

STUDY OF THE REMEDIATION OF DEFICIENCIES IN AUDITORY PERCEPTION¹

GERALDINE H. IRVIN, Kent City Schools, Kent, OH 44240

KENNETH C. HOEDT, Department of Counseling and Special Education, University of Akron, Akron, OH 44325

Abstract. The screening of 243 students from 10 kindergarten classes resulted in the identification of 39 children with perceptual deficiencies in the auditory channel. Auditory training procedures dictated by Lerner's definition of auditory perception were introduced into 5 kindergarten classes. Five no-treatment classes were included as control groups. Effects of the training program reported for these 39 subjects indicated growth at the meaningful level of language usage and improvement in the ability to analyze words. The effects of the auditory training program on reading readiness and self-concept were encouraging.

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It has been postulated (Rosner 1970, Lerner 1971) that auditory modality figures prominently among the problems which underlie reading difficulties. Auditory disorders may be divided into two categories: (a) auditory disorders which result from impairment to, or dysfunction of the physical auditory system rendering the ear incapable of transforming and/or transmitting sounds adequately, thus resulting in decreased auditory acuity, and (b) auditory disorders which are not related to organic abnormalities or the ear itself, but to abnormalities in perception associated with stimulation to the sensory organ.

Ferrald and Schamber (1973) and Oakland and Williams (1971), have suggested that when adequate development in auditory perception has failed to occur, intervention should be initiated. Intervention for children who have no organic abnormality of the ear should result in improved auditory functioning which in turn should facilitate improvement in reading skills. It further seems reasonable to assume that improved reading skills will meliorate children's adjustment to school.

Lerner (1971) suggested that auditory processes have been sadly neglected in research studies dealing with reading problems. This apparent neglect along

with the recognized importance of a successful reading experience to the personal and school adjustment of primary school students led to the present study.

The general hypothesis tested was that a program of auditory perceptual training, included as a part of a total class curriculum for kindergarten children who had exhibited a deficiency in auditory perception would improve auditory functioning and readiness and would thus result in a more positive self-concept.

RESEARCH DESIGN

All kindergarten students (N=243) in 5 elementary schools who were between the ages of 5-0 and 6-0 on 1 October, of the school year under consideration, were administered a battery of tests for the purpose of identifying those who manifested deficits in auditory perception. The battery of tests included the Wepman Test of Auditory Discrimination, the auditory memory subtests of the Dallas Preschool Screening Test (DPST) (Percival and Paxon 1972), and the Auditory Blending Subtest of the Illinois Test of Psycholinguistic Abilities (ITPA). These tests measure representative components of auditory perception as defined by Lerner (1971). The order of administration was varied to control for possible order effect. When 2 of the 3 tests were either passed or failed, screening was stopped and a decision was made regarding whether the pupils' tested behaviors indicated a deficit in auditory perception.

Error scores above the critical level on the Wepman Test and scores one standard deviation or more below the normalized means of the other auditory tests were considered evidence of an observed deficit. Students who manifested a deficit in auditory ability as measured

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by any 2 of the 3 tests were considered to have an auditory perceptual disability needing remediation.

Concurrent with the above screening procedure, all kindergarten students were tested for a possible hearing loss with a puretone audiometer. Children whose hearing threshold was below 30 decibels were eliminated from the study. This action eliminated from the study children with a severe organic hearing problem, according to the criteria accepted by Berry and Eisensohn (1956).

Students selected as having an auditory perceptual disability were administered the Peabody Picture Vocabulary Test (PPVT). Any student who earned an IQ score below 90 was dropped from the study in order to eliminate the confounding effect of a sub-population of slower learning children.

Following the above procedure, the subjects of the study were those kindergarten children who manifested a deficiency in auditory perception on 2 of the screening instruments, earned an IQ score in the average range or better as measured by the PPVT, and children whose hearing was within a near normal range as measured by the puretone audiometer.

The system in which the study population attended school employed 5 kindergarten teachers each of whom taught a class in the morning and a class in the afternoon. Subjects of the study were members of the 10 classes. One of the 2 classes of each of the teachers was randomly assigned to the experimental treatment, the remaining class of each teacher comprised the control situation. By using this procedure, we assured that both the experimental and control groups were represented in morning and afternoon classes, and that each teacher had an experimental and a control class.

Target children within the experimental and control classes were unknown to the educators providing the therapy, as treatment was directed to the total class population. The disabled population contained more boys than girls. However, the assignment procedure resulted in more girls than boys being in the experimental groups and more boys than girls being in the control groups. This potential problem was handled in the statistical treatment by using sex as a covariant.

The final research design included 10 kindergarten classes, each of which had been randomly assigned to an experimental or a control condition. The target population was embedded in these classes and was comprised of 5 experimental groups (total $N=20$), and 5 control groups (total $N=19$). The groups did not differ to any practical degree in PPVT scores (\bar{M} dif., .67), age in month (\bar{M} dif., .56), or days absent (\bar{M} dif., 1.86).

Auditory training procedures purported to remediate deficits in auditory perception were administered to the 5 classes containing the experimental groups once a week for a half-hour session by one of two speech therapists. The other 4 days of each week, for a period of 15 minutes, the kindergarten teachers conducted prescribed auditory training with their experi-

mental classes. The treatment sessions extended over a 20 week period.

Training procedures followed a developmental sequence for auditory discrimination, auditory memory, and auditory blending. As none of these skills are used in isolation, training was simultaneous in the areas identified. Activities were gleaned from various sources and adapted for the kindergarten-age child.

Speech therapists' activities at the beginning of each session generally focused on discrimination activities in addition to treatment related to an auditory developmental task. The sounds used for discrimination training by the speech therapists were those consonant sounds suggested by Poole (1934) as causing discrimination and articulation difficulties for the kindergarten-age child.

The data gathered from the experimental and control groups for statistical analysis included: pre- and post-test scores on the self-concept section of the Self-Concept and Motivation Inventory (SCAMIN) (Milchus *et al* 1967) and four auditory subtests of the ITPA: Auditory Reception, Auditory Sequential Memory, Auditory Closure, and Auditory Association. In addition, post-test scores only on the Rosner Auditory Analysis Test (Rosner and Simon 1970), Metropolitan Listening Subtest, and total Metropolitan Readiness Test were obtained for analysis. Post-testing was completed within one week after cessation of treatment. The Metropolitan Readiness Test was administered to all kindergarten classes within the succeeding two weeks by the kindergarten teachers. Hypotheses that related to each of the department variables were tested in null form using Multiple Linear Regression Analysis. Differences due to sex, IQ, teacher and pre-test scores were convaried where appropriate.

RESULTS

The results are reported in table 1 as mean post test differences. Two of the 5 dependent variables were significantly related to auditory functioning; namely the Auditory Association Subtest of the ITPA, and the Auditory Analysis Test. Non-significant results were found for the remaining 3 ITPA subtests: Auditory Reception, Auditory Sequential Memory, and Auditory Closure.

Significant results were found for 2 measures of reading readiness (the Listening Subtest of the Metropolitan Readiness Test and the total score of the Metropolitan Readiness Test) and for self-concept development as measured by the SCAMIN. All differences between the experimental and control groups, found to be significant, favored the treatment group.

TABLE 1
Mean post-test differences and probability that differences between the experimental and control groups were due to chance.

Criterion	Post-Test Diff.	Peabody Picture Vocabulary Test			
		and Pretest	Pretest, Sex & Teacher	Covaried	Sex & Teacher Covaried
Auditory Reception	3.67	0.33	0.31	N/A†	N/A†
Auditory Sequential Memory	1.55	0.29	0.37	N/A	N/A
Auditory Closure	0.71	0.21	0.19	N/A	N/A
Auditory Association	2.82	0.03*	0.03*	N/A	N/A
Auditory Analysis	4.94	N/A	N/A	0.06	0.05*
SCAMIN	2.02	0.02*	0.02*	N/A	N/A
Listening Subtest	1.94	N/A	N/A	0.01*	0.01*
Total Readiness Test	13.01	N/A	N/A	0.03*	0.02*

† N/A = Not applicable.

* Differences where $P < 0.05$ were considered statistically significant.

DISCUSSION

Two of the auditory subtests of the ITPA, (Auditory Sequential Memory and Auditory Closure) for which results were non-significant, measured auditory skills at the automatic organizing level (Kirk and Kirk 1971). The Auditory Reception Subtest, a test of skill at the representational receptive level, also yielded non-significant results. The Auditory Association Subtest, which showed a significant difference between experimental and control groups, measured auditory perception at a level described by Kirk and Kirk (1971) as the representational organizing level (the highest level measured by the 4 subtests). Although the data does not indicate the reason for non-significance, it is possible that results of treatment of perceptual disability as defined by Lerner (1971) may be manifest at a meaningful level.

The non-significant results from testing for differences on the Auditory Sequential Memory Subtest could be attributable to several factors. One possibility is that a program of 20 weeks duration was not long enough to produce measurable effects. It was noted that neither the experimental nor the control group exhibited a gain in auditory sequential memory due to maturation even though the test is reportedly correlated with age ($r = .76$) (Paraskevopoulos and Kirk 1969). Perhaps significant growth in auditory sequential memory occurs only

when an extended training period is provided. A second factor may be that the memory training section of the instructional program deals with meaningful material while the criterion measure utilized non-meaningful material. Results would therefore depend upon transfer or non-transfer of training.

The Auditory Analysis Test (AAT), which did differentiate the experimental from the control groups, appears on the surface to be a measure of skills at the automatic level. Its content is similar to that of the Auditory Closure Subtest of the ITPA, however, success on the AAT required analysis skills while closure seems to require more of an ability to synthesize. The correlation between these 2 tests was only .33, which suggested that they measure different factors.

Rosner (1970) stated that the skills tapped by the AAT are an essential component of reading. Improved scores on the AAT for the experimental group beyond those obtained by the control group indicated that the treatment may have made an important contribution to the readiness of the auditory disabled children to begin reading instruction. The AAT was sensitive to teacher and sex differences, therefore, caution should be exercised in generalizing this particular finding beyond the research population.

The 2 reading readiness measures were highly correlated with each other ($r = .69$) but not with other criterion measures.

Reading readiness measures were the criterion which differentiated between the experimental and control groups. It is postulated that the ability to listen and follow directions was responsible for the improved performance in this area. Oakland and Williams (1972) suggested that the ability to direct and sustain attention to sound is basic to educational development. Harris (1956) indicated that learning to listen attentively and follow directions correctly are important social factors in building for reading.

The SCAMIN did not correlate with other criterion measures, but did differentiate significantly the experimental from the control group. In terms of treatment expectations, more positive self-concepts may have been the side effect of improved skill in listening and following directions which could have resulted in more positive responses from significant others.

Reviewed studies of auditory perception have been mainly concerned with auditory discrimination, or have left the definition of auditory perception to the reader's imagination. The ambiguity of terminology and explanations make comparisons of such studies difficult. Our study incorporated Lerner's (1971) definition of auditory perception and employed a training program which was dictated by that definition. It involved not a pure auditory training situation, but one that involved motor responses, visual motor responses, tactual and vocal responses. The use of various modes in an auditory training program while creating problems in defining treatment effect seems defensible, as seldom is one

channel of communication used in isolation.

Effects of the program administered at the kindergarten level suggest that it can meliorate some problems related to auditory perception. It is a prevention oriented program as the point of intervention is prior to rather than in place of reading instruction.

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