when a human organism receives the data aurally. Three aspects which reportedly influence listening are: 1) capacity; 2) willingness; and 3) habits (Weaver, 1972). Frequently reported reasons to improve listening are: 1) it enables the individual to learn more; 2) the individual will be better informed; 3) the individual will be liked and respected by others; 4) the individual maintains contact with reality; and 5) the individual will be a more dependable person. Good listening is a native process demanding alert and active participation and is viewed as an art requiring knowledge and effort which is developed through training and practice (Dominick, 1958). Good listening requires discipline as an expression of one's will. "Listening between the lines" shows that an individual is attentive not only to what is said but to the total facts of the situation as well. Concentration is another aspect of good listening which requires the individual to be patient with himself, to remove distractions, and to become an active participant. A third component of good listening is comprehension. This requires understanding and a grasp of the meaning of what is heard. Human beings reportedly think four times faster than they speak so the components of good listening appear essential to promote learning.

Lundsteen (1979) has delineated a multi-step model that outlines a definition of proficient listening. Step one is the ability to hear which assumes that the individual has adequate auditory acuity, discrimination, analysis, and auditory sequencing skills. The second step requires that the individual be able to hold in memory the sounds that are heard. Involvement of long term and short term memory with rehearsal and association skills are involved in this step. Step three requires the individual to attend to the sounds. That is to say that an individual must listen, focus, and select cues from the speech sounds heard. Concentration is an important aspect of this step. The formation of images occurs in step four which requires internalization of the sounds heard. In step five the individual must search his or her past store of ideas and experience to relate what he has heard to his vocabulary competencies, language background, standards, ways of organization, or purpose of what has been heard. In step six, the comparison step, the message heard must be compared with the previous store of knowledge in terms of the individuals larger organizational structure. This includes: 1) time sequencing; 2) cause/effect; 3) part/whole relationships; 4) contrast; and 5) use of indexing and scanning skills. Testing hypotheses take place in step seven permitting the listener to test his or her hypotheses to see if the material has been monitored correctly (e.g., as asking the speaker to clarify a portion of what has been heard). In step eight a recoding of the listened to message takes place and in step nine the individual must acquire the meaning of what has been heard. In the final step of this process (step ten), the individual must intellectualize the material heard and process this to facilitate further learning in the future.

In the sub-skills necessary for successful reading comprehension, listening has been given a high priority. Clymer's (1967) view is typical in that reading is viewed as a four-part process comprised of decoding, understanding, evaluating the message and finally making that message part of one's general attitude and behavior in life. This approach to reading emphasized the necessity of listening skills. Others (Rankin, 1926; Fries, 1962 and Smith, 1971) have related essential points of reading skills to similar differences in the sub-skills related to listening. It has been pointed out that the child must learn that the printed words are signals for spoken words and that they have meaning analogous to those of written words. If the child does not have adequate listening skills, successful reading ability will be almost impossible to attain. Duker (1965) collected the results of many early studies supporting the relationship between reading and listening. He cites 23 major studies between 1926 and 1961, with correlations ranging from a low of .45 to a high of .70 with a mean .59. From this data, Duker hazards two suggestions. First, poor readers will not generally gain a great deal from aural instruction since poor readers do not listen much better than they read. That is to say that the problems with listening seem to be little different than the problems related to reading. Second, both reading and listening are receptive forms of communication and neither seems to depend that heavily on the transference of written (decoding or aural hearing) symbols to a more meaningful form.

In summary, listening appears to be the basic fundamental component in the hierarchy of communication skills. As Figure 2-2 indicates, one may view listening as the outermost of a series of concentric circles in terms of further processes which will be developed. One must develop the components necessary for good listening in order to successfully acquire the knowledge and skills necessary for more complex communication abilities.

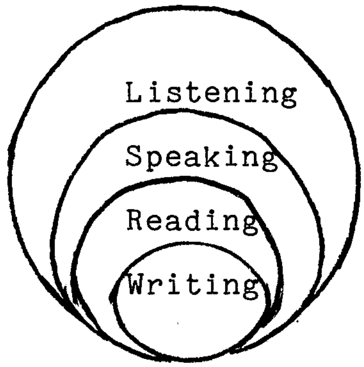


Fig. 2-2
Schematic Diagram of Listening Hierarchy

The Impact of Noise

Noise versus Sound

Sound refers to a change in air pressure detected by the ear. These pressure changes are created by a wave-like movement of air molecules in response to object vibration. Frequency (the number of times per second a wave motion completes a cycle) is perceived by the listener as pitch. Variations in wave height, or amplitude, are determined by the amount of energy or pressure that we experience as differences in loudness (Cohen and Weinstein, 1981).

The intensity of sound is commonly expressed in decibels (dB). Zero decibels (0dB) is about the level of the weakest sound that can be heard by a person with very good ears in an extremely quiet environment. Fifty-five decibels is roughly equivalent to traffic noise, 70dB to a vacuum cleaner at 10 feet, 110dB to a riveting machine, and 120dB to a jet take off at 200 feet (Cohen and Weinstein, 1981).

Noise is a psychological concept and is operationally defined as sound that is unwanted by the listener because it is unpleasant, bothersome, interfers with important activities, or is believed to be physiologically harmful (Kryter, 1970). Sounds can be unwanted because of their physical properties (e.g., intensity, frequency and intermittancy) or because of their signaled properties (i.e., their meaning). Unwanted effects of sound related to its physical properties include the masking of desired sound, auditory fatigue and hearing damage, excessive loudness, bothersomeness, and startle (Kryter, 1970). Recent data also suggest that the meaning of a sound plays an important role in determining its effects on annoyance, performance and possibly health (S. Cohen, 1980; S. Cohen, Glass, and Phillips, 1979).

A Theoretical Perspective

Broadbent (1971), Cohen (1978), and Poulton (1979), have provided some overall theoretical structure to the psychological understanding of noise.

Broadbent (1971) has argued that exposure to moderate and high-intensity noise causes an elevation in arousal. Heightened arousal, in turn is said to lead to a narrowing of one's attention. The first inputs to be ignored are those that are irrelevant or only partially relevant to task performance. As arousal increases, attention is further restricted and task relevant cues may also be neglected.

S. Cohen (1978) similarly predicts attentional focusing will often occur under high-intensity noise, but explains the focusing as a strategy commonly used to decrease the amount of information processed when one's processing capacity is overloaded by the combined demands of the stressor (the noise) and the ongoing task. Cohen also argues that the information load imposed under noise exposure is affected more by the meaning of the noise and the situation than by the intensity of the sound.

Poulton (1979) argues that there is an increase in arousal when continuous noise is first switched on, but that the arousal gradually lessens over time. He asserts that this initial increase in arousal often results in improved performance. Poulton also suggests that reported deficits in task performance under continuous noise occur because of the subjects' inability to hear acoustic cues (including hearing one's own internal speech) that aid performance when the task is performed in quiet. Deleterious effects of intermittent noise are attributed to the distraction that occurs at the onset of the noise.

Field Research on Performance During Noise

In a study of the effectiveness of aircraft noise abatement, S. Cohen, Evans, Krantz, Stokols, and Kelly (1981) reported that after controlling for possible socio-economic and racial differences, third grade children who spent the year in noise abated classrooms had better math scores than children in non-abated rooms. A similar, although non-significant, pattern was found for reading scores. In an earlier study, S. Cohen, Evans, Krantz, and Stokols (1980), found that when tested in quiet conditions, children attending the noisy schools were poorer on both a simple and difficult puzzle solving task and were more likely to "give up" on the task than their counterparts from quiet schools. Again, race, social class, and hearing damage were ruled out as possible explanations. In a study of third through fifth grade children living in apartment buildings built on bridges spanning a busy expressway (S. Cohen, Glass, and Singer, 1973), it was found that when tested in a quiet setting, children living in noisier apartments showed signs of auditory discrimination and reading ability lower than those living in quieter apartments. Interestingly, the magnitude of the correlation between noise and auditory discrimination increased with the length of residence. Again, race, social-class variables, and hearing losses were ruled out as possible alternative explanations.

Zentall and Shaw (1980) performed experiments to assess the affects of task-overlapping linguistic noise (ambient noise, including conversations) on activity and performance of hyperactive and control children. High and low levels of linguistic classroom noise were each presented while children were performing tasks requiring auditory processing of information and repeated-measures cross-cover design tasks. The hyperactive children were most active and performed math and alphabet tasks worse in high than in low linguistic noise situations. Evidence for sex differences for the effects of classroom noise on children were obtained by Christie and Glickman (1980), who performed experiments to clarify the relationship between classroom noise and childrens' intellectual performance. One hundred fifty six (156) first-, third-, and fifth-grade children worked on a matrix task in either a noisy environment (70dB) or in an quiet environment (40dB). Childrens' performance on the intellectual task increased with age. Moreover, in the environment with classroom noise, boys consistently solved more complex matrix problems than did girls.

Limited flight operations by the Concorde Supersonic Aircraft provided a unique opportunity to study its impact upon individuals living in the airport area (Allen, 1980). Residents of an even greater area would now be subjected to noise levels above 100dB. Several tests designed to assess the effect of the increased noise levels created by the Concorde were administered to forty-eight (48) residents living around Dulles International Airport and thirty-one (31) persons not living near an airport. Results of a pretest questionnaire and lack of significant changes and annoyance levels indicated that, while airport-area residents may be more conscious of aircraft noise, changes in the perceived intensities of sounds may not occur. In another study on the effects of airport noise, Arnoult and Voorhees (1980) recorded sounds of three different types of aircrafts (a propellor airplane and two different types of helicopters) which were played while subjects engaged in an audiovisual task. The results of the study were in close agreement with previous field studies on the rated "annoyingness" of aircraft sounds and provided no support for the contention that one type of aircraft noise is more disruptive in ways not accounted for by simple measures of loudness levels. Although many of the negative effects of noise decrease rapidly in laboratory studies (Glass and Singer, 1972; Kryter, 1970), community noise research provides little evidence that people adapt well to noise in residential settings. The findings of many researchers (S. Cohen et al., 1980; S. Cohen, Glass, and Singer, 1973) have indicated that long time neighborhood residents are at least as bothered by noise as more recent arrivals.

Noise and Health

Most would argue that outside of the effects of high-intensity sound on hearing (Kryter, 1970), there is little convincing evidence for a causal-link between noise and physical disorders. However, noise can reportedly alter physiological processes including the functioning of the cardio-vascular, endocrin, respitory, and digestive systems (McLean and Tarnopolsky, 1977). Since such changes, if extreme, are often considered potentially dangerous to health, many feel that pathogenic effects of prolonged noise exposure are likely. Physiological changes produced by noise consist of non-specific responses typically associated with stress reactions (Glorig, 1971; Selye, 1956).

On one hand, there is mixed evidence that a number of physiological responses do not habituate to repeated exposure and thus could constitute the physiological basis for long-term harmful effects of noise. On the other hand, others report that habituation of these responses occurs after only short exposure to noise (e.g., Glass and Singer, 1972). Thus, prolonged exposure might not necessarily produce continuous elevation of physiological responses inhibital to normal bodily functions. Kryter's (1970) conclusion that "the exact course and degree of adaption of all these responses has not been thoroughly studied", probably best represents the overall state of our knowledge in this area.

Recapitulation

The effectiveness of Project MARRS has been repeatedly documented with mild hearing impaired students. Results of the project have also shown that present hearing screening techniques may not be adequate for identification of students with mild hearing losses who may otherwise be labeled as inattentive or learning disabled. Evaluative implementation of the project in a community in close proximity to a large airport would permit expansion of the project to a normal student population in a "noisy" environment.

Since hearing appears to be one of the most sophisticated of man's primary five senses, a brief account of its mechanical functions was presented. Small's (1973) diagram schematically presented the segments of a sound chain process from the source of the sound to the sound receiver: (the external component of the human auditory system - the outer ear). Schubert's (1978) description of the components of man's auditory system presented a simplistic description of the three components (outer, middle, and inner ears) necessary to facilitate audition. The continuation from the mechanical process of audition to the auditory perceptual process was described by Sanders (1978). The auditory perceptual system provides information related to one's environment, enables the individual to identify and locate sound sources, and provides influences for language and communication skills (Dirks, 1978; Sanders, 1977).

Lundsteen (1979), Weaver (1972), Clymer (1967), and Dominick (1958) were among those cited as defining listening and attributing importance to listening in the development of other skills; such as speaking, reading, and writing. Duker's (1965) review of the results from many early studies also supported the close relationship between listening and reading.

Noise was distinguished from sound due to its interference with important activities (Kryter, 1970). Cohen and Weinstein (1981) gave various examples of noise levels reported in decibels (dB) ranging from 0 dB to 120 dB which illustrated various levels of noise. A theoretical context in which to view noise was presented by utilizing Broadbent's (1971), Cohen's (1978), and

Poulton's (1979) psychological accounts of noise. The findings from previous field studies on students' performance during noise has, on the whole, indicated that noise adversely affects students' performance. For example, the following results have been reported: improved math and reading scores in noise abated classrooms (S. Cohen, et. al., 1981); children from noisy schools "giving up" on simple and complex puzzle-solving tasks (S. Cohen, et. al., 1980); and lowered auditory discrimination and reading ability in children from noisy apartments (S. Cohen, et. al., 1973). Hyperactive children (Zentall and Shaw, 1980) and girls (Christie and Glickman, 1980) also reportedly showed poor performance on various tasks during noisy situations.

An essential aspect of the present field experiment was the individuals ability to listen in the presence of extraneous noise. A systematic attempt was made to determine if amplification is effective as a method of improving language and achievement skills (which appear to be closely related to listening ability) in an environment considered "noisy".

CHAPTER III

METHOD

HYPOTHESES

The following null hypotheses were tested:

1. There are no significant differences in performance between the experimental and control group subjects on the language scale (Clinical Evaluation of Language Functions).
2. There are no significant differences in performance between the experimental and control group subjects on the achievement scale (Stanford Achievement Test).
3. There are no significant differences in performance among the fourth, fifth or sixth grade students on the language scale and the achievement scale in the experimental and control groups.

SUBJECTS

Sixty-three (63) students selected from fourth, fifth and sixth grade classes served as experimental subjects in this investigation and received amplification treatment. In addition, fifty-nine (59) students served as control subjects receiving no amplification treatment. The six classrooms (three experimental and three control) selected for inclusion in this study constituted a sample of convenience. Three teachers who could be persuaded to wear the microphone and transmitter were chosen as experimental teachers who taught the experimental groups. A systematic attempt was made to consider the composition of the students within each experimental classroom and the qualities of the experimental teachers in order to attain three comparable control groups. That is to say, that factors such as similarity in teaching style and homogeneity of the students were considered in an attempt to match the experimental and control groups. For example, classrooms in which a teacher was well known in regard to special skills related to the handling of difficult behavior problems and using unique teaching methods were not selected as experimental nor control group classrooms.

The school district used in the present investigation is located approximately twenty (20) miles Northwest of downtown Chicago and is adjacent to the boundaries of O'Hare International Airport. The socio-economic status of those persons residing within the target school district range from middle- to upper-middle class levels. According to a study compiled in September 1981, ethnic composition is as follows: Non-Hispanic White 4,234 (85.9%), Hispanic 269 (7.1%), Asian/South Pacific 230 (6.1%), Black 21 (.6%), and American Indian 11 (.3%). The population of 3,765 students is serviced in eight (8) elementary and three (3) junior high schools.

PROCEDURE

After careful and systematic selection of control and experimental groups was completed, the electronic aparatus was installed in the three experimental classrooms. Concurrent with the installation of the equipment and the audiometric test administered by the school speech pathologist, the pretest measure of the Clinical Evaluation of Language Function (CELF) was administered to all subjects in both the experimental and control groups. Audiometric screening was also completed by the school's speech pathologist. The results of these screenings were eliminated from the present study since they were not directly relevant to the research topic of primary interest. The language pre- and post-tests (Clinical Evaluation of Language Functions) were administered to all subjects by the school psychology interns from the district and group achievement tests were administered by the classroom teachers as scheduled by each school's principal.

INSTRUMENTATION

The Clinical Evaluation of Language Functions Test (CELF):

The Clinical Evaluation of Language Functions Test (CELF) by Eleanor M. Semel and Elisabeth H. Wigg is published by Charles E. Merrill Publishing Company, (1980). The CELF Screening Tests, Elementary and Advanced Levels, were designed to assist psychologists, educators, clinicians and other professionals in identifying elementary and secondary level students with potential language disabilities. The overall purpose of these tests is reportedly to provide a measure for screening the language processing and production abilities of school-aged children over a wide range of grade levels.

These screening tests are constructed to cover two grade ranges. One level covers the elementary grades, K through 5, and the second level covers grades 5 through 12. At each level items were designed to fall within one of two categories. One set of items present oral directions and require no verbal responses. These items have been grouped to form the Processing section of the test at each level. The second set of items, the Production section, present spoken stimuli which require a verbal response on the part of the student. The organization of the test consists of overlapping or parallel items on both levels. At the Elementary Level thirty-one (31) items are included in the Processing Section and seventeen (17) items in the Production Section. The Advanced Level includes thirty-four (34) items in the Processing Section and eighteen (18) items in the Production Section. Sample copies of both levels of this test may be found in Appendix A of this manuscript.

The CELF norm tables are based on a standardization sample of 634 cases at the elementary level and 771 cases at the advanced level. The sample was selected according to the following stratification variables: 1) grade level, 2) sex, 3) racio-ethnic background, and 4) geographic region. Attempts were made to reflect the 1970 U.S. Census as closely as possible. There are a number of tables in this manual that delineate distribution of this sample by the various categories. Overall characteristics of the children for inclusion in the standardization sample included exhibition of patterns of normal development and the absence of hearing or uncorrected vision problems, physical handicaps, speech and language disorders, learning disabilities, mental retardation, or emotional disorders.

The concurrent validity of the CELF Screening tests, both Elementary and Advanced Levels, was established in comparison with three selected criterion measures. The criterion measures were selected because of their relatively common useage in the screening and diagnosis of language disorders. The criterion measures selected were the 1) verbal subtests of the Illinois Test of Psycholinguistic Abilities (ITPA), 2) verbal subtests of the Detroit Test of Learning Aptitude (DTLA), and 3) Northwestern Syntax Screening Test (NSST). Pearson product-moment correlation coefficients (r) ranging from .45 to .62 were calculated to establish the concurrent validity in the manual.

Test-retest procedures were used in three studies to obtain measures of reliability. The various studies (n=30, 21, 30) contained randomly selected academically achieving children with normal language development in grades 3, 4, and 8 from different public schools. The intervals between tests ranged from three to six weeks depending on the study. The Pearson product-moment correlation coefficients (r) obtained in the studies ranged from .67 to .88. Interrelationships among processing and production items for each level of the selfscreening tests were also evaluated. Pearson product-moment correlation coefficients (r) were calculated to assess these relationships also included are tables indicating internal consistency estimates of reliability for the processing production and total scores. These estimates quantify the degree to which all items in a test or group of test items measure the same ability. The range of correlation is vast, from r=.20 to r=.91. The manual states: "Because the screening tests are meant to be relatively wide-range samples of behaviors related to language processing and production abilities, very high estimates of internal consistency do not seem as highly desirable as they might in tests which claim to probe a single factor, ability, or skill." This caution should be considered in the interpretation of the test scores.

The Stanford Achievement Test (SAT): The Stanford Achievement Test (SAT) by R. Madden, E.F. Gardner, H.C. Rudman, B. Karlsen, and J.C. Merwin is published by Harcourt Brace Jovanovich, Inc. (1974). For use in the elementary schools (grade kindergarten through six) there are five levels available (Primary Levels I, II, III and Intermediate Levels, I, II). The levels provide extended grade coverage in order to make it possible to use a particular battery at the higher or lower range than it is intended to be used. This is to allow flexibility of interpretation of scores unique to a specific class or an entire school system. Various forms of each battery are available at the different levels. The abilities measured in each level in the current (1973) edition are those to which the greatest attention is given in the grades for which the test was primarily designed. The maximum number of tests included at the various grade levels are: 1) Vocabulary; 2) Reading Comprehension; 3) Word Study Skills; 4) Mathematical Concepts; 5) Mathematical Computations; 6) Mathematical Applications; 7) Spelling; 8) Language; 9) Social Science; 10) Science; and 11) Listening Comprehension. Grade level scores were used in computation of statistical analyses. This type of score was all that was available in the collection of data.

The restandardization of the Stanford Achievement Test was a rather massive and comprehensive project. A total of 109 school systems drawn from 43 states participated for a total of over 275,000 pupils. The norms were developed through a three-stage process. The first step in planning the standardization was to determine the number of separate standardization programs to be undertaken and the time of the year these programs were to be conducted. The second step was the decision to standardize the three forms (A, B, and C) at all levels simultaneously in both times selected; near the end of each grade in May and near the beginning of each grade in October. The third step of the standardization program was the establishment of specifications for the norm groups with respect to such characteristics as geographic distribution, types of school systems to be included, numbers of pupils desired per grade, and the extent of participation within cooperating systems. The final standardization samples were selected to represent the national population in terms of geographic region, size of city, socio-economic status, and public and non-public schools. Furthermore, a special socio-economic index based on median family income and median years of schooling for adults in the communities was used for selecting the Stanford standardization samples. Once the test data was available, they were weighted to permit the construction of norm groups by grade level that were comparable in mental ability to the norm groups for the Otis-Lennon Mental Ability Test (OLMAT). This was to provide a Stanford norm group for each grade level with a normal distribution of mental ability, a mean OLMAT deviation I.Q. of approximately 100 and a standard deviation of approximately 16.

Validity and reliability of the test were dealt with in very general terms. Content validity, in terms of the extent to which the content of the tests constitutes a representative sample of the skills, knowledge, and understandings that are the goals of instruction in a contemporary school, are stressed. Towards this goal, instructional objectives for each of the tests and item groupings within subtests for the Standford Achievement Test have been prepared and are described in the Teacher's Guide for Interpretation. Two types of reliability coefficients are presented: one in terms of split-half estimates based on oddeven scores corrected by Spearman-Brown Formula (r_{11}) and the second based on Kuder-Richardson Formula 20 ($^{r}KR\ 20$). Both measures correspond closely with only a .01 difference between the two figures. The range in reliability coefficients is given for each level and standardization for every subtest which range from .88 to .95. Standard Errors of Measurement statistics are also indicated for each test in each battery.

DESIGN & STATISTICAL ANALYSES

The analytic paradigm for this study is presented below:

		Experimental (n=63)	Control (n=59)
Grades	4		
	5		
	6		

Grade placement (4th, 5th, or 6th) and treatment (control or experimental group) are the independent variables of primary interest and the dependent variables are the Clinical Evaluation of Language Functions (CELF) Screening Test scores and the Stanford Achievement Test (SAT) scores.

Since it was impossible to randomly select subjects or conditions (an intact sample of convenience), this is a "faulty" quasi-experimental design set-up as a compromise before-after (Pretest-Postest) experimental-control group design.

Y_b	X	Y_a	(Experimental)
Y_b	X	Y_a	(Control)

The experimental group received amplification as a treatment, while the control group did not. In reality, there are three experimental groups and three control groups due to the additional independent variable of grade placement.

The statistical analyses performed to test the three null hypotheses consisted of a combination of ANOVA differences among pretest scores and analyses of covariance procedures to determine if the differences in the dependent measures (language and achievement test scores) between the experimental and control groups at the various grade levels were statistically significant.

CHAPTER IV

RESULTS

Results of Pretest ANOVAS

To test the significance of the differences of dependent variables across groups at the time of the pretest, two-factorial analyses of variance (ANOVA) procedures were carried out. Tables 1(a) through 1(k) (see Appendix B) show that there were no significant differences between experimental and control groups on the eleven (11) dependent variables (three (3) CELF test scores and eight (8) SAT scores) at the time of the pretesting. The P-values obtained ranged from 0.15 (CELF - Language Production) to 0.76 (SAT - Math).

The range of P-Values for interaction effects (Group*Grade) at pretest was 0.03 (SAT - Math) to 0.80 (SAT - Listening). Although the 0.03 P-Value for SAT - Math could be considered significant, the Group P-value was the highest obtained, thus negating attributing any significance to this statistic. On the whole, there were no significant interaction effects at the time of pretesting.

However, significant differences were found for all eleven (11) dependent variables (with the exception of the CELF Language Total Score) for the independent variable of grade-level. In all cases, the P-value was less than 0.00 (with the actual value being 0.0001 in all the cases). Of course, significant differences across grades would be expected due to developmental differences.

Overall Examination of Means and Standard Deviations

Tables 2 through 12 (see Appendix B for details) report the means, standard deviations and adjusted means for scores obtained to determine if the experimental group subjects improved their scores significantly more than the control group subjects from pretest condition to post-test condition. Fig. 4-1 presents a summary of these findings.

The differences for the CELF scores are based on the number right. Therefore, a difference of 5.33 indicates an increase of slightly more than five items. The differences from the SAT results are based on grade scores and a difference of 1.98 indicates a gain of close to the equivalent of two school years. Figure 4-2 lists the maximum difference for each of the test results.

Systematic examination of variance in standard deviations units (S_x) provides us with an index of homogeneity. All differences were within approximately one unit. Out of sixty-six possible differences in standard deviations from pretest to post-test, only three differences (1.61, 1.50, 1.32) were greater than one unit and all three were found in the sixth grade CELF test results.

Table Number	Test	Control 4	Control 5	Control 6	Experimental 4	Experimental 5	Experimental 6
2	CELF - Language Total						X
3	CELF - Language Processing	X					
4	CELF - Language Production						X
5	SAT - Vocabulary						X
6	SAT - Math						X
7	SAT - Reading			X			
8	SAT - Word Study Skills			X			
9	SAT - Language						X
10	SAT - Listening			X			
11	SAT - Total Reading	X					
12	SAT - Total Auditory			X			

Fig. 4-1
Summary of Indication of Greatest Difference in Means
from Pretest to Post-test by Group and Grade.
(Where X denotes largest gain)

Table Number	Test	Maximum Difference In Means
2	CELF - Language Total	5.33
3	CELF - Language Processing	3.35
4	CELF - Language Production	3.39
5	SAT - Vocabulary	1.90
6	SAT - Math	1.98
7	SAT - Reading	1.80
8	SAT - Word Study Skills	1.56
9	SAT - Language	1.62
10	SAT - Listening	2.48
11	SAT - Total Reading	2.21
12	SAT - Total Auditory	1.77

Fig. 4-2
Maximum Difference in Scores from Pretest to Post-test

Results of Analysis of Covariance Procedures

Use of gain or change scores has been frequently criticized due to the possible sensitizing effects of the pretest and failure to detect differences using analysis of change scores. In the present study, covariance (ANCOVA) was selected for use as a proper alternative to the analysis of change scores. A two-factor ANCOVA was performed on each of the eleven dependent variables. The ANCOVA procedure permits one to use the pretest scores to make adjustments to the post-test scores. Therefore, ANCOVA procedures allow one to control for the differential effects that the pretest scores have on the observed value of the post-test scores before analyzing the differences among the post-test scores.

Using ANCOVA procedures no significant differences were found between experimental and control groups on any of the dependent variables. The P-values for Group ranged from 0.08 (see Table 19) to 0.88 (see Table 20). However, significant differences were found in terms of grade level for the following dependent variables: CELF - Language Total (see Table 13); CELF - Language Production (see Table 15); SAT - Vocabulary (see Table 16); SAT - Math (see Table 17); and SAT - Listening (see Table 21). Testing for interaction effects (Group*Grade) resulted in a significant P-Value for SAT - Vocabulary (see Table 16).

Summary of Results

In summary, null hypothesis one was not rejected indicating that there were no statistically significant differences between experimental and control groups on the language scale (Clinical Evaluation of Language Function Test).

Null hypothesis two was also not rejected indicating that there were no statistically significant differences between experimental and control groups on the achievement scale (Stanford Achievement Test).

However, null hypothesis three was rejected indicating that the differences among grade levels were statistically significant in terms of student performance on the language production and language total on the Clinical Evaluation of Language Functions (CELF) Test and in terms of student performance on the vocabulary, math, and listening subtests of the Stanford Achievement Test. All things considered, the negative findings reported here do appear to be powerful, indicating that amplification, utilized as a generalized treatment condition, does not appear to be a viable method for the improvement of language and achievement in a noisy environment.

CHAPTER V

DISCUSSION

Introduction

The purpose of this field experiment was to carefully examine the effectiveness of amplification as a method for improvement of language and/or achievement skills in a noisy environment. Noise was defined as sound that is unwanted by the listener because it is unpleasant, bothersome, or interferes with important activities (Kryter, 1970). The proximity of the experimental classroom settings used in the present study to O'Hare International Airport created a noise level that was often higher than the average ambient noise levels in regular classrooms. The amplification procedures successfully utilized in previous Project MARRS experiments were used as the treatment condition in the present investigation. As pointed out previously, Project MARRS amplification procedures have been shown to be quite effective as an alternative to self-contained class placement for mild-hearing impaired students (Sarff, 1981; Sarff and Ray, 1981, Bagwell et.al., 1980).

The third, fourth, and fifth grade students participating in this study were administered pretests and post-tests in various areas of language (CELF) and achievement (SAT). The analysis of the results of the data collected were presented in Chapter IV. In this chapter, a critical discussion related to findings of the present study and provision of suggestions relevant to relevant to future use of the Project MARRS procedures in noisy environments are presented.

General Findings of Test Results

As expected, due to developmental differences, significant performance differences across grade-levels were found in the present investigation. Tables 1(a) through 1(k) (see Appendix B) indicate the presence of homogeneity at the time of the pretest. The means and standard deviations for each of the eleven dependent variables are presented in Tables 2 through 12 and are summarized by use of the maximum difference gains by group and grade in Figures 4-1 and 4-2.

With the exception of two tests, greatest improvement for every dependent variable occurred in the sixth grade. As expected, both the control and experimental groups in the sixth grade achieved greater gains than control or experimental groups in the fourth or fifth grades.

It is important to point out that at the outset of this study when pretesting had been completed, the investigator was informed by the teacher for the sixth grade control group that both classes involved in the study at that grade would be changing classes for instruction in various subjects. An attempt was made to determine which students were in which room for various subjects to aid in the interpretation of results, but this task was not feasible due to the nature of the various subjects taught by the teachers and the impossibility of categorizing these subjects to correspond to the breakdown of the sub-topics of the tests used. It is likely that all of the students in the sixth grade were exposed to the experimental treatment (i.e., amplification), at some time during the course of the school year for varying amounts of time.

The gains of the fourth grade control group in the areas of CELF - Language Processing and SAT - Total Reading could have occurred for a number of reasons. Many factors related to threats to internal validity (i.e., testing, instrumentation, or selection) could be cited as possible explanations for significant improvements in these two areas of greatest gain. Language processing skills as measured by the CELF (see Appendix A for a sample copy) consisted of a listening comprehension task which required the individual to follow simple to complex oral directions in a "Simple Simon" game fashion (i.e., "Touch your nose, Touch your ears, etc."). The SAT - Total Reading Score incorporates a number of tests where listening is also required as a prerequisite for success. Listening and reading are both receptive forms of communication (Tuman, 1980) which have been shown to be closely related.

Overall, The results of ANCOVA procedures (see Tables 13 - 23 in Appendix B) indicated no significant differences in the dependent variables between the experimental and control groups. Hypothetically, if the level of significance were raised to .10 (a rather high significance level for rejection rate) two dependent variables could be considered marginally significant (i.e., SAT - Word Study Skills with a 0.08 level of significance and SAT - Listening with a 0.11 level of significance). Interestingly, the type of skills tested by these sub-tests are related in terms of hearing and listening abilities (Lundsteen, 1979; Weaver, 1972; Dominick, 1958). Perhaps, amplification could be more effective for improvement of various skills than was indicated by the results of the present study. Use of raw scores rather than grade level scores on the SAT results may also have increased the power of the test and resulted in statistically significant differences.

In general, there are a number of factors which appear to be particularly important in the discussion of the negative results of this field experiment. Internal validity is a major concern in this instance due to: 1) situational testing; 2) lack of sensitivity and possible ceiling effects of the instrumentation; 3) selection; 4) maturation; and 5) interaction with selection (maturation, history, or instrumentation). The Clinical Evaluation of Language Functions (CELF) tests were administered by school psychology interns. The settings varied for each testing session depending upon what was available at the school that particular day (i.e. the principal's office, the music room, a storage room, or a vacant classroom). Unfortunately, the distractibility factor may have been quite varied depending upon the testing location. Closely related to the testing problem is the question of the sensitivity of the instrumentation for the detection of differences among the variables of interest. The CELF test is a screening device which was selected by the speech pathologists from within the school district because it is one of the few instruments available for intermediate level (fifth grade and above) students. A major concern regarding this test is that due to its nature (i.e., a screening device) it may not have been sufficiently sensitive to detect significant differences across comparison groups.

Selection as a concern was dealt with in Chapter III. The students in this study constituted an intact sample of convenience and the teachers were volunteers. Furthermore, all teachers in the experimental classrooms were male, while all the control group teachers were female.

The grade levels of classrooms selected was chosen to correspond with previous MARRS projects for compatible comparisons of results. As students progress in elementary school, academic development occurs in addition to social and emotional development. Preadolescent social/emotional concerns related to increased maturity at a particular grade level may have been a factor compromising internal validity, to some unknown degree.

Finally, interaction of selection with any or all of the other factors previously described (instrumentation, maturation, history) is an additional concern in terms of threats to internal validity.

Relationship to Noise Research

Noise was defined as unwanted by the listener because it is unpleasant or interferes with important activities (Kryter, 1970). Due to the proximity of Des Plaines to O'Hare International Airport, the schools in this field experiment exist in a very noisy environment. On numerous occasions the investigator systematically clocked the amount of time between overhead planes. It was often as frequent as every three and one-half minutes. From the parking lot at one school building, it appeared as if the planes were landing on the roof. Visually, it was an awesome sight to see these massive aircraft at such close range in motion. Auditorally, it was deafening. For a brief period the noise level must have approximated at least 100 dB (Cohen and Weinstein, 1981; Allen, 1980). Whenever a jet was overhead, classroom instruction appeared to be disrupted. In amplified classrooms, teachers were observed both ceasing and continuing verbalizations during the noise interruption. In the control classrooms, teachers almost always would stop talking and wait until the jet had passed before continuing whatever they had been saying. Students in both experimental and control classrooms were frequently observed continuing and waiting for the noise to cease.

The importance of listening (Lundsteen, 1979; Weaver, 1972; Dominick, 1958) has been discussed in terms of its relationship to reading and other receptive skills. One of the three aspects that Weaver (1972) cites as influencial in the listening process is habit. Habituation to the noise level created by the jets seems to be a major factor in the listening habits of the students in this study. This conclusion was arrived at through systematic observation of the students' responses during class and the lack of statistically significant differences in terms of improvement of any scores from pretest to post-test due to the amplification treatment.

Components of all three theoretical interpretations (Broadbent (1971), Cohen (1978), Poulton (1979)) of individuals adjustment to noise presented in Chapter II appear particularly relevant in regard to supporting the findings of the present investigation. Poulton's (1979) explanation seems to be most appropriate. Poulton postulates that the initial increase in arousal due to noise often results in improved performance particularly in the case of intermittent noise. The subjects involved in this particular study all showed improvements (though not statistically significant) in all of the dependent variables measured. Interestingly, the local norms reported to parents from SAT results in the present study are higher than the national norms. Habituation to the noise level and increased arousal may enhance students' learning rather than depress their performance.

Furthermore, intermittent amplification procedures may be the most effective for improvement of language and achievement skills. The sixth grade students had the most exposure to amplification, but on an intermittent basis due to the changing of classes. These sixth grade students were the ones who demonstrated the most significant gains from pretest to post-test.

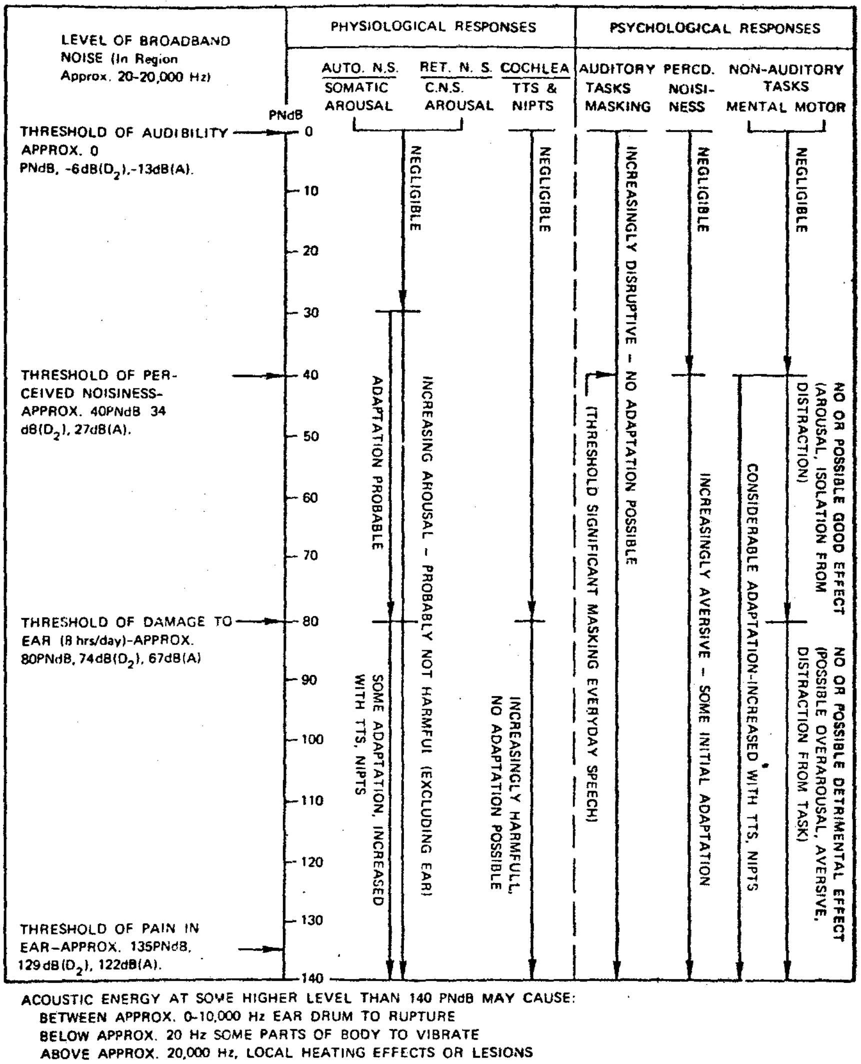
From the discussion presented above, the individuals in this study appear to have adapted rather well to the extraneous and reportedly disruptive noise in their environments. Adaptation refers to changes that aid the individual organisms to survive and function in his or her particular environment (Glass and Singer, 1972). In terms of both long-term and short-term after-effects, it would thus seem important to question the validity of the simplistic idea that adaptation is unqualifiably beneficial to man. In spite of adaptation, a stressor (in this case; the noise) may leave its imprint on behavior occurring after stimulation has ceased. Glass and Singer's (1972) working hypothesis was that the process of adaptation required cognitive work. This cognitive work included searching for appropriate coping responses and/or attempting to redefine the stimuli. High local norms reported on SAT results and observed teacher and student response patterns to noise support the habituation-adaptation noise theory. An overall summary of the conclusions drawn from noise research and human task performance which appear to be particularly applicable to the field experiment reported here is as follows:

> "...(O)ther than as a damaging agent to the ear and as a masker of auditory information, noise will not harm the organism or interfere with mental or motor performance. Man should be able, according to this concept, to adapt to his noise environment, with only transitory interference effects of physiological, mental, and motor behavior activities during this period of adaption." (Kryter, 1970)

Arousal level may be a particularly important factor in support of the lack of statistically significant results in this field experiment. Low or high levels of arousal may produce inefficiency, but performance is reportedly best at an intermediate (optimal) level of arousal (Broadbent, 1971). The principles related to arousal have been investigated in considerable detail by Spence using a modification of Hull's learning theory. Broadbent's (1971) position relates that noise behaves like incentive affecting perceptual selection as predicted from the Hull-Spence theory. Presently, the most popular forms of this theory (Glass and Singer, 1972; Poulton, 1978) assume that those exposed to noise show higher levels of arousal immediately following exposure. Performance increases in increments up to an optimal point which is said to be associated with a focusing of attention on the cues most relevant to task performance (Cohen, 1980). These factors (level of arousal, noise as incentive, focusing) of arousal theory are pertinent to the results of this theory. Figure 5-1 presents an attempt by Kryter (1970) to summarize the general limits of adaption and arousal and physiological and psychological responses at various decibel levels.

Fig. 5-1

Summary of General Limits of Adaption and Arousal at Various Decibel Levels.



Basic physiological and psychological responses of man to habitual environmental noise. Auto. N.S., Ret. N.S., and C.N.S. stand for autonomic, reticular, and central nervous systems, respectively.

Note: From Kryter, K.D. The effects of noise on man. New York: Academic Press, 1970

Recommendations for Future Research

Social and emotional factors of exposure to noise and stress should be carefully investigated. Focusing of attention which occurs under noise conditions reportedly places extra demands on the organisms ability to monitor the stressor (noise) which may result in attentional overload. Cohen and Lezak (1977) state that social cues most often neglected when attention is restricted are those that carry information concerning the moods and needs of others. The results of the study by Cohen and Lezak (1977) suggest that the reallocation of attention under disruptive noise conditions has serious implications for interpersonal perceptions. Cohen (1978) has also suggested that attentional focusing could lead to an insensitivity to others' needs. A study related to the individuals' social-emotional perceptions of others using various self-report and observational measures used within the context of a field experiment are two important possibilities for future research in this area.

Environments which suffer from high levels of disruptive noise often have other characteristics (i.e., pollution, poor housing, and high levels of population density) which may also affect behavior and health (Cohen, et.al., 1981). The field setting of this experiment was a middle- to upper-middle class predominantly white suburb. The negative characteristics cited above which often accompany noise conditions did not exist in the sample selected for this field experiment. Perhaps, it would be a good idea to replicate the present study in another suburb where the population is of low socio-economic and minority ethnic composition. A comparison of results from the two studies would allow greater certainty as to the viability of the concept of arousal-habituation as a possible overall theoretical explanation of the findings reported here.

CHAPTER VI

SUMMARY

This field experiment was designed to investigate the effectiveness of amplification as a viable method for the improvement of language and achievement in a noisy environment.

Amplification techniques have been utilized successfully in Project MARRS (Mainstreaming Amplification Resource Room Studies) for approximately six years for the purpose of remediating educational deficits in students with minimal hearing losses. In the present study, three classes (one fourth, one fifth, and one sixth grade class) were selected as intact experimental groups receiving the amplification treatment condition. In addition, three comparable classrooms (in terms of students at the same grade level) were carefully selected to serve as control groups receiving no amplification treatment. All students in both the experimental and control groups were individually administered the Clinical Evaluation of Language Functions (CELF) Test at the beginning and at the end of the school year. Subtest results of teacher administered group achievement tests (Stanford Achievement Test) for previous and present grade levels were also included as additional dependent variables. Results indicated that there was no statistically significant difference between the experimental and control groups performance scores on the language scale (Clinical Evaluation of Language Functions).

Furthermore, there was no statistically significant difference between the experimental and control groups performance scores on the achievement scale (Stanford Achievement Test).

However, performance differences across grade levels was statistically significant in terms of language production and language total test scores on the Clinical Evaluation of Language Functions (CELF) Test and on the vocabulary, math, and listening subtests of the Stanford Achievement Test (SAT). The overall findings of this field experiment indicated that amplification was insufficient as a treatment effect in producing statistically significant differences across groups but not across grade levels.

However, the negative findings reported here do appear to be powerful, indicating that amplification, utilized as a generalized treatment condition, does not appear to be a viable method for the improvement of language and achievement in a noisy environment.

Finally, an overall explanation related to increased arousal and habituation to noise utilizing a combination of components form three theoretical interpretations of an individual's adjustment to noise (Broadbent, Cohen and Poulton) was offered in support of the findings of this field experiment.

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APPENDIX
A

Name ________________________ Date ____________

Birthdate ______________ Grade ____________ Sex ________

School ________________________ Teacher ______________

Home Address ________________________________

Other Relevant Background ________________________________

____

____

____

Summary and Comments ________________________________

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____

Examiner ________________________________

	Total	Processing	Production
Raw Score			
Percentile Rank			

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COLUMBUS, OHIO 43216

Clinical Evaluation of Language Functions

Eleanor Messing Semel
Elisabeth H Wiig

ADVANCED LEVEL SCREENING TEST

8119-X

Language Processing Screening Items

TRIAL ITEMS. (Each command may be read twice.)

1. SUIT NAMES.
   Point to a spade.
   Point to a heart.
   Point to a diamond.
   Point to a club.

2. NAMES OF FACE CARDS.
   Point to a King.
   Point to a Jack.
   Point to an Ace.
   Point to a Queen.

3. CARD VALUES.
   Point to a four.
   Point to a seven.
   Point to a two.
   Point to a five.
   Point to a nine.
   Point to a six.
   Point to an eight.
   Point to a three.
   Point to a ten.

Screening may proceed if the names of all suits, face cards, and card values are known. If one or more of the names are not known after the second reading of a command, the Elementary Level processing items should be administered.

TEST ITEMS. (Each command may be read only once.)

SCORING. Record the child's responses by marking through the appropriate score (1 or 0). Each correct response receives a score of 1 point. Incorrect responses receive a score of 0. To obtain the total score, add the scores of the individual items.

STIMULUS	RESPONSE	CORRECT	INCORRECT
1. Point to a five, point to a nine.		1	0
2. Point to the red Queen and the black Jack.		1	0
3. Point to an Ace with your right thumb.		1	0
4. Point to the lowest card. (Value)		1	0
5. Point to any of the tens.		1	0
6. Quickly point to all of the Spades.		1	0
7. Point to all the Jacks except the red Diamond.		1	0
8. Point to all of these: Fours, fives, twos, tens.		1	0
9. Point to several Clubs.		1	0
10. Point to a King, point to a Spade, point to a Four.		1	0
11. When I say "King of Spades," then point to the King of Spades: (PAUSE) Seven of Hearts, King of Spades, two of Clubs, King of Spades, five of Diamonds, ten of Clubs, three of Spades, King of Spades.		1	0
12. If I say "ten of Clubs," then point to it. (PAUSE) Three of Clubs, ten of Hearts, two of Clubs, ten of Diamonds, ten of Spades.		1	0
13. Point to the eights, then the twos, and then the Aces.		1	0
14. Point to the Queen above the Queen of Hearts.		1	0
15. Point to the card that is next to the Diamond and is not a ten.		1	0
16. Point to the card that is not a Queen and not a Diamond.		1	0
17. Point to every diamond with your left hand.		1	0
18. Point to the card which is the farthest away from the Jack of Hearts.		1	0

STIMULUS	RESPONSE	CORRECT	INCORRECT
19. Where is the card that is higher than a seven but lower than a nine?		1	0
20. Point to the card which is next to a five and which has a heart in the middle of it.		1	0
21. After you point to the five of Clubs, point to the six of Spades.		1	0
22. Before you point to the Jack of Diamonds, point to the Queen of Hearts.		1	0
23. Point to the card that is three below the top card.		1	0
24. Point to all of these: Two of the fours, some of the fives, all of the twos, and any of the tens.		1	0
25. Point to the two of Clubs with your thumb. Then point to the five of Spades with your pinkie and the King of Hearts with your thumb.		1	0
26. Put your left thumb on the card that is next to the seven of Spades.		1	0
27. Pcint to the Jack of Diamonds, seven of Spades, three of Hearts, and Queen of Clubs.		1	0
28. The card that is not black is the one I want you to point to.		1	0
29. The card which is to the left of the Queen of Hearts and is not a Queen of Clubs is the one I want you to point to.		1	0
30. **(READ CAREFULLY)** Point to all of the cards that are higher than a five except *the one that is one lower* than nine.		1	0
31. Point to the last Queen with your left hand and point to the first eight with your right hand.		1	0
32. **(READ CAREFULLY)** Point to the red card in the row two rows above the Ace which is to the left of a Diamond.		1	0
33. Point to the red King last, the black ten first, and the Ace of Diamonds second.		1	0
34. John played the highest card. Mary played the second lowest card and Eric played the card which was one lower than John's. Which card did Eric play? Which card did Mary play?		1	0

Language Production Screening Items

TRIAL ITEMS. (Each command may be read twice.)

1. Count to five.
2. Repeat this word after me: HIPPOPOTAMUS.
3. Complete this phrase: "On my feet I wear socks and ________."

TEST ITEMS. (Each command may be read only once.)

SCORING. Record responses verbatim and score each by marking through the appropriate score (1 or 0).

STIMULUS	RESPONSE	CORRECT	INCORRECT
1. Complete this phrase: "men, women, and ________."		1	0

STIMULUS	RESPONSE	CORRECT	INCORRECT
2. Complete this phrase: "You play baseball with a bat. You play tennis with a ________."		1	0
3. Repeat this phrase: "One nation indivisible."		1	0
4. Tell me everything you can about orange juice. (Allow 30 second period for responding.)	*NO. OF DISCRETE FEATURES NAMED = ________ (Score 1 if 5 or more, score 0 if fewer than 5.)*	1	0
5. Tell me the names of the months of the year. (Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec.)		1	0
6. Tell me the names of the seasons of the year. spring summer fall (autumn) winter		1	0
7. Tell me which month comes two months before November. (Sept.)		1	0
8. Repeat this word after me: "complyishment." kŭm plī ' ĭsh mĭnt		1	0
9. Repeat this sentence after me: "Wasn't the rhinoceros crossed by the river?"		1	0
10. Repeat this sentence after me: "The mailman sorted, stacked, bundled, and delivered the magazines."		1	0
11. Repeat this word after me: "tachapheminopia." tăk ' ə fē mĭn ō pē ə		1	0
12. Count to thirty by threes. (3, 6, 9, 12, 15, 18, 21, 24, 27, 30)		1	0
13. Tell me the three letters that come after "K."		1	0
14. What is the opposite of "multiply?"		1	0
15. What is the opposite of "active?"		1	0
16. Repeat this sentence after me: "Jack likes hamburgers with relish, mustard, and ketchup."		1	0
17. Repeat this sentence after me: "Pale luminous feelings blithely painted the ocean."		1	0
18. Repeat this sentence after me: "Jack likes french fries and hamburgers with ketchup, onions, mustard, and relish."		1	0

CLINICAL EVALUATION OF LANGUAGE FUNCTIONS

E ______________________ DATE ______________

THDATE ____________ GRADE ________ SEX ________

OOL ______________________ TEACHER ______________

E ADDRESS ________________________________

ER RELEVANT BACKGROUND:

MARY AND COMMENTS:

	Total	Processing	Production
Raw Score			
Percentile Rank			

ELEMENTARY LEVEL SCREENING TEST

8120-3

DEMONSTRATION ITEMS.

1. Simon says: Touch your ear.
2. Simon says: Touch your nose.
3. Point to your nose.
4. Simon says: Clap your hands, wave good-bye, salute the flag.

TRIAL ITEMS.

1. Simon says: Hold up your pink
2. Touch your knees.
3. Simon says: Touch your mouth, point to your shoe.

TEST ITEMS. (each command may be read only once.)

SCORING: Record the child's responses by marking through the appropriate score (o or 1). Correct responses after the first reading of an item score 1 point. Errors score zero points.

STIMULUS	RESPONSE	CORRECT	INCORRECT
1. Simon says: Touch your hand, touch your head.		1	0
2. Simon says: Point to your wrist.		1	0
3. Simon says: Point to your toes.		1	0
4. Simon says: Point to the lowest part of your face.		1	0
5. Simon says: Clap your hands slowly.		1	0
6. Raise your hands above your head quickly.		1	0
7. Simon says: Point to all of your fingers except your thumbs.		1	0
8. Point to one of your feet.		1	0
9. Simon says: Point to your eyes.		1	0
10. Simon says: Touch your knees, touch your toes, touch your nose.		1	0
11. Simon says: After I say the word "clap," you clap your hands. (PAUSE) Tap, snap, clap, slap.		1	0
12. Put your hands in front of your face.		1	0
13. Simon says: Put your hands up, put your hands down.		1	0
14. Simon says: Touch your head above your ears.		1	0
15. Simon says: Raise your left knee, touch your nose.		1	0
16. Simon says: Touch your hip.		1	0
17. Touch your ear, touch your thumb.		1	0
18. Simon says: Point to your longest finger.		1	0
19. Simon says: When I say the word "nose," touch your nose. (PAUSE) Toes, knees, eyes, nose, hands.		1	0
20. Simon says: Put your hands between your knees.		1	0
21. Simon says: Touch your leg below the knee.		1	0
22. Simon says: Point to all of these: hands, hips, head.		1	0
23. Touch your elbow.		1	0
24. Simon says: Clap your hands, tap your forehead, snap your fingers.		1	0
25. Simon says: Turn right, then face me.		1	0
26. Simon says: Point to your cheek, chin, chest.		1	0
27. Turn around.		1	0
28. Simon says: If I say the words "Raise your hand," then do it. Listen carefully. Raise your foot. Raise your knee. Raise your hand. Raise your elbow.		1	0
29. Simon says: Point to some of these: knees, nose, ear, eye, toes.		1	0

STIMULUS	RESPONSE	CORRECT	INCORRECT
30. Simon says: Put your right hand on your right hip, your left hand on your left shoulder, your right hand on your left hip.		1	0
31. Simon says: Turn to the left, then face me.		1	0

Language Production Screening Items

TRIAL ITEMS

1. Count to five.
2. Repeat this word: hippopotamus
3. Complete this phrase: "On my feet I wear socks and ______."

TEST ITEMS. (Each command may be read only once.)

SCORING. Record the child's responses verbatim and score each by marking through the appropriate scord (1 or 0).

STIMULUS	RESPONSE	CORRECT	INCORRECT
1. Complete this phrase: "Red, white, and ________."		1	0
2. Complete this phrase: "Knife, fork, and ________."		1	0
3. Tell me the names of the days of the week. (Sun. Mon. Tue. Wed. Thurs. Fri. Sat.)		1	0
4. Tell me everything you can about orange juice. (Allow 60 second period for responding.)	*NO. OF DISCRETE FEATURES NAMED = ______ (Score 1 if 3 or more; score 0 if fewer than 3.)*	1	0
5. Tell me which month comes after March.		1	0
6. Tell me the letters of the alphabet. (a b c d e f g h i j k l m n o p q r s t u v w x y z)		1	0
7. Repeat this sentence after me: "Jack likes hamburgers with ketchup."		1	0
8. Repeat this word after me: "complyishment." kŭm plī′ ĭsh mĭnt		1	0
9. Repeat this sentence after me: "Jack likes hamburgers with ketchup and mustard."		1	0
10. Repeat this word after me: "tachapheminopia." tăk′ ə fē mĭn ō pē ə		1	0
11. Count to twenty by twos. (2, 4, 6, 8, 10, 12, 14, 16, 18, 20)		1	0
12. Tell me the three letters that come after "K."		1	0
13. What is the opposite of "full"?		1	0

STIMULUS	RESPONSE	CORRECT	INCORRECT
14. What is the opposite of "add"?		1	0
15. Repeat this sentence after me: "Jack likes hamburgers with relish, mustard, and ketchup."		1	0
16. Repeat this sentence after me: "Pale luminous feelings blithely painted the ocean."		1	0
17. Repeat this sentence after me: "Jack likes french fries and hamburgers with ketchup, onions, mustard, and relish."		1	0

APPENDIX
B

TABLE 1(a)

Analysis of Variance of Pretest Scores On The CELF - Language Total Score

Source	DF	MS	F	P
Group	1	34.19	1.71	0.19
Grade	2	14.27	2.83	0.06
Group*Grade	2	8.97	0.89	0.41

TABLE 1(b)

Analysis of Variance of Pretest Scores On The CELF - Language Process Score

Source	DF	MS	F	P
Group	1	7.16	0.83	0.37
Grade	2	35.25	17.61	0.01
Group*Grade	2	2.24	1.12	0.33

TABLE 1(c)

Analysis of Variance of Pretest Scores On The CELF - Language Production

Source	DF	MS	F	P
Group	1	10.76	2.05	0.15
Grade	2	21.44	10.72	0.01
Group*Grade	2	1.54	0.77	0.46

TABLE 1(d)

Analysis of Variance of Pretest Scores On The SAT - Vocabulary Score

Source	DF	MS	F	P
Group	1	2.85	1.47	0.23
Grade	2	31.88	15.94	0.01
Group*Grade	2	0.80	0.40	0.67

TABLE 1(e)

Analysis of Variance of Pretest Scores On The SAT - Math

Source	DF	MS	F	P
Group	1	0.15	0.10	0.76
Grade	2	75.53	37.74	0.01
Group*Grade	2	0.07	0.03	0.03

TABLE 1(f)

Analysis of Variance of Pretest Scores On The SAT - Reading

Source	DF	MS	F	P
Group	1	2.54	0.83	0.36
Grade	2	36.87	18.44	0.01
Group*Grade	2	2.81	1.41	0.25

TABLE 1(g)

Analysis of Variance of Pretest Scores On The SAT - Word Study Skills

Source	DF	MS	F	P
Group	1	2.33	0.56	0.46
Grade	2	20.05	10.02	0.01
Group*Grade	2	1.49	0.74	0.48

TABLE 1(h)

Analysis of Variance of Pretest Scores On The SAT - Language

Source	DF	MS	F	P
Group	1	0.70	0.25	0.61
Grade	2	36.84	18.40	0.01
Group*Grade	2	0.68	0.34	0.71

TABLE 1(i)

Analysis of Variance of Pretest Scores On The SAT - Listening

Source	DF	MS	F	P
Group	1	1.46	0.41	0.52
Grade	2	32.32	16.15	0.01
Group*Grade	2	0.44	0.22	0.80

TABLE 1(j)

Analysis of Variance of Pretest Scores On The SAT - Total Reading

Source	DF	MS	F	P
Group	1	0.47	0.15	0.70
Grade	2	50.63	25.31	0.01
Group*Grade	2	2.01	1.00	0.37

TABLE 1(k)

Analysis of Variance of Pretest Scores On The SAT - Total Auditory Scores

Source	DF	MS	F	P
Group	1	1.65	0.55	0.46
Grade	2	34.38	17.17	0.01
Group*Grade	2	1.93	0.97	0.38

Table 2

Means, Standard Deviation, and Adjusted Means for CELF: Language Total Scores

Group/Grade	Pretest		Post-test		Adjusted
	$\bar{X}$	S_x	$\bar{X}$	S_x	$\bar{X}$
Control 4th	37.59	3.89	42.06	3.34	42.51
Control 5th	37.04	5.43	41.23	4.63	41.98
Control 6th	39.35	4.88	44.00	3.38	43.51
Experimental 4th	37.13	4.33	41.69	3.65	42.39
Experimental 5th	39.24	3.81	42.36	3.68	41.93
Experimental 6th	40.28	4.01	45.61	2.40	44.61

Table 3

Means, Standard Deviation, and Adjusted Means for CELF: Language Processing

Group/Grade	Pretest		Post-test		Adjusted
	$\overline{X}$	S_x	$\overline{X}$	S_x	$\overline{X}$
Control 4th	25.00	3.04	28.35	2.69	29.47
Control 5th	27.23	3.09	28.81	2.70	28.76
Control 6th	28.10	3.31	29.95	2.24	29.45
Experimental 4th	24.19	3.33	27.13	3.36	28.66
Experimental 5th	28.24	2.63	30.28	2.09	29.71
Experimental 6th	29.06	2.15	31.00	1.33	30.01

Table 4

Means, Standard Deviation, and Adjusted Means for
CELF: Language Production

Group/Grade	Pretest		Post-test		Adjusted
	$\overline{X}$	S_x	$\overline{X}$	S_x	$\overline{X}$
Control 4th	12.59	1.62	15.47	1.75	14.89
Control 5th	9.81	2.87	12.42	2.45	13.09
Control 6th	11.25	2.17	13.95	1.66	14.00
Experimental 4th	12.94	1.53	14.56	1.31	13.83
Experimental 5th	11.00	1.83	12.12	2.42	12.26
Experimental 6th	11.28	3.03	14.67	1.71	14.68

Table 5

Means, Standard Deviation, and Adjusted Means for SAT: Vocabulary

Group/Grade	Pretest		Post-test		Adjusted
	$\overline{X}$	S_x	$\overline{X}$	S_x	$\overline{X}$
Control 4th	4.32	1.29	5.04	1.50	5.86
Control 5th	5.03	1.53	6.58	1.58	6.82
Control 6th	6.04	1.47	6.98	1.28	6.39
Experimental 4th	4.29	1.27	4.29	1.22	5.14
Experimental 5th	6.00	1.43	6.63	1.45	6.41
Experimental 6th	6.51	1.20	8.41	1.40	7.44

Table 6

Means, Standard Deviation, and Adjusted Means for SAT: Math

Group/Grade	Pretest		Post-test		Adjusted
	$\overline{X}$	S_x	$\overline{X}$	S_x	$\overline{X}$
Control 4th	3.96	0.68	5.25	1.12	6.69
Control 5th	5.57	1.51	7.34	1.79	7.19
Control 6th	6.54	1.10	8.44	1.16	7.34
Experimental 4th	3.84	0.90	4.89	1.01	6.45
Experimental 5th	5.57	1.09	7.12	1.42	6.98
Experimental 6th	6.50	1.66	8.48	1.53	7.42

Table 7

Means, Standard Deviation, and Adjusted Means for SAT: Reading

Group/Grade	Pretest		Post-test		Adjusted
	$\bar{X}$	S_x	$\bar{X}$	S_x	$\bar{X}$
Control 4th	4.11	1.27	5.78	1.95	7.11
Control 5th	5.74	2.09	7.24	2.38	7.15
Control 6th	6.27	1.65	8.07	1.85	7.50
Experimental 4th	4.19	1.20	5.91	1.03	7.18
Experimental 5th	5.68	1.87	7.10	2.13	7.05
Experimental 6th	7.45	1.96	8.86	1.71	7.25

Table 8

Means, Standard Deviation, and Adjusted Means for
SAT: Word Study Skills

Group/Grade	Pretest		Post-test		Adjusted
	$\overline{X}$	S_x	$\overline{X}$	S_x	$\overline{X}$
Control 4th	5.31	1.98	6.43	1.99	7.29
Control 5th	6.66	2.23	7.98	2.11	7.87
Control 6th	6.87	1.91	8.43	1.82	8.16
Experimental 4th	4.83	1.96	6.08	1.99	7.28
Experimental 5th	7.23	2.06	7.86	2.05	7.34
Experimental 6th	7.51	2.03	8.07	1.79	7.35

Table 9

Means, Standard Deviation, and Adjusted Means for SAT: Language

Group/Grade	Pretest		Post-test		Adjusted
	$\bar{X}$	S_x	$\bar{X}$	S_x	$\bar{X}$
Control 4th	4.08	0.92	5.43	1.39	7.07
Control 5th	5.92	1.77	7.34	2.37	7.06
Control 6th	6.39	1.93	7.52	1.68	6.74
Experimental 4th	4.11	1.51	5.25	1.72	6.85
Experimental 5th	6.32	1.84	7.57	2.38	6.86
Experimental 6th	6.27	1.48	7.89	1.87	7.23

Table 10

Means, Standard Deviation, and Adjusted Means for SAT: Listening

Group/Grade	Pretest		Post-test		Adjusted
	$\overline{X}$	S_x	$\overline{X}$	S_x	$\overline{X}$
Control 4th	3.98	1.37	5.52	2.15	6.91
Control 5th	5.86	2.18	7.71	2.35	7.60
Control 6th	6.66	2.00	9.14	1.66	8.40
Experimental 4th	4.48	1.76	5.44	1.60	6.43
Experimental 5th	5.81	1.88	7.35	2.14	7.28
Experimental 6th	7.12	1.81	9.05	1.88	7.93

Table 11

Means, Standard Deviation, and Adjusted Means for SAT: Total Reading

Group/Grade	Pretest		Post-test		Adjusted
	$\overline{X}$	S_x	$\overline{X}$	S_x	$\overline{X}$
Control 4th	4.00	1.29	6.21	2.46	6.53
Control 5th	5.22	1.60	6.85	2.26	7.08
Control 6th	6.77	2.20	8.09	2.17	6.93
Experimental 4th	4.30	1.50	5.72	2.12	6.77
Experimental 5th	5.00	1.57	7.09	1.98	7.52
Experimental 6th	7.61	2.29	8.80	1.74	6.90

Table 12

Means, Standard Deviation, and Adjusted Means for SAT: Total Auditory

Group/Grade	Pretest		Post-test		Adjusted
	$\bar{X}$	S_x	$\bar{X}$	S_x	$\bar{X}$
Control 4th	4.63	1.44	6.29	1.93	7.49
Control 5th	6.18	2.00	7.68	2.22	7.56
Control 6th	6.61	1.59	8.38	1.68	7.88
Experimental 4th	4.41	1.39	6.08	1.07	7.46
Experimental 5th	6.30	1.84	7.55	1.98	7.30
Experimental 6th	6.54	1.93	8.68	1.58	7.37

Table 13

Analysis of Covariance of Post-test Scores Of CELF - Language Total Scores

Source	df	Mean Square	F	P-Value	Regression Coefficient
Group	1	2.74	0.36	0.55	
Grade	2	48.10	6.40	0.00	
Group*Grade	2	4.66	0.62	0.54	
1st Covariance (Language Total)	1	690.14	91.76	0.00	0.54
Error	115	7.52			

Table 14

Analysis of Covariance of Post-test Scores Of
CELF - Language Processing Scores

Source	df	Mean Square	F	P-Value	Regression Coefficient
Group	1	1.58	0.43	0.51	
Grade	2	3.78	1.02	0.36	
Group*Grade	2	7.85	2.11	0.13	
1st Covariance (Language Process)	1	270.97	73.03	0.00	0.52
Error	115	3.71			

Table 15

Analysis of Covariance of Post-test Scores Of
CELF - Language Production Scores

Source	df	Mean Square	F	P-Value	Regression Coefficient
Group	1	4.66	0.43	0.52	
Grade	2	36.92	3.38	0.04	
Group*Grade	2	8.77	0.80	0.45	
1st Covariance (Language Prod.)	1	123.29	11.28	0.00	0.45
Error	115	10.93			

Table 16

Analysis of Covariance of Post-test Scores Of
SAT - Vocabulary Scores

Source	df	Mean Square	F	P-Value	Regression Coefficient
Group	1	0.03	0.04	0.85	
Grade	2	14.10	19.24	0.00	
Group*Grade	2	7.60	10.37	0.00	
1st Covariance (Vocabulary)	1	140.46	191.68	0.00	0.82
Error	106	0.73			

Table 17

Analysis of Covariance of Post-test Scores Of
SAT - Math

Source	df	Mean Square	F	P-Value	Regression Coefficient
Group	1	0.44	0.81	0.37	
Grade	2	3.15	5.86	0.00	
Group*Grade	2	0.27	0.50	0.61	
1st Covariance (Math)	1	155.45	288.72	0.00	0.98
Error	106	0.54			

Table 18

Analysis of Covariance of Post-test Scores Of SAT - Reading

Source	df	Mean Square	F	P-Value	Regression Coefficient
Group	1	0.24	0.17	0.68	
Grade	2	0.75	0.52	0.60	
Group*Grade	2	0.20	0.14	0.87	
1st Covariance (Reading)	1	259.20	179.30	0.00	0.89
Error	106	1.45			

Table 19

Analysis of Covariance of Post-test Scores Of SAT - Word Study Skills

Source	df	Mean Square	F	P-Value	Regression Coefficient
Group	1	5.50	3.12	0.08	
Grade	2	1.56	0.88	0.42	
Group*Grade	2	1.30	0.74	0.48	
1st Covariance (Word Study Skills)	1	230.49	130.61	0.00	0.72
Error	106	1.76			

Table 20

Analysis of Covariance of Post-test Scores Of
SAT - Language

Source	df	Mean Square	F	P-Value	Regression Coefficient
Group	1	0.02	0.02	0.88	
Grade	2	0.01	0.01	0.99	
Group*Grade	2	1.42	1.44	0.24	
1st Covariance (Language)	1	324.34	329.18	0.00	1.05
Error	106	0.99			

Table 21

Analysis of Covariance of Post-test Scores Of
SAT - Listening

Source	df	Mean Square	F	P-Value	Regression Coefficient
Group	1	4.74	2.58	0.11	
Grade	2	13.69	7.47	0.00	
Group*Grade	2	0.08	0.04	0.95	
1st Covariance (Listening)	1	234.48	132.93	0.00	0.80
Error	106	1.83			

Table 22

Analysis of Covariance of Post-test Scores Of
SAT - Total Reading Scores

Source	df	Mean Square	F	P-Value	Regression Coefficient
Group	1	0.39	0.18	0.70	
Grade	2	1.20	0.57	0.57	
Group*Grade	2	3.32	1.57	0.21	
1st Covariance (Total Reading)	1	266.53	126.48	0.00	0.89
Error	106	2.11			

Table 23

Analysis of Covariance of Post-test Scores Of
SAT - Total Auditory Scores

Source	df	Mean Square	F	P-Value	Regression Coefficient
Group	1	1.77	1.55	0.22	
Grade	2	0.37	0.32	0.73	
Group*Grade	2	0.44	0.39	0.68	
1st Covariance (Total Auditory)	1	241.85	211.03	0.00	0.86
Error	106	1.15			

APPROVAL SHEET

The dissertation submitted by Renee Z. Lewin has been read and approved by the following committee:

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The final copies have been examined by the Director of the Dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the Committee with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the Degree of Doctor of Education.

4/31/83
Date

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