Comparison of below-average and above-average classroom attenders ability to discriminate speech in background noise

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THE COMPARISON OF BELOW-AVERAGE AND ABOVE-AVERAGE CLASSROOM ATTENDERS' ABILITY TO DISCRIMINATE SPEECH IN BACKGROUND NOISE

By

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ABSTRACT

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Research has established that auditory discrimination is one important aspect of attention and vital to learning. A child, therefore, must possess adequate discrimination skills in order to learn at his fullest capacity. Because individuals demonstrate differences in hearing acuity, cortical functioning, and experience, children demonstrate different auditory discrimination skills. Some of these differing skills are demonstrable only in a noisy environment. With particular interest in the noise environment of primary grades, the author investigated whether first-grade, normal-hearing, below-average attenders demonstrate poorer speech discrimination skills in noise than first-grade, normal-hearing, above-average attenders.

Experimental subjects were designated by their first-grade teachers as above-average or below-average classroom attenders. A total of ten normal-hearing subjects ranging in age from 6 years, 8 months to 7 years, 4 months made up each group. Two noise subtests from the Goldman-Fristoe, Woodcock Auditory Selective Attention Test were used to assess the speech discrimination skills in noise of both groups.

The finding demonstrated that performance of the above-average attenders was significantly better than that of the below-average attenders under both noise conditions. Both groups performed significantly better on the linguistically meaningful noise subtest than the non-meaningful subtest. The interaction effect of noise condition and attending status was non-significant.

If one accepts the premise that poor auditory discrimination skills lead to poor attending in the noise environment found in typical primary grades, then auditory discrimination screening should be conducted well before a child's first grade entrance and needs to be conducted using signal-in-noise tests. It was further concluded that greater attention might be given noise control in constructing primary grade classrooms.
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CHAPTER I

INTRODUCTION

Mostofsky (1974) stated: "To layman and professional alike, the association of attention with learning and schooling is firm, and long standing. Those entrusted with the development of educational skills speak of providing for proper attention, and credit undesirable behaviors or inferior achievement to inattention." Teachers may even use the degree of attention their pupils demonstrate during ongoing class activities to gauge the success of their teaching skills, rather than using the pupils' achievement test scores (Jackson & Belford, 1965). Because pupil attention does play such a vital role in learning, studies have been conducted to establish a better understanding of those variables affecting attention, methods for measuring attention, and the relationship between children's attention and academic achievement. The greater amount of this research has dealt with visual attention and has largely ignored the role of auditory attention in the classroom learning situation.

The ability to discriminate speech in background noise auditorily is one possible important aspect of attention.
The psychoacoustic literature provides evidence that background noise adversely affects auditory speech discrimination (Nober, 1973). The greater the amount of "noise" as compared to "signal," the less likely will be the accurate perception of the signal. This formulation is consistent with the Gestalt formulation regarding figure-ground relationships in visual perception (Deutsch, 1964).

Various researchers have been concerned with how children auditorily discriminate in a noisy classroom. Nober (1973) stated, "Surprisingly, average classroom noise levels have not been adequately determined relative to occupied and empty room conditions, nor have standards been determined for construction relative to the acoustic environment of classrooms." She used the Wepman Auditory Discrimination Test, developed to be administered in a quiet schoolroom and in a teacher-student relationship, to measure the auditory discrimination performance in quiet and noise of three young groups of children: normals, speech defective, and reading retarded. Nober found that although the reading retarded group demonstrated the greatest performance deficit in noise, all three groups performed more adequately in the quiet versus the noise condition. Therefore, her findings supported the abundance of auditory research demonstrating the adverse effects of noise upon speech discrimination. She also concluded that because the children's speech discrimination skills were poorer in noise than in quiet, it is
doubtful that auditory discrimination testing in a quiet listening situation serves as a valid estimate of the child's discrimination performance in a noise-infested classroom. Sanders (1965) was also concerned with classroom noise. He demonstrated classroom noise levels in relation to grade level and found kindergarten and primary grade classrooms to produce the highest noise levels of all grade levels studied.

Because primary grade classrooms are often noisy, speech discrimination is adversely affected by noise, and teaching in a primary grade makes extensive use of the auditory as well as the visual channel; the pupil must be able to attend selectively to relevant auditory stimuli in order to learn.

Factors other than immediate noise in the environment may also affect the way an individual auditorily discriminates. Duetsch (1964) stated that variables such as hearing acuity, cortical functioning, and learning experience contribute to individual differences in auditory discrimination skills.

Auditory discrimination involves a process of selectively attending to auditory stimuli. Attention, in general, is vital to learning. Therefore, a child must possess adequate discrimination skills in order to learn at his fullest capacity, particularly in the primary grade classroom which is often characterized by high noise levels. Because individuals demonstrate differences in hearing acuity, cortical functioning and experience, different auditory discrimination
skills are to be expected, including differing skills in discriminating speech in a noisy background. With particular interest in the noise environment of primary grades, this author hypothesized that first-grade, normal-hearing, below-average attenders demonstrate poorer speech discrimination skills in noise than first-grade, normal-hearing, above-average attenders.

Review of the Literature

As stated previously, the greater amount of research on attention has concentrated on visual versus auditory behaviors. The typical study on attention used visual motor tasks rather than auditory tasks to measure fluctuation in an individual's attention to experimental factors. Nevertheless, some research has been conducted on the factors which influence auditory attention and, given the possible interaction of visual and auditory attention, it seemed plausible that some factors affecting visual attention may also affect auditory attention, and vice versa. Therefore, research isolating those factors which affect either visual or auditory attention was relevant to this study.

Factors Influencing Attention

Various studies have demonstrated that age is significantly related to attending behavior. Druker and Hagen (1969) investigated the developmental trend in the processing of
task-relevant and irrelevant information, using children in the fourth, sixth, and eighth grades. They concluded that the older children tended to focus more exclusively on relevant stimuli, when instructed to do so, than younger children, by using specific verbal labeling and visual scanning. Hale and Towell (1973) were interested in age in relation to children's performance on measures of component selection and incidental learning. Studying the performance of five- and eight-year-old children in a visual attention and recall task, they also found that as children grew older, they tended to employ a greater degree of selective attention when it was advantageous to do so. Doyle (1973) conducted a study in which she researched the effect of age upon selective attention in an auditory recall task, using eight-, eleven-, and fourteen-year-old children. Her findings were similar to results obtained in studies of visual incidental learning. She concluded that the older children had much information about the distracting words available, but that they did not allow the material to intrude during the selective task. The younger children showed a greater performance deficit on the selective listening task when auditorily distracted. It appears that a child's ability to selectively attend, whether visually or auditorily, increases with chronological age.

An individual's mental age may have implications for the way he attends. Crosby (1972) studied attention and distractibility in mentally retarded children and intellectually
average children by using a visual-motor task. He concluded
that the attentive behavior of non-brain damaged institution­
alized retarded children differed significantly from normal
children of the same chronological age but not from that of
average children of the same mental age. Lahaderne (1968)
researched the intellectual and attitudinal correlates of
attention, using sixth grade children as subjects. Although
she did not find a significant relation between attention
and student attitudes toward school or teacher, a signifi­
cant relation was noted between attention and IQ, with the
brighter students more likely to be attentive in class.

Klein, Ferbes, and Nader (1975) demonstrated that a
child's early physiological status may have bearing upon
his attending in later life. They studied children who had
been afflicted with congenital hypertrophic pyloric stenosis,
a type of malnutrition in early infancy caused by the narrow­
ing of the pyloric orifice and thickening of the circular
muscle of the pylorus. The malnutrition is not associated
with social deprivation, and ranges from minimal dehydration
to gross starvation. The authors' results suggested that the
onset of starvation between twenty-one and thirty days was
significantly related to school problems involving immaturity,
overactivity, and misconduct which, in turn, relate to a
child's attending behavior for a defined period of time.
They concluded that some of the basic mechanisms necessary
for control of attention are developed in early infancy.
McCarthy and McCarthy (1969) stated that a deficit in attention control is often observed in brain damaged children. Although this is not true of all brain damaged children, minimal brain dysfunction is certainly a variable which should be evaluated if a child has extreme difficulty in attending to tasks.

Boeke (1962) studied the effect of brain damage upon attending using epileptic adults for subjects. He demonstrated that epileptic persons have longer and more variable reaction times in continuous tasks than control adults, suggestive of an attentional deficit to more rapid changing stimuli. However, Wagenaar (1975) compared mentally disabled people with a substantiated epileptic history with a group of non-epileptic mentally disabled persons. Both groups were matched as closely as possible with respect to IQ and chronological age. He did not find a group difference in reaction time or correct responses versus errors, and concluded that epileptic patients were generally as successful attention-wise as the non-epileptic mentally retarded subjects. It appears from these two studies, that the relationship between attending and epilepsy is inconclusive.

Research has shown that one's environment is capable of influencing how one attends to various stimuli. Grunebaum, Weiss, Gallant, and Cohler (1974) demonstrated that an individual's past environmental history may have consequences on his present attending behaviors. They compared the attention
of young children of psychotic mothers with children of non-psychotic mothers, using visual-motor tasks. They did not find sex to be a significant variable. They did find significant differences in the one-, three- and five-year-old children of psychotic mothers compared to children of non-psychotic mothers regarding the number and duration of non-looking behaviors, failure to respond to a relevant stimulus, and attention span in general. They did not find this to be true of the six-year-old children and suggested that perhaps this was due to a small sample size or perhaps developmental lags resulting from parent-child interaction occurring primarily before age six.

Black (1965) investigated the relationship of environment specifically to auditory attention. He stated, "Culturally disadvantaged children often are found to have deficient auditory discrimination skills due to being raised in a very noisy environment with lack of connected discourse and generally inadequate communication stimulation." This type of environment tends to create a signal-to-noise ratio in which the signal (speech) is of lower intensity than the noise (household noise), providing an inadequate learning situation for the discrimination of speech.

Aitken and Hutt (1975) demonstrated that an individual's immediate environment may also influence his attending behavior. They were concerned with the effect of stimulus
incongruity upon visual attention and found that by age three years children do respond differentially to visual stimuli by paying more attention to incongruous versus ordinary stimuli. Considering that this difference is very likely due to the process of adaptation to ordinary stimuli, this would also appear to hold true for auditory stimuli.

The literature concerned with factors affecting attention has established that a variety of physiological, environmental, and maturational factors may interact to play a significant role in the development of a child's attention. The author will attempt to control for maturational factors and school environment in order to test the relationship between attending and speech discrimination skills in noise.

Measures of Classroom Attention

Studies concerned with classroom behavior have employed various means of measuring a student's ability to attend within the classroom situation. As in most other studies, measurements assessed pupils' abilities to attend visually rather than auditorily. Frequency counts of specific behaviors and teacher ratings of attention are the more frequently used methods for measuring pupil attention.

A direct way of measuring pupils' attention by behavior frequency counts involves recording a pupil's attending behaviors during a specific task. Samuel and Turner (1974)
measured the attention of students during the reading hour by recording their task-relevant visual behaviors. They found their measure to be a good indicator of pupils' attention to the reading task. Kirchner and Knopf (1974) also used behavioral frequency counts to measure student attention. Their subjects were involved in a task of visual vigilance in which every time they noticed even a small change in the test stimulus, they were to press a button. The small change consisted of a red star which was flashed onto the stimulus for one second. By recording the number of an individual's responses, the authors were able to assess the attention level of the subject. It is evident that frequency counts may be used to measure different aspects of student attending.

A more indirect and global measure of pupil attention is teacher evaluation. Ricks and Mirsky (1974) employed teacher reports in defining children as inattentive and underachieving or attentive and achieving. They concluded that teacher reports are supported by more objective behavioral measures of attending. Lerner, Pine, and Orloff (1974) concluded that teacher evaluation appears to be a valid estimate of students' attention to classroom activities. Myklebust (1971) devised The Pupil Rating Scale to be used by classroom teachers as a screening tool for identifying children with possible deficits in learning. Several questions on the scale are concerned with the child's
ability to attend in the classroom. The scale was developed on the hypothesis that "if areas of deficit are carefully defined and delineated, they can be observed and rated by regular classroom teachers who are in close contact with children." On this premise, an experimental investigation was undertaken and the results disclosed that teachers can indeed identify these children with deficits in learning.

It appears from the literature that a pupil's ability to attend in the classroom may be measured either directly or indirectly; specifically or more generally. Behavioral frequency counts are often used as a direct, specific measure of pupils' attending, while teacher ratings are most frequently used as an indirect, general means of measuring the students' attention. This author used teacher evaluations in identifying below-average and above-average classroom attenders.

Measurement of Speech Discrimination

Speech discrimination tests such as The Wepman Test of Auditory Discrimination and the Washington Speech Sound Discrimination Test are often used in elementary schools to assess pupils' discrimination skills. These tests assess the individual's ability to discriminate between minimal pairs of words, and are typically administered in a quiet environment. Therefore, an estimate of the child's speech discrimination skills in noise is not ordinarily obtained,
even though research has shown that noise is often a prevalent factor in the primary classroom.

The Goldman-Fristoe-Woodcock Auditory Selective Attention Test (1974) was developed to assess speech discrimination skills in both quiet and noise. Its test stimuli are also minimal pairs of words. As the two discrimination-in-noise subtests both begin, the intensity of the speech signal is 12 dB greater than the background noise. However, by the end of each subtest, the intensity of the background noise is 12 dB greater than the speech signal. Thus, as the subtests progress, the listening task becomes more difficult. This discrimination test appears to offer a truer measure of how a child may be expected to discriminate in a noisy classroom than does a test administered in quiet. For this reason, it was used in this study to measure the speech discrimination skills in noise of both below-average and above-average classroom attenders.

Statement of the Problem

It was evident from researching the literature that attention is vitally important to a child's classroom learning, and that the ability to discriminate speech in noise is one likely aspect of classroom attention. However, most research deals with visual attending and tends to ignore auditory attending. The purpose of this study was to dis-
cover whether first-grade, normal-hearing, below-average attenders significantly differ from normal-hearing, above-average attenders in their ability to discriminate speech in noise.
CHAPTER II

PROCEDURE

Subjects

First grade classroom teachers were used in the selection of experimental subjects for each of the two subgroups, above-average and below-average classroom attenders. Each teacher received a printed handout of behaviors characteristic of a child attending in the classroom (appendix A). Each teacher was instructed to select her three best and three poorest attenders based upon the listed criteria of the handout and to rank order the children within each subgroup. Final participation in each respective subgroup was determined by selecting, in order of teacher ranking, those who met screening qualifications and were in attendance, but the number selected in each respective subgroup from an individual class did not exceed 10 percent of that room's population. This limit was enforced as a precaution for influencing factors created by differential classroom size.

Ten below-average and ten above-average classroom attenders participated as experimental subjects, with seven males and three females in the below-average group, and five males, five females in the above-average group.
All children were selected from five first grade classrooms in Missoula, Montana and were between the ages of 6 years, 8 months to 7 years, 4 months. Each subject was required to demonstrate a normal receptive vocabulary by obtaining a minimum raw score of 53 points on the Peabody Picture Vocabulary Test as well as normal bilateral hearing acuity, screened at 10 dB for the frequencies 250, 500, 1000, and 2000 Hz. Each subject was also required to demonstrate Type A tympanograms bilaterally.

Two potential subjects in the teacher-selected below-average group were disqualified by not meeting the impedance testing criteria. No potential subjects in the above-average group were disqualified because of impedance testing and none in either group were disqualified because of hearing acuity nor absenteeism. The ordering of those from each classroom within each subgroup provided sufficient numbers to replace the disqualified subjects within the 10 percent maximum limit.

Stimuli

A modification of the Goldman-Fristoe-Woodcock Auditory Selective Attention Test was used to assess the individuals' speech discrimination skills under two different noise conditions: Cafeteria Noise (non-linguistically meaningful), and Verbal Distraction (linguistically meaningful). The commercial booklet and response forms were used by the examiner.
The examiner rerecorded the test cassette tape in order to eliminate the Fan-like Noise Subtest. A tape player was also modified to include two output jacks. This allowed the examiner to monitor the test tape with earphones. The tape player met the stated specifications of the manual: 1) a relatively flat (± 3 dB) frequency response from 100 to 10,000 Hz; and 2) a flutter and wow of less than 0.3 percent. The subjects wore earphones which met the manual specifications: 1) a flat frequency response of 100 to 6000 Hz; and 2) less than 1 percent distortion.

Experimental Procedure

For each subject, the Peabody Picture Vocabulary Test (Form B) was administered, subjects' hearing acuity was tested, and tympanograms were obtained. All testing was conducted in the University of Montana's Mobile Speech and Hearing Unit, in a well lighted and acoustically treated room that allowed hearing level determination to be made in accordance with ANSI-1971 standards. The total testing time for each subject lasted approximately forty minutes.

Before administration of the test, the tape player's volume was adjusted to each child's preferred intensity level. A training period of fifteen trials was then utilized to familiarize the subject with the word-picture associations. The training instructions stated, "You are going to see some pictures. I will say a word, then I want
you to point to the picture of the word I have said." Each training trial consisted of a set of four pictures and a recorded voice instructing the subject to point to a specified picture. All subjects were allowed three attempts, if needed, on each trial in order to obtain the appropriate word-picture associations.

The Quiet-Noise Subtest was then administered. The purpose for giving this subtest was to teach the subjects how to take the test, and to stabilize learning effects.

The Cafeteria Noise Subtest was then administered. For both noise subtests the instructions stated, "Now I am going to show you some more pictures. At first it will be easy for you to hear the word, but later you will hear some noise that will get louder and louder. The noise may get so loud that you will not be able to hear what you are to do. Then the noise will go away and some new noise will begin and will become louder and louder. Try to hear what you are to do even if the noise seems too loud." Upon a subject's completion of this subtest, the examiner stated, "You are doing a good job. Keep trying your best and your teacher will have something for you at the end of class." The purpose of this statement was to control for auditory fatigue between noise subtests. The Verbal Distraction Subtest was then administered.

The test stimuli were paced so that each subject was allotted the same amount of time to look at each page before
the stimulus statement for that page was given.

Scoring

All correct and incorrect responses were recorded by the examiner. If the subject made a response and then changed it, the examiner accepted and recorded the last response.
CHAPTER III

RESULTS

This study hypothesized that first-grade, below-average and above-average classroom attenders significantly differ in their abilities to discriminate speech in noise. It was thus predicted that the data would support the rejection of the null hypothesis.

The means for the above-average and below-average attenders on the two administered noise subtests of the Goldman-Fristoe-Woodcock Auditory Selective Attention Test are given in table 1. A two-factor, mixed design was used to evaluate the differences among these means, with results given in table 2 (the coefficient of risk used was .05).

The interaction affect of noise conditions by attending groups was not significant at the .05 level ($F = .695, df = 2$). The main effect of attending was significant at the .05 level ($F = 13.9, df = 1$), with the above-average group performing better on both the Cafeteria Noise and Verbal Distraction Subtests than the below-average attenders. This result indicates that the above-average group displayed significantly better speech discrimination skills under both noise conditions.
TABLE 1

MEAN SCORES FOR ATTENDING GROUPS AND NOISE CONDITIONS

<table>
<thead>
<tr>
<th></th>
<th>Cafeteria Noise Subtest</th>
<th>Verbal Distraction Subtest</th>
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<tr>
<td>Above-Average</td>
<td></td>
<td></td>
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<tr>
<td>Classroom Attenders</td>
<td>27.6</td>
<td>29.6</td>
<td>28.6</td>
</tr>
<tr>
<td>Below-Average</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Classroom Attenders</td>
<td>26.4</td>
<td>27.5</td>
<td>26.9</td>
</tr>
<tr>
<td>Total</td>
<td>27.0</td>
<td>28.5</td>
<td>27.7</td>
</tr>
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TABLE 2

SUMMARY OF ANALYSIS OF VARIANCE

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<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>ms</th>
<th>F</th>
<th>p*</th>
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<tr>
<td>Total</td>
<td>140.975</td>
<td>39</td>
<td>---</td>
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<tr>
<td>Between Subjects</td>
<td>62.475</td>
<td>19</td>
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<tr>
<td>Conditions</td>
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<td>1</td>
<td>27.225</td>
<td>13.9</td>
<td>.005</td>
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<tr>
<td>Error_b</td>
<td>35.25</td>
<td>18</td>
<td>1.958</td>
<td></td>
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</tr>
<tr>
<td>Within Subjects</td>
<td>78.5</td>
<td>20</td>
<td>---</td>
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<td></td>
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<tr>
<td>Trials</td>
<td>24.025</td>
<td>1</td>
<td>24.025</td>
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<tr>
<td>Trials x Conditions</td>
<td>52.45</td>
<td>2</td>
<td>1.0125</td>
<td>.695</td>
<td>ns</td>
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<tr>
<td>Error_w</td>
<td>52.45</td>
<td>17</td>
<td>3.085</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*.05 coefficient of risk was used
The main effect of noise was also significant at the .01 level ($F = 8.25$, $df = 1$), with both groups demonstrating significantly better speech discrimination skills on the Verbal Distraction Subtest versus the Cafeteria Noise Subtest. This indicates that both groups of attenders were able to discriminate speech significantly better in the presence of linguistically meaningful background versus nonlinguistically meaningful noise.

The statistical data did allow the rejection of the null hypothesis that there would be no significant difference between the above-average and below-average attenders regarding their abilities to discriminate speech in noise.
CHAPTER IV

DISCUSSION

Research has established that attention is vital to learning and that the discrimination of auditory figure from ground is one likely aspect of classroom attention. Because one's auditory discrimination skills are influenced by such factors as hearing acuity, cortical functioning and learning experience, individuals demonstrate different abilities in discriminating auditory figure from ground.

Noise may also affect how well an individual auditorily discriminates. The greater the noise-to-signal ratio, the less likely the signal will be accurately perceived. Primary grades often demonstrate high noise levels which made accurate perception of the signal (teacher's speech) difficult, particularly for those children with underdeveloped discrimination skills.

The author was interested in whether normal hearing, below-average attenders in the first grade classroom demonstrate poorer speech discrimination skills in noise than above-average attenders. Statistical analysis of the test data revealed that the below-average attenders did demonstrate significantly poorer speech discrimination skills
compared to the above-average attenders on both the Cafeteria Noise and Verbal Distraction Subtests.

One possible explanation for this result is that below-average classroom attenders actually demonstrate a lack of attention in all sensory modalities under all situations. Mostofsky (1968) stated, "Attention reflects a composite of responses along several modalities and several response dimensions. Attention reactions should therefore be thought of as a profile of behaviors rather than any single neuro-sensory-muscular act." According to this explanation, one might assume that a child demonstrating overall below-average attention in the classroom situation has a generalized lack of attention involving all modalities and situations, including an auditory discrimination test situation. Therefore, one would have expected the difference between the two groups in speech discrimination in noise, as found in this study.

A second possible explanation for the obtained results is that the below-average attenders have a specific difficulty in selectively attending auditorily which does, in fact, cause them to generally become overall poor classroom attenders. Considering the often noisy nature of the first grade classroom, the group's poorer speech discrimination skills in noise, and the ability of one sensory modality to influence another, this explanation appears somewhat feasible.

If a child's poor selective auditory attention skills do contribute to his becoming a poor classroom attender, certain
implications for school screening procedures and classroom construction become apparent. Although a child's ability to discriminate speech is sometimes screened just before he enters the first grade, such screening procedures are typically conducted in quiet, and not in noise. Nober (1973) concluded in her study that it is doubtful that auditory discrimination testing in a quiet listening situation serves as a valid estimate of a child's discrimination performance in a noise-infested classroom. Considering that the primary grades have been found to produce the highest noise levels of all classrooms, it would seem more appropriate to screen children's discrimination skills in noise rather than in quiet, or to screen in both quiet and noise. This method would be more likely to find these children who may have problems discriminating speech in the first grade classroom, and would allow for possible remediation to begin before the first grade, thereby decreasing the child's chances for future learning problems. Remediation by auditory training might be a successful procedure in reducing classroom attending difficulties.

This study has demonstrated that the Cafeteria Noise Subtest and Verbal Distraction Subtest from the Goldman-Fristoe-Woodcock Auditory Selective Attention Test are capable of differentiating between children's speech discrimination skills in noise, and therefore could be used as a screening tool. However, the test's Quiet Subtest is not
designed to differentiate between children's discrimination skills in quiet. The development of a screening tool which can be used to obtain a precise measurement of a child's discrimination abilities in both quiet and noise would likely be a fruitful contribution to future research and intervention in the area.

Considering the importance of visual attention as well as auditory attention to classroom learning, it would also seem necessary to screen children for visual attention difficulties. This procedure would provide the first step towards remediation of a child's visual problems which may also affect his overall attention level.

It seems that if poor auditory selective attention skills do contribute to a child's becoming a below-average attender and possible underachiever, the sooner a child is found to have poor auditory selective attention, the better his learning prognosis. This is assuming, of course, that remediation or compensatory procedures are available to the child. Lane (1976) studied the speech discrimination abilities of three-year-old, high risk and normal children in both quiet and noise. She concluded from her results that the use of an auditory discrimination test in noise appears to be a promising means of identifying learning disabled children as young as three years of age. Deutsch (1968) stated, "While we do not at present know precisely the time at which the maximum capacity to develop auditory
discrimination is reached, we do know that by the time chil-
dren come to the first grade, many of them have poor dis-
 crimination abilities." We can thus assume that a better
time to teach good auditory discrimination skills would be
before first grade. Both studies have implications for
screening procedures regarding the optimum time to screen
a child's discrimination skills. One suggestion might be
that screening procedures be administered in nursery schools
and day-care centers, rather than in kindergarten or just
prior to first-grade entrance.

Even though children having difficulties in speech
discrimination may be identified early and begun on a plan
of remediation, this does not assure that the problem will
nor can be alleviated by the time they reach the first
grade. However, there are various ways in which to reduce
classroom background noise, thereby possibly lessening the
child's discrimination problem. For instance, if a class-
room is constructed well acoustically, much unnecessary back-
ground noise from within and without the classroom can be
dampened. This may be accomplished with the use of class-
room and hallway carpeting, classroom curtains, and acous-
tically treated building materials.

The hypothesis that a child's poor auditory selective
attention causally contributes to his becoming a below-
average attender and possible underachiever is not as yet
adequately documented. There are several suggestions for
research in this area which may help to prove or disprove
the hypothesis. One suggestion is to compare both groups
in quiet and noise in order to observe whether the below-
average attenders demonstrate a basic deficit in their
ability to discriminate speech compared to the above-average
attenders, or whether indeed their speech discrimination
difficulties are more specific to the noise situations.
Another suggestion is to compare the speech discrimination
abilities of below-average attenders from both "quiet" first
grade classrooms and "normal" first grade classrooms in
order to see whether the groups differ in their discrimina-
tion abilities. This study involved children who came from
first grade classrooms which were considered to contain a
normal level of background noise. A further suggestion would
be to monitor the below-average attenders as they leave the
primary grades for quieter upper grades and note whether
their overall attention levels improve as the level of class-
room noise diminishes. Of course, in doing so, one would
have to take into consideration the effects of maturation.
It would also be interesting to note whether first grade
children designated as below-average attenders are indeed
underachievers.

Another interesting result from the study was that both
groups discriminated speech significantly better under the
Verbal Distraction Subtest than the Cafeteria Noise Subtest.
One might have anticipated poorer results on the linguistically
meaningful subtest due to its more interesting, and therefore distracting content. However, there are several possibilities for why the obtained result occurred. Perhaps, due to the ordering of subtest presentation a learning effect occurred (even though a quiet discrimination test was administered first to minimize the learning effect), therefore resulting in higher scores for both groups on the Verbal Distraction Subtest. Or, perhaps the promise of reinforcement after the Cafeteria Noise Subtest motivated the subjects to perform better than usual on the Verbal Distraction Subtest. Nevertheless, since both types of noise occur in the typical primary classes, the results tend to substantiate the need for proper acoustical construction of classrooms so that each child may learn to the best of his abilities. It is recommended that further understanding of the differential effects of types of noise also be obtained by counterbalancing for order in future studies.
CHAPTER V

SUMMARY AND CONCLUSIONS

This study hypothesized that below-average, first grade classroom attenders significantly differ from above-average attenders in their ability to discriminate speech in noise.

First grade classroom teachers selected above- and below-average attenders based upon suggested criteria characteristics of a child attending in the classroom. All subjects were screened for receptive vocabulary age as well as hearing acuity. Tympanograms were also obtained.

The Cafeteria Noise and Verbal Distraction Subtests from the Goldman-Fristoe-Woodcock Auditory Selective Attention Test were used to assess the subjects' speech discrimination skills in noise. Statistical analysis of the test data supported the hypothesis. The below-average attenders demonstrated significantly poorer speech discrimination skills on both noise subtests compared to the above-average attenders. Several explanations as to why this result occurred were discussed.

One explanation was that below-average attenders actually demonstrate a lack of attention in all sensory modalities under all situations, and therefore would have
been expected to demonstrate poorer speech discrimination skills in noise. A second explanation was that the below-average attenders' specific difficulty in selectively attending auditorily did in fact cause them to generally become overall poor classroom attenders. Favoring this hypothesis was the fact that primary grade classrooms are noisy compared to other grade levels, that the below-average attenders did demonstrate poorer discrimination skills in noise, and that the attention levels of one modality are capable of influencing the attention level of another.

Assuming that this explanation is true, several implications become apparent: there is need for speech discrimination screening in noise as well as in quiet; there is need for early detection of children with speech discrimination difficulties and provision for remediation sources through the screening of nursery schools and day care centers; and there is need for adequate acoustical construction of primary grade classrooms or other compensatory procedures.

Both groups performed significantly better on the Verbal Distraction Subtest (linguistically meaningful subtest) than on the Cafeteria Noise Subtest (non-linguistically meaningful subtest). It was hypothesized that either an order effect or promise of reinforcement caused this effect, however a generalized noise effect seems likely. Since classrooms contain both linguistic and non-linguistic noise, the main implications discussed above should still be considered.
At the present time little research has been conducted concerning children's abilities to discriminate speech in noise or the implications of these abilities upon classroom behavior. Therefore further test construction and data collection is needed to verify and confidently interpret the results obtained in this study.


Flynn, P. T., and Byrne, M. C. "Relationship Between Reading and Selected Auditory Abilities of Third-Grade Children." *Journal of Speech and Hearing Research* (1970), 731-740.


Riske, V. J. "Relate Auditory Discrimination to Reading Achievement." Reading World (1973), 44-51.


APPENDIX A

TEACHER HANDOUT
TEACHER HANDOUT

The following characteristics are indicative of classroom attending:

1) Follows the instructional directions of the teacher.
2) Focuses on academic subject to which the teacher calls attention.
3) Listens to and follows peer discussions according to his/her age and grade.
4) Orients eyes to text, teacher, or blackboard according to assigned task.
5) Appears to listen and comprehend at age level.
6) Attends to assigned materials rather than to unassigned materials (toys, etc.) during a task.

Based on the above characteristics of attending, choose the three children in your classroom whom you consider to be the better classroom attenders, and the three children whom you consider to be the poorer attenders. Rank order the children in each group.


APPENDIX B

RAW SCORES
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<th>Verbal Distraction Subtest</th>
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