

USE OF MUSIC TRAINING TO FACILITATE
RIGHT-LEFT DISCRIMINATION
IN YOUNG CHILDREN

by
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We hereby recommend that the thesis prepared under
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CHAPTER I

Introduction

Music therapy has traditionally been concerned with the remediation of problems of handicapped persons. Yet it seems that since even so called "normal" persons experience learning difficulties, music could be effectively utilized in training programs for these individuals as well. It is time for music therapists to give more consideration to the development of needed skills by the general population. This study has attempted to demonstrate the benefits of music therapy in one small area of the general education of young children, that area being right-left discrimination.

Statement of the Problem

The problem explored in this study was whether young children, given right-left discrimination training by means of music activities, would significantly improve in their ability to discriminate right from left.

Operational Definitions

Right-left discrimination. For the purpose of this study, right-left discrimination is defined as the correct labeling or identifying of the right-left dimensions of one's own or another person's body and the demonstrated ability to move on command to the right and to the left.

Laterality. For the purpose of this study, laterality is defined as demonstrated knowledge of the right-left dimensions of one's own body.

Lateral dominance. For the purpose of this study, lateral dominance is defined as the preferred usage of a right or left body-part.

Directionality. For the purpose of this study, directionality is defined as demonstrated knowledge of the right-left gradient in space, including, but not restricted to knowledge of right-left dimensions of a mirror image.

Need for the Study

Young children must acquire a great variety of skills in order to function optimally in our society. One area of difficulty for many is right-left discrimination. Hebb (1949) spoke of "the notorious difficulty of choosing between left and right, to be observed by anyone who tries to teach twelve-year-old children to 'turn right' promptly on command" (p. 118). As early as 1935, Davidson conducted a study on right-left reversals of the letters p, b, d, and q. Without adequate knowledge of right and left a child will experience difficulty in following words on a printed page and even in following verbal directions to the grocery store.

Right-left discrimination is traditionally taught by the kindergarten or first-grade teacher using whatever methods he deems appropriate. Some teachers visually mark one hand

for easy identification; others use games or repetitive practice (Frostig and Maslow, 1970). All must wedge right-left training into already busy schedules.

In our school systems the music specialist often functions as a provider of cultural enrichment and recreation. All too often he is not included in academic curriculum planning and execution. In a day when students are graduating from our nation's high schools then suing state boards of education because the graduates lack the basic academic skills needed to secure employment, schools can no longer afford to overlook the benefits available by using the music program as a structure and a reinforcer for the teaching of academic skills. Each school program must be utilized to full advantage for the sake of the children. As stated by D. D. Campbell (1972), "instead of having reading taught here, music there, and arithmetic somewhere else at another time, all can be combined to produce a milieu totally conducive to learning, to growing, and to developing the skills that the children will need" (p. 39). The music therapist, with his training in evaluating learning problems and designing activities for their remediation, has much to offer the school setting.

Since music therapists have traditionally been concerned with the handicapped, and since music educators have traditionally identified themselves as being advocates of "art for art's sake", much research in the area of the use of music

in training academic skills in normal children still remains undone (Rejto, 1973). More studies are needed to validate whether music training can facilitate the normal child's learning of various pre-academic and academic skills, and if so, whether certain methods are more efficient than others. This study was designed to determine whether right-left discrimination, a basic perceptual-motor skill, could be trained in normal young children by means of music activities.

Delimitation of the Study

It was not the intent of this study to justify the merits of music therapy over music education, nor to prove the superiority of one type of training over another. This study did attempt to determine whether in a limited amount of time and using music activities as material for training sessions, children's proficiency in right-left discrimination could be improved.

The data collected will not indicate whether certain activities were more beneficial than others, the optimum number of training sessions, nor the optimum session length. It is not known whether the results of this study could be replicated in a different population.

CHAPTER II

Related Literature

Right-Left Discrimination

The ability to discriminate between right and left is a basic perceptual-motor task (O'Donnell, 1969). This ability has at least three component parts. Laterality, the knowledge of right and left body-parts (Frostig & Maslow, 1970), is the simplest. A more difficult task in right-left discrimination is identifying right-left on a mirror image, as in a subject differentiating right-left on a person facing the subject (Howard & Templeton, 1966; Kidd & Rivoire, 1966). The third and most difficult component is awareness of right-left relations of three or more objects in a row, as "a pencil to the left, a key in the middle and a coin to the right" (Belmont & Birch, 1965, p. 62). Laterality has been termed a map of inner space, while directionality, a combination of the second two aspects of right-left discrimination, has been called a map of outer space (Hunter, 1968).

Laterality "appears to be based on somasthetic (i.e., tactual and proprioceptive) components and visual sensory components" (O'Donnell, 1969, pp. 17-18). The human body at birth is both symmetrical and bilateral. The young child has the task of developing an understanding of the relationship

of his body's two sides by means of experiences and sensory input. Visual stimuli may be important early in development, but it is likely that experiences in movement are essential for adequate laterality development. O'Donnell stated that movement creates conditions of shifting balance requiring adjustments by one or the other body sides to maintain or restore equilibrium. Learning which side to move and to what degree aids the child in differentiating between the two sides.

Piaget (1928) held that right-left discrimination was a developmental task. Since right-left concepts have ego-centric reference, as opposed to north and south which have absolute spatial reference, Piaget saw the evolving of directionality as a lessening of ego-centrism: the child being more able to understand the point of view of others, to see that some concepts are relational as opposed to absolute. Chaney and Kephart (1968) suggested that following a developmental chain, the child must have an awareness of laterality before he can comprehend directionality.

Whether a function of maturation or not, right-left discrimination is often a confusing task for young children (L. J. Harris, 1971). Howard and Templeton (1966) stated that there are up-down cues but not right-left cues in most objects. This absence of intrinsic cues increases difficulties in right-left awareness. Rudel and Teuber (1963)

suggested that right-left confusion might have some neurological basis, while Corballis and Beale (1970) held that the confusion might stem from man's bilateral symmetry.

Piaget (1928) found that by age 6, most children had mastered the concept of laterality and by age 8 could identify right-left on a mirror image. In a study of 5- to 11-year-old normal children, Belmont and Birch (1963) reported that 95% of those above 7 years of age could correctly label right and left of their own body-parts, while only 69% of those under 7 could do so. Most of the subjects by age 7 were able to distinguish right-left parts of a person seated at a 180 degree angle to the subject. However, the subjects were not able to correctly identify object relations until age 11. Early elementary-school age was the earliest time when subjects in other studies exhibited adequate laterality (Benton, 1957; Swanson & Benton, 1955). Ayres (1966) found most 4- to 8-year-old subjects in her study unable to differentiate right and left on the body of another person and in object relations.

Although right-left discrimination may be at least partially a developmental function, the ability can be improved through training (Rudel & Teuber, 1963). In a study by Wohlwill and Wiener (1964), 4- and 5-year-old subjects were trained to recognize right-left reversals of a standard figure. Yet right-left reversal errors have been

reported as common in kindergarten and first-grade children (Davidson, 1935). According to Mussen, Conger, and Kagan (1969) "the young child, although often failing to pay heed to the orientation of objects, is capable of detecting and reacting to spatial orientation if his attention is specifically called to this dimension" (p. 294).

Exercises to give the child practice in following left to right progressions may serve to improve right-left discrimination (Schonell, 1963). Frostig and Maslow (1970) suggested that the child with difficulties in directionality be provided with a fixed cue to tell his hands apart. Kephart (1960) concurred and recommended that a weighted arm band be used as the cue. Games and movement exercises were stated by Frostig and Maslow (1970) to be helpful in training the child in laterality and directionality.

Although, as stated earlier, right-left discrimination is sometimes a difficult skill to acquire and may require training, the ability is important to the child. If he

does not achieve a functional level of laterality, he may find that he is unable to move one side of the body or an extremity on one side without simultaneously moving the other side or an extremity on the other side. Thus, when the very young child writes on a piece of paper, both arms and hands move in a similar pattern. (O'Donnell, 1969, p. 20)

The ability to discriminate right from left is also an important pre-academic and pre-reading skill. Reinhold (1963) stated that it is essential to distinguish right from

left in order to read and write. Jones and Hart (1968) suggested that before the child can distinguish between similar visual symbols in reading, he must be able to discriminate between right and left. The necessity of adequate laterality and directionality in reading proficiency has been confirmed in studies by Belmont and Birch (1965), A. J. Harris (1957), and Stauffer (1969). Clark (1970) found that 7-year-old children who scored high on a test of right-left differentiation had a higher mean reading-quotient than those who scored low on the test. A retest of the same subjects two years later revealed that the better readers again scored higher on tests of right-left differentiation. Mussen et al. (1969) suggested that young children tend to confuse letters which are mirror images or right-left reversals of one another (e.g., b and d).

Studies have been conducted to determine the relationships, if any, between perceptual-motor abilities, such as right-left discrimination, and a number of other qualities. IQ and several aspects of perceptual-motor performance were reported to be independent functions (Singer & Brunk, 1967). Douglass (1965) found a slight positive correlation between IQ scores and scores on a test of directions, but the validity of the directionality test was not established. Herndon (1970) found intelligence and perceptual-motor ability were associated in preschool children she used as subjects.

Right-left discrimination has been reported to be independent of the development of lateral dominance. Laterality, in fact, was found to precede clear establishment of hand dominance by approximately two years (Belmont & Birch, 1963). Benton and Meneffee (1957) found a small correlation between degree of unilateral hand preference and ability to discriminate right and left, yet stated that the major determinant of directionality was variation in learning experiences. Laterality, but not lateral dominance, has been positively associated with reading ability (Belmont & Birch, 1965; Frostig & Maslow, 1970).

Tests of Right-Left Discrimination

A survey of literature revealed that most researchers in the field of right-left discrimination employ self-made tests or tests adapted from those used by previous researchers. Buros (1974) listed no standardized tests specifically designed to measure right-left discrimination. Some of the listed perceptual-motor instruments, however, contained right-left differentiation subtests.

Piaget (1928) designed an instrument to measure the right-left orientation of children. The questions required the child to "Show" left and right on his own body-parts and on the body of the examiner facing him. In addition the child was asked several questions concerning the relative positions of three objects in a row. Finally the child was

shown another three-object array for 30 seconds only, then asked to answer from memory questions concerning the relative positions of the objects.

The instrument utilized by Piaget has been borrowed and modified by other researchers for studies on right-left discrimination. Belmont and Birch administered Piaget's scale with three additional laterality questions to male 9- and 10-year-old retarded and normal readers (1965) and to normal kindergarten through sixth-grade children (1963). L. J. Harris (1971) in a study with kindergarten and second-grade subjects utilized a modification of Piaget's instrument. When asked to identify right and left body-parts of the examiner, each of Harris' subjects was seated just behind and to the left of the examiner and facing in the same direction. This was done to eliminate the mirror-image variable present when the examiner faced the subject. Harris' administration of the modified Piaget scale was done in connection with the administering of similar instruments for concepts of up-down and front-back.

In a study using 92 children aged 4 to 8 years, Ayres (1966) employed an instrument requiring identification of right and left sides of the subject's own body and that of the examiner, as well as the relative position of objects. She found that the test was too difficult for the age range to which it was applied.

Studying 7-year-old normal and slow readers, Clark (1970) administered a 5-item test, including a mirror-image question with the examiner's arms crossed ("Point to my right hand") and a question involving two discriminations ("Point to your left ear with your right hand", p.37). She found better readers scored higher on the test both at age 7 and two years later in a follow-up study.

Douglass (1965) included questions on right-left discrimination as part of a 14-item test on knowledge of directions including up-down, sunup-sundown, and north-south-east-west. A. J. Harris (1957) attempted to assess whether right-left confusion was within the normal range for 9-year-old slow readers. However, his use of a brief three-item scale has been questioned (Belmont & Birch, 1965). Subjects 4- to 8-years-old answering consistently to a 16-item test of right-left discrimination administered by Benton and Meneffee (1957) were awarded a perfect score, even if the labels were consistently reversed. The researchers structured the test to evaluate the discrimination ability, not the language proficiency of the children.

Music Training in Academic and Motor Tasks

Training subjects with the aid of music to improve academic and motor performance has been the subject of several previous studies. Rejto (1973) in a one-subject pretest-posttest design found that music training in perceptual

skills, including right-left awareness, was associated with that subject's increase of 15 points on the Weschler Intelligence Scale for Children and 2- to 4-year gains on an accepted battery of achievement tests. Gains occurred over a 12-month period. Rejto suggested that music as a skill subject could readily be adapted to a prescriptive function.

In some studies the utilization of music was restricted to background recordings during training sessions. Quiet, nonstimulative music was successfully used by Perry (1945) to facilitate the learning of braille by blindfolded sighted subjects. Carlson and Hergenbahn (1967) investigated the effects of rock-n-roll and classical music on the learning of nonsense syllables by college students and found no significant differences in learning between either of the experimental groups and a control group. In an earlier study of similar design, Baugh and Baugh (1965) found that the group listening to rock-n-roll music learned significantly fewer syllables than did the control group. Familiarity with the rock music was given as the probable cause for its distracting influence during training.

Rhythmic activity was used by Painter (1966) in an attempt to investigate its effect on the body image and perceptual-motor integration of kindergarten children. He selected

the lowest functioning half of a class as his subjects.

After 21 half-hour training sessions the experimental group performed significantly better on a posttest designed to measure perceptual-motor functioning than did a control group receiving no training.

As pointed out by D. D. Campbell (1972), "rhythm seems to facilitate production of the responses necessary to coordinate such bodily movements as speech, writing, reading, walking, and dancing" (p. 38). Dillon (1952) conducted a 3-year study involving 240 college females of intermediate swimming ability. Those subjects taught swimming with the aid of rhythmic music improved more in speed and form on two swimming strokes than did those taught without music.

Beisman (1967) used a pretest-posttest design to investigate the effect of rhythmic accompaniment on the learning of fundamental motor-skills. The treatment period for the 607 elementary-grade subjects was ten weeks. Post-test results supported the use of music in motor-skill training programs. Groves (1969), however, found no significant differences in children's ability to synchronize body movements with rhythmic stimuli, regardless of whether training was received. A follow-up test 18 months later seemed to confirm that age and maturation were more important than rhythmic training in acquiring this skill.

A music activity program, in conjunction with speech therapy, was found by Seybold (1971) to be more effective than speech therapy alone in stimulating spontaneous speech in preschool children with delayed speech. Galloway and Bean (1974) studied the effects of action songs on the development of body-image and body-part identification in hearing-impaired preschool children. After 17 training sessions of 15-minutes each, posttest results indicated "music may be a useful method in teaching selected concepts to hearing-impaired children" (p. 132).

Robins and Robins (1967) cited certain of their music activities as being appropriate for use in training right-left discrimination in normal children, but no data were reported. An introductory note reads "an opportunity is presented for careful evaluation of its [the activity's] effectiveness and research in the mechanism of learning" (p. 9).

Summary

Right-left discrimination is a basic perceptual-motor task with at least three levels: identification of right-left on one's own body-parts, identification of right-left on a mirror image, and identification of the relative positions of objects. Studies were cited which reported laterality to be a simpler skill than directionality. Other researchers offered theories as to why right-left concepts are more difficult for the young child than are concepts of up-down.

Age 6 or 7 was found to be the time at which laterality is firmly established, while identification of object relations is not generally adequate until age 11.

Right-left discrimination was improved with training in several studies. The task was considered worth the effort involved because right-left discrimination was found to be correlated with independence of limb movement and with reading proficiency. Laterality was not found to be dependent on lateral dominance. The reported relationship of IQ to perceptual-motor ability varied from study to study.

A review of literature revealed no standardized tests in print measuring right-left discrimination exclusively. Most researchers used an adaption of a scale developed by Piaget.

Music training was shown to be successful in improving academic and motor performance in several areas. In other areas music was found to be of no significant value; and in one instance, rock-n-roll was found to be a distracting influence in the training of a skill. It was the purpose of the present study to determine whether young children, given music training focused on right-left discrimination, would score higher on a test of such discrimination than would children not receiving training.

Hypothesis

There will be no difference in posttest scores for subjects receiving music training and subjects receiving no training.

Alternates to the Hypothesis

1. Subjects receiving music training in right-left discrimination will score significantly higher on the posttest than will subjects receiving no training.
2. Subjects receiving music training in right-left discrimination will score significantly lower on the posttest than will subjects receiving no training.

CHAPTER III

Experimental Design

Selection of Subjects

Subjects (Ss) in the study were 5- to 7-year-old children enrolled in a summer day-care program in Cedar-Hill, Texas. Children were informally screened for knowledge of left and right. This was accomplished by playing the game "Simon Says" with commands calling for left and right movements. Any children who appeared to have a good comprehension of laterality and directionality were removed from consideration as Ss. At this same time, students were screened for knowledge of the terms "hand", "foot", "ear", "watch", "ring", "step", and "stand" as used in the testing instrument. No children were found who showed confusion about any of these terms.

From the eligible population, 40 Ss were randomly selected and randomly assigned to one of four groups: A. pretested-experimental; B. pretested-control; C. unpretested-experimental; D. unpretested-control. These assignments are in accordance with the Solomon Four-Group Design (D. T. Campbell and Stanley, 1963):

R_A O₁ X O₂

R_B O₃ O₄

R_C X O₅

R_D O₆

Because two subjects moved out of town during the study and two others left on summer vacations, data was available on only 36 Ss. Group A consisted of two boys and seven girls and had a mean chronological age (C.A.) of 5.8; group B contained five boys and five girls and had a mean C.A. of 6.1; group C consisted of three boys and five girls and had a mean C.A. of 6.3; group D contained three boys and six girls and had a mean C.A. of 5.7. The total group contained 13 boys and 23 girls and had a mean C.A. of 6.0.

Setting

All sessions were held in a classroom at Cedar Hill Day School. Both testing sessions were conducted between 10:00 a.m. and 12:00 noon. Thirteen of the 20 training sessions were held at 10:00 a.m., the remainder at 3:00 p.m.

Equipment and Materials

The following equipment and materials were used in the study:

- 1 Dynasty wristwatch
- 1 North Star wristwatch
- 1 Gold and diamond wedding ring set
- 1 Porcelain and gold ring
- 1 Goya G-10 classical guitar

Testing Instrument

The test (Appendix A) used as pretest and posttest contained 20 items and was modeled after a similar test by Piaget (1928). As suggested by Lehman (1968) ordering of test items was done on a simple-to-complex basis. Since developmental specialists are in general agreement that laterality is established before directionality, the first half of the test contained items measuring laterality and the second half contained items measuring components of directionality. Within their respective halves of the test, items were randomly assigned an order.

The construct validity of tests such as the one used in this study was supported by Corbin (1973).

Assessment of the level of development of the right-left discrimination capacities of the child is usually determined by observing the child's behavior in responding to such statements as "Show me your right hand" or "Touch your left ear". (pp. 145-146)

To further insure validity of the instrument, ten teachers of young children were asked what useful information could be gained by giving this particular test to their children. Each replied that the test would be a good measure of a child's knowledge of left and right.

Reliability of the test was assessed in a preliminary study. One-week test-retest reliability was .81 and split-half reliability was .97. Inter-rater reliability averaged .95. (See Appendix B for description of test development.)

In this study the test was administered to Ss one at a time and scored by two observers (Os), one of whom was blind to the group assignments of the Ss. The experimenter (E) sat directly opposite S, facing him and about two feet away. The Os sat to the right of E. E gave no assistance, only stated the questions. E attempted to refrain from showing approval or disapproval of S's responses.

Procedure

After Ss had been given group assignments groups A and C, the experimental groups, then participated in a series of 20-minute training sessions designed to improve right-left discrimination. Twenty such sessions were held. Activities for the sessions were selected from the list in Appendix C. Listed beside each activity is a record of the number of times that activity was used during the twenty sessions. The determinant of which activities would be used in any session was the judgment of E as to their relative effectiveness and appropriateness in achieving the purpose of the training sessions.

The basic procedure for the training sessions was as follows: Experimental Ss were located and asked to go to the training room. When they had assembled, attendance was recorded. Ss were asked to hold up their hands. Any necessary corrections of Ss' responses were made by E. Several of the activities from the list in Appendix C were

conducted. Again Ss were corrected when necessary in choices of right and left. Between activities, Ss could volunteer to be asked a question about right and left by another S. At the end of each session, those wishing to do so could answer a right-left question sung by E and be rewarded for a correct response with an opportunity to strum the guitar.

Control Ss, groups B and D, participated in outdoor free play during the time the training sessions were held. For the duration of the study, to the knowledge of E, no S received right-left discrimination training other than that given in the training sessions of the study.

Following the completion of the 20 training sessions, all four groups were given the posttest. Again the test was administered to one S at a time and rated by two observers. Inter-rater reliability for the posttest was .99.

Evaluation

A 2 X 2 analysis of variance was used to evaluate the posttest data from all four groups. An analysis of covariance was performed on the posttest scores of groups A and B, the pretested-experimental and pretested-control groups, using the pretest scores as the covariate.

CHAPTER IV

Presentation of the Data

The Solomon Four-Group Design was used in this study.

The design is as follows:

R_A O_1 X O_2

R_B O_3 O_4

R_C X O_5

R_D O_6

This design was selected because it provides measures for the main effect of testing and the interaction of testing with the experimental variable, training. It also indicates the combined effect of maturation and history.

A two-factor analysis of variance was used to analyze the posttest data from all four groups. Rows and columns were as illustrated:

Pretested Unpretested

X: O_2 O_5

No X: O_4 O_6

Row means were used to estimate the effect of the training sessions; column means were used to estimate the main effect of the pretest; cell means were used to estimate the effects of the interaction of training sessions and the pretest.

Table 1 indicates the number of Ss in each group.

Table 1
Number of Subjects

	Pretested	Unpretested	Row Total
X	9	8	17
No X	10	9	19
Col. Total	19	17	36

Table 2 illustrates the mean scores for each group. The combined effects of history and maturation can be shown by comparing the column mean for pretest scores with the post-test score for the unpretested control group. A t test found this difference to be non-significant.

Table 2
Group Mean Scores

	Pretest	Posttest		Row Total
		Pretested	Unpretested	
X	(9.77)	18.22	17.76	17.94
No X	(8.10)	8.30	8.88	8.58
Col. Total	(8.89)	13.00	13.00	13.00

Note. Pretest scores are in parenthesis to indicate that they are not included in the row totals nor in the grand total of the table.

Standard deviations for the tests are shown in Table 3.

Table 3
Standard Deviations

	Pretest	Posttest		
		Pretested	Unpretested	Row Total
X	(.67)	1.20	3.12	2.16
No X	(2.73)	3.83	2.62	3.24
Col. Total		5.46	5.12	5.33

The results of the analysis of variance of posttest scores are shown in Table 4.

Table 4
Analysis of Variance Results

	Sum of Squares	df	Mean Squares	F
Training	786.12	1	786.12	96.57*
Testing	0.0	1	0.0	0.0
Interaction	3.45	1	3.45	0.5
Within	260.43	32	8.14	
Total	1,050.00	35		

* Significant beyond .001 level of confidence

The effects of pretesting and the interaction of training and pretesting being non-significant, an analysis of covariance of O_4 versus O_2 was performed, using the pretest scores as the covariate. The findings of this test were similar to those of the analysis of variance.

When posttest scores were grouped by sex, mean score for the girls was 13.91 and for the boys, 11.38, with standard deviations of 5.629 and 4.862, respectively. The computed t value was 1.357, non-significant at .10 level of confidence.

Posttest scores were grouped by age, yielding a mean score of 11.77 for the 5-year-olds, 14.44 for the 6-year-olds, and 13.21 for the 7-year-olds, with standard deviations of 4.50, 5.08, and 6.58, respectively. Results of t tests indicated no significant differences at .05 confidence level.

Summary of Results

An analysis of variance performed on posttest data indicated training was associated with a significant ($\alpha = .001$) difference between experimental and control groups. No significant differences were found due to the effect of testing or to the interaction of testing with training. An analysis of covariance of the two pretested

groups also indicated a significant difference associated with the variable of training. No significant difference was found between scores of girls and boys; no significant differences were found associated with age.

CHAPTER V

Discussion, Implications, and Recommendations

Discussion of Results

The analysis of variance test indicated that the effects of pretesting on posttest scores were negligible, as was the interaction of pretesting with the experimental variable, training. Posttest scores were not greatly influenced by the administration of a pretest.

However, training sessions did seem to affect posttest scores. Children receiving music training in right-left discrimination scored significantly ($\alpha = .001$) higher on the posttest than did children not receiving training. For this reason the null hypothesis is rejected and the alternate is accepted: Subjects receiving music training in right-left discrimination will score significantly higher on the posttest than will subjects receiving no training.

This finding seems consistent with earlier work which found that although young children do not usually make accurate right-left discriminations, they can be trained to do so (Wohlwill & Wiener, 1964). These results also would seem to partially validate the statements by Robins and Robins (1967) that certain music activities are an aid in training right-left discrimination.

No significant differences were found between the scores of boys and the scores of girls. It is interesting to note that 6-year-olds scored higher on the posttest than both 5-year-olds and 7-year-olds, although these differences did not reach statistical significance.

Possible Use of Testing Instrument

The testing instrument used in this study was evaluated in a preliminary study (see Appendix B). The test was found to have a split-half reliability of .97 and, over a one-week period, a test-retest reliability of .81. Construct validity was established by comparison with other tests of right-left discrimination and by obtaining the professional opinions of ten educators of young children. Inter-rater reliability in the preliminary and main studies ranged from .95 to 1.00. These coefficients would seem sufficiently high to justify use of this test by other therapists and educators in evaluating the right-left awareness of children with whom they are working.

The test was not difficult for the experimenter to administer alone, and as established in a preliminary study, only about three minutes was required to test an individual child. These indications would seem to prove the instrument suitable for group as well as individual evaluation of right-left discrimination.

This test would not, however, be suitable for standardization. Age norms for 7-year-old children could probably be established, but performance levels of 5-year-olds would be difficult to predict, due to the somewhat random responses of these preschool children to the questions on this test. The possibility exists that similar problems encountered by other researchers could partially account for the lack of standardized tests of right-left discrimination.

Implications for Music Education

Music activities directed toward right-left discrimination may be effective in improving the discrimination ability in normal 5- to 7-year-old children. The training of discrimination would seem to be an area where music specialists in the schools could assume more responsibility. An interested specialist could begin by assessing the right-left awareness of the children in his class. In one 30-minute class period, 10 to 15 children could be tested.

After all the children in a class had been tested, a certain number of sessions could be devoted to music activities stressing right and left. (Many such activities can be found in the state-adopted music series books.) If the music specialist preferred, only a portion of each class period could be devoted to these activities, the rest of the period to other types of music activities.

At the end of the semester or at any end-point the music specialist chose, the children could be re-evaluated. Gain scores would serve as the indicator of each child's progress in the area of right-left discrimination.

Such data could serve to strengthen the position of the music specialist in securing a voice in curriculum planning for the children he serves. Planning with the non-musical as well as musical needs of the children in mind is indicative of a responsible concern for the total development and well-being of the children.

Implications for Music Therapy

Although this study was conducted with normal children, it has application for music therapy if one considers that each individual is in some way handicapped, and that dysfunction labels are often applied because of differences in degree rather than type of handicap. Following left-right progressions has been shown to be an important pre-reading skill, yet in many cases, the young children in this study did not show adequate concepts of laterality. Perhaps it is no wonder that many normal children experience difficulty in learning to read. If one considers the responsibility of a therapist as being that of helping each individual he serves function in society at the optimum level for that individual, the normal children in this study would indeed be considered proper clients for the therapist.

With music-activity training these children improved in their ability to discriminate right from left. Earlier studies (Belmont & Birch, 1965, Clark, 1970) have shown that children who score high on tests of right-left discrimination are generally better readers than those who score low on such tests. The time has come for music therapists to give more consideration to the learning problems of the normal child.

If handicaps are a matter of degree, perhaps music-training programs would be effective in improving the right-left discrimination of children classified as learning disabled. Such children were used as subjects in a preliminary study (See Appendix B) and did improve with training in their ability to discriminate right from left. However, the lack of random assignment and of a control group in that study prevents predictive value from those results.

Recommendations

The scope of the study under consideration was quite limited. No provision was made for determining the optimum number of training sessions, nor the optimum session length. Further study is needed to make these determinations and to discover whether certain music activities are more effective than others in training right-left discrimination. A comparison of effectiveness in training right-left

discrimination between a structured music program and a structured non-music program would also seem to be in order.

This study was conducted with normal 5- to 7-year-old children. Further work is needed to ascertain whether the results could be replicated with other populations, such as learning-disabled children.

The highly-positive results of this study would seem to indicate a justification for future studies investigating the effects of directed music-training on other aspects of the perceptual-motor abilities of young children. Such studies would do well to incorporate designs of a broader range than the present study, attempting to answer some of the questions left open by this study. These studies could also make provisions for follow-up testing to determine the degree of retention of skills some period after training; such follow-up work would need to control for the effects of maturation.

Summary

A Solomon Four-Group Design was utilized with 36 children, aged 5- to 7-years, in an attempt to determine whether young children given music-activity training in right-left discrimination, would improve significantly more in the ability to make such discriminations than would children not receiving training. Subjects were randomly

selected from those available in a summer day-care program and were randomly assigned to one of four groups: pretested-experimental, pretested-control, unpretested-experimental, unpretested-control. Subjects selected for pretest were tested for right-left discrimination, then all experimental subjects received 20 training sessions, each of 20-minute length. Sessions consisted of music activities focused on right and left. Control subjects spent the time in outdoor free play. Following the completion of the training sessions, all four groups were given the posttest of right-left discrimination.

An analysis of variance indicated the effects of pretesting and the effects of the interaction of pretesting with training were negligible. The effects of training were found to be significant beyond the .001 level. An analysis of covariance performed on both pretested groups confirmed that subjects receiving music training scored significantly ($\alpha = .01$) higher on the posttest than did subjects not receiving training. Further study was indicated to determine the optimum number of sessions, optimum session length, most beneficial activities, and generalizability to other populations.

APPENDIX A

Testing Instrument

Student _____ Birthdate _____

Observer _____ Date _____

- | | | |
|-------------|---------------|--|
| ___ correct | ___ incorrect | 1. Show me your left ear. |
| ___ correct | ___ incorrect | 2. Show me your left foot. |
| ___ correct | ___ incorrect | 3. Show me your right foot. |
| ___ correct | ___ incorrect | 4. Show me your right hand. |
| ___ correct | ___ incorrect | 5. Show me your right ear. |
| ___ correct | ___ incorrect | 6. Show me your left hand. |
| ___ correct | ___ incorrect | 7. Is the watch on your left hand or
is the watch on your right hand? |
| ___ correct | ___ incorrect | 8. Is the ring on your right hand or
is the ring on your left hand? |
| ___ correct | ___ incorrect | 9. Step to your left. |
| ___ correct | ___ incorrect | 10. Step to your right. |
| ___ correct | ___ incorrect | 11. Show me my right hand. |
| ___ correct | ___ incorrect | 12. Show me my left ear. |
| ___ correct | ___ incorrect | 13. Show me my right ear. |
| ___ correct | ___ incorrect | 14. Show me my left hand. |
| ___ correct | ___ incorrect | 15. Show me my left foot. |
| ___ correct | ___ incorrect | 16. Show me my right foot. |
| ___ correct | ___ incorrect | 17. Is the watch on my left hand or
is the watch on my right hand? |
| ___ correct | ___ incorrect | 18. Is the ring on my right hand or
is the ring on my left hand? |
| ___ correct | ___ incorrect | 19. Stand by my right side. |
| ___ correct | ___ incorrect | 20. Stand by my left side. |

APPENDIX B

Report of Preliminary Studies

Prior to the undertaking of the main study, two smaller studies were conducted. One of these studies was conducted to insure that the testing instrument and training activities were appropriate in length and difficulty and could be efficiently administered by the experimenter. The other study was designed to measure the validity and reliability of the testing instrument constructed by the experimenter. Another purpose of the preliminary studies was to alert the experimenter to possible problems in conducting the main study.

First Study

This study was designed to informally assess appropriateness of activities and length of training sessions and to determine inter-rater reliability and time required to administer the testing instrument.

Subjects. Selected subjects were seven private-school students, aged 6 to 8 years, enrolled in a class for children with moderate learning disabilities. Average academic performance of the subjects was one year behind grade level.

Setting. Testing and training sessions were conducted in a classroom at Children's Development Center, a United

Way school for children with developmental handicaps and/or emotional disturbances. Sessions were held at 12:30 p.m. on school days.

Procedure. Because it was not the purpose of this pilot study to test the hypothesis of the main study, subjects were not randomly selected nor was any provision made for a control group. The selection of this class for use as subjects was based on the similarity of the children in age and academic performance to normal 5- to 7-year-olds, the group that was to be evaluated in the main study.

The subjects were pretested one at a time with the experimenter orally asking the questions (see Appendix A for a copy of the testing instrument). The classroom teacher and teaching assistant served as blind observers and raters.

Four 20-minute training sessions were conducted, one on each of four successive school days. The subjects were instructed in songs, dances, and movement activities selected from the list in Appendix B. Activities 1, 3, and 7 were used one time each; activities 2 and 6 were used twice; activity 5 was used three times. Raters were not present during the training sessions.

Following the four training sessions the raters were informed that the test needed to be given again. The posttest was administered under the same conditions described for the pretest.

Results. Inter-rater reliability for the pretest was .91 and for the posttest, 1.00. Time consumed for testing six students was approximately 18 minutes.

Discussion. The testing procedure did not appear to be tedious for the children. Following the pretest four of the subjects made remarks on the order of "That was fun!" or "May I do it again?"

During training sessions subjects participated without being urged to stay on task. All were able to perform the activities with only minimal assistance from the experimenter. Feedback from the classroom teacher indicated that the children had found the sessions enjoyable.

These informal indications that the test and activities were appropriate were accepted as sufficient to warrant the effort of an extended study. An average testing time of 3 minutes per subject was judged acceptable to permit use of the test with the 40 subjects in the main study.

This study alerted the experimenter to a possible problem in conducting the main study. This possibility was reduction in group size. Due to absences on testing days, a proposed group of seven subjects produced useful pretest and posttest data for only four subjects. An additional consideration was that one subject, present for both pretesting and posttesting, missed a training session.

Second Study

This study was designed to collect data on the reliability of the testing instrument to be used in the main study.

Both test-retest and split-half reliability were desired.

Subjects. Subjects were 25 second-grade students in a public school classroom in Midlothian, Texas.

Setting. Testing was done in the school classroom between 9:00 and 11:00 a.m. on school days.

Procedure. While the students were involved in written work at their desks, subjects were called one at a time to the teacher's desk and orally asked the questions on the test. One week later the same subjects were given the test under similar conditions. The teacher administering the instrument was informed only that the test needed to be given twice with one week intervening between tests and that no right-left awareness training should be given between the administering of the two tests.

Results. Test-retest reliability was .81. Split-half reliability was .97.

Discussion. Two of the subjects were described by the teacher as "highly distracted" during the first test. She commented that their scores on that test were not representative of their abilities. This could partially explain the test-retest coefficient being lower than the split-half.

A typographical error in the printed test was found and corrected during this study. The experimenter became aware of possible mechanical errors in the main study.

APPENDIX C

Material for Experimental Sessions

1. Old Brass Wagon--Folk Dance (8 times)
2. Step to the Right, Baby**--Rhythmic Movement Chant (3 times)
3. Hokey Pokey--Circle Game (3 times)
4. Looby Loo--Circle Game (1 time)
5. This is my Right Hand--Movement Song (15 times)
6. Partners*--Movement Song (3 times)
7. Minuet--Dance (3 times)
8. Right Hand, Right Arm Keep Moving--Movement Song (2 times)
9. Put Your Hands Up in the Air*--Movement Song
10. I Put my Right Hand Out to You--Movement Song (10 times)
(Tune: Mulberry Bush)
11. If You're Happy and You Know It--Movement Song (3 times)

* Available from Educational Activities, Inc.

Freeport, N. Y. 11520

**Available from Kitching Educational

Ludwig Industries

505 E. Shawmute

La Grange, Ill. 60525

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