This study investigated the effects of age, singing ability, and training with pitched instruments on preschool children's auditory perception of five melodic components: absolute pitch level, melodic rhythm, melodic contour, tonal center, and melodic interval. The results of the study, based on the vocal responses of 91 3- to 5-year-old subjects, revealed the following: (a) significant differences associated with age were found in preschool children's perception of melodic rhythm, melodic contour, and melodic interval; (b) high-ability singers scored higher than low-ability singers on perception of melodic rhythm, melodic contour, tonal center, and melodic interval; (c) instrumental and noninstrumental treatment groups did not differ significantly in perception of the melodic components.

Jonny H. Ramsey, *Central Intermediate Unit No. 10, West Decatur, Pennsylvania*

The Effects of Age, Singing Ability, and Instrumental Experiences on Preschool Children's Melodic Perception

Aural perception is a crucial component of the music learning process, and a basic knowledge of the manner in which aural perception of musical sounds develops and functions during childhood is essential to music educators. Recent research (Michel, 1973) has indicated that significant musical development, particularly the development of vocal and auditory abilities, occurs during the preschool years. However, little information about the nature of the development of musical auditory perception of the preschool child is available.

Studies in other sensory modes, particularly visual perception (Piaget, 1970; Vernon, 1960), have disclosed that perceptual learning changes as children's cognitive structures change and develop. Some research (Carter, Ricker, & Corsini, 1972) has suggested that a similar phenomenon also may exist in auditory perception. Particularly in the area of

For reprints of this article, contact Jonny H. Ramsey, Central Intermediate Unit No. 10, West Decatur, Pennsylvania 16878.

melodic perception (De Gainza, 1970; McDonald & Ramsey, 1979; Sergeant & Roche, 1973), research has suggested that young children may focus on different aspects of melody and that their perceptual responses, consequently, may differ with age. The conflicting results in age differences in these studies, however, point to the need for further research in this area.

Furthermore, several studies (Buckton, 1977; Moore, 1973; Sergeant, 1969) have suggested that young children's melodic perception may be enhanced by experiences with pitched instruments during early childhood. No study, however, has explored specifically the effect of instrumental experience on preschool children's ability to perceive component aspects of melody. In addition, research (Lenz, 1978; Williams, 1932) has indicated that a singing response is a viable measure of young children's perception of musical stimuli, particularly perception of pitch and melody, if some index of the child's vocal control abilities is available before the onset of research procedures. Although singing has been used frequently as a mode of response for measurement of melodic perception among preschool children, no study has attempted to control singing as a variable or to investigate its effect on measurement of melodic perception.

PURPOSE

The purpose of this study, therefore, was to investigate the effects of age, singing ability, and training with pitched instruments on preschool children's auditory perception of melody. The study investigated children's perception (as indicated by song vocalization) of five specific melodic components: absolute pitch level, melodic rhythm, melodic contour, tonal center, and melodic interval. Specific research questions, which the study sought to answer, included the following:

1. Are there significant interactions among the factors of age, singing ability level, and training treatments as reflected through the perceptual task mean scores of preschool children?
2. Are there significant differences across age groups in preschool children's auditory perception (as measured through song vocalization) of melodic components such as (a) absolute pitch level, (b) melodic rhythm, (c) melodic contour, (d) tonal center, and (e) melodic interval?
3. Is there a significant difference between the auditory perception of melodic components of preschool children classified as high-ability singers and that of preschool children classified as low-ability singers?
4. Is there a significant difference between the auditory perception of melodic components of preschool children whose training included experiences with pitched instruments and that of preschool children whose training did not include such experiences?

PROCEDURES

The subjects selected for the study were children enrolled in five preschool programs in Pennsylvania and Iowa. The programs included

two federally funded Headstart programs and one university early childhood education center that was partially tuition-funded, one church-affiliated day-care center, and one privately operated day-care center, both of which were tuition supported. The preschools were selected because of their availability and the willingness of the administrators and teachers to participate in the study.

A total of 114 subjects participated in the study; however, the results were based on the responses of 91 children who completed all phases of the study. These 91 children ranged in age from 38 to 70 months, including 24 3-year-old, 43 4-year-old, and 24 5-year-old children. In all, 46 female and 45 male subjects completed all phases of the study.

The study used a three-way fixed-factor design to measure differences in perceptual learning across age, singing ability, and treatment factors on each of five dependent variables (absolute pitch level, melodic rhythm, melodic contour, tonal center, and melodic interval). Differences in perceptual learning were measured through subjects' vocalizations of *unfamiliar* task-melodies, thus necessitating the selection of a posttest-only design.

Before the main study, intact classes at four preschools were assigned randomly to one of two treatment groups (instrumental or noninstrumental). Each subject at the fifth preschool (the university early childhood education center) was assigned randomly to one of the two treatments, so that both treatments were represented at that school.

So that subjects could be categorized by singing ability, it was necessary that a preliminary measurement of subjects' singing capabilities be made before the treatment phases of the study. A search of the literature disclosed no suitable evaluative instrument; consequently, the Preschool Singing Ability Level Test (PSALT) was designed.

Development of the PSALT

The PSALT was constructed in two parts. Part 1 measured children's competency in reproducing pitches within a range appropriate for preschool singing. Ten pitches within the identified vocal range b^b to c'' were selected randomly for the ten test items of Part 1 of the PSALT.

In addition, Part 1 was structured around a story appropriate for preschool children which, when presented, provided opportunities for subjects to participate actively in the testing procedure through the manipulation of flannel board "pictures" (a procedure intended to motivate the subjects to match presented pitches). The story line of *Good-Night, Owl!* (Hutchins, 1972) was used. This story presented numerous animal characters, each with its own particular "animal sound" that could be imitated vocally by the child as the story progressed. The ten test pitches were assigned randomly to each of the ten animal sounds. Consequently, as the story of Part 1 was presented by the test administrator, each of the animal sounds was sung on a specified pitch, first by the tester and then by the subject.

Part 2 of this PSALT measured children's ability to reproduce a song. In Part 2, each subject was required to sing a song of his own choosing.

For cases in which a child could not think of a song, the test administrator suggested a familiar nursery song for the subject to sing. Seven familiar nursery songs, which are sung frequently by young children, were identified for this purpose.

The PSALT was pilot-tested with 3- to 5-year-old children and revised in preparation for use in the main study. The pilot-tests indicated that the test could be administered in approximately 20 minutes. Using the test-retest method with 20 subjects randomly chosen from the main study, a reliability coefficient of .71 was established for the PSALT.

The Main Study

The study was implemented in five phases at each school site. First, an orientation period allowed the subjects to become acquainted with the investigator and the testing environment at each school. The orientation period occurred 2 weeks before the testing and training phase of the study. During this period, the investigator engaged in spontaneous play and ongoing daily activities with the children and led the subjects in nonmusical activities in the room where testing and training were scheduled to occur.

During the second phase, the PSALT was administered individually to subjects. The subjects' responses were tape-recorded. The taped responses were transcribed and then scored according to predetermined scoring criteria. Scores on the PSALT were used only to classify subjects by singing ability level. Scores on the PSALT ranged from 0 to 15 points; the median score was 7 points. Subjects scoring at the median level or higher were assigned to the high-singing-ability group; others scoring below the median were assigned to the low-singing-ability level group. Thus, 52 subjects were classified as high-ability singers, while 39 subjects were categorized as low-ability singers.

The third segment of the study included implementing the treatment programs. During this phase, three task-songs previously selected for their appropriate preschool range, interval structure, verbal content, and unfamiliarity to subjects were presented to the subjects during six sessions of 30 minutes each, using either instrumental or noninstrumental treatment procedures.

In the instrumental treatment group, the subjects played selected beginning motives of the songs on tone bells under the guidance of the researcher. During this procedure, each subject sang as he played the motive, and the remainder of the subjects sang along. In lieu of instrumental experiences, the noninstrumental treatment group engaged in "echo games." The researcher sang the selected motive and asked individual children to echo the motive. The number of times that the subjects heard and sang entire songs and motives was equalized between the two treatment groups.

During these sessions, several procedures were followed for both treatment groups. First, subjects participated in the task-song sessions in groups of five or six children. Second, the songs were presented by rote at invariant pitch levels without harmonic accompaniment. Third, a

picture card was associated with each of the three task-songs. The picture cards depicted animals or concepts presented in the text of each song. These cards served as visual cues during subsequent testing phases of the study to initiate subjects' singing without the aid of vocal cues from the researcher. Fourth, movement games and creative drama activities were associated with the various task-songs to provide participatory experiences for subjects and to hold the children's attention on the task during the six sessions. Fifth, during these sessions, emphasis was placed on the subjects' hearing of the songs as sung by the researcher so that perceptual learning could occur. Subjects were encouraged to listen closely and then sing along. No attempt was made to correct the subjects' singing during these sessions.

During the fourth phase of the study, the subjects were required to sing the three task-songs in individual testing situations. The testing occurred 1 week following the completion of the task-song training sessions. At no point during the testing did the researcher provide beginning pitches or sing portions of the songs. Rather, to stimulate the subjects to begin each song, cueing techniques were used, including (1) the presentation of the picture cue card previously associated with each song, (2) verbal descriptions or physical reproductions of the movement or creative drama activity previously associated with each song, and (3) recitation (but not singing) of the initial words of a song. The task-song performances of each subject were tape-recorded for later evaluation.

During the final phase of the study, the investigator transcribed the tape responses of each subject and then scored the notated responses, using predetermined scoring scales for each of the five melodic perceptual variables—absolute pitch level, melodic rhythm, melodic contour, tonal center, and melodic interval.

The reliability of song transcription and scoring procedures was established through intraclass correlations among the investigator's transcription and scoring evaluations and those of two independent judges. The reliability coefficients resulting from these procedures were as follows: (1) transcription reliability, .99; (2) absolute pitching scoring reliability, 1.0; (3) melodic rhythm scoring reliability, .99; (4) melodic contour scoring reliability, .98; (5) tonal center scoring reliability, .82; and (6) melodic interval scoring reliability, .99.

RESULTS

The three-way fixed-factor design of the study enabled the determination of the effect of (1) age factors across three levels, (2) singing ability factors across two levels, (3) treatment factors across two levels, and (4) the interaction of the three factors on each of the five melodic perceptual variables measured. However, data collected from the 91 subjects from the five preschool sites resulted in an unbalanced design of unequal, disproportionate cell sizes. Consequently, to answer the questions posed in the study, five separate three-way least squares analyses of variance were performed on the collected data—one analysis for each of the five melodic variables measured.

Table 1—Least Squares (LS) Means and Standard Errors of the Least Squares Means of Age Groups on the Five Melodic Variables

Melodic Variable	Age Group	*n*	LS Mean	Standard Error of LS Mean
Absolute Pitching	3 years	24	.86	.28
	4 years	43	.90	.20
	5 years	24	.99	.30
Melodic Rhythm	3 years	24	5.01	.80
	4 years	43	7.11	.57
	5 years	24	8.41	.84
Melodic Contour	3 years	24	12.10	1.28
	4 years	43	14.14	.92
	5 years	24	17.00	1.35
Tonal Center	3 years	24	3.76	.55
	4 years	43	3.64	.39
	5 years	24	4.82	.58
Melodic Interval	3 years	24	27.61	3.34
	4 years	43	32.72	2.41
	5 years	24	44.64	3.52

In each analysis, least squares means were computed for each main effect and each interactive effect that resulted from the three-way design. Least squares means for unbalanced designs are "estimates of the class or subclass arithmetic means that would be expected had equal subclass numbers been available" (Goodnight & Harvey, 1978, p. 8). Tables 1, 2, and 3 report the computed main effects least squares means and standard errors of the means for age, singing ability, and treatment groups on each of the five melodic variables measured.

Table 2—Least Squares (LS) Means and Standard Errors of the Least Squares Means of Singing Ability Groups on the Five Melodic Variables

Melodic Variable	Singing Group	*n*	LS Mean	Standard Error of LS Mean
Absolute Pitching	High	52	.82	.20
	Low	39	1.03	.23
Melodic Rhythm	High	52	8.22	.57
	Low	39	5.47	.64
Melodic Contour	High	52	16.71	.92
	Low	39	12.12	1.03
Tonal Center	High	52	4.90	.39
	Low	39	3.25	.44
Melodic Interval	High	52	41.91	2.40
	Low	39	28.07	2.70

Table 3—Least Squares (LS) Means and Standard Errors of the Least Squares Means of Treatment Groups on the Five Melodic Variables

Melodic Variable	Treatment Group	*n*	LS Mean	Standard Error of LS Mean
Absolute Pitching	Instrumental	43	.89	.23
	Noninstrumental	48	.96	.20
Melodic Rhythm	Instrumental	43	6.80	.66
	Noninstrumental	48	6.89	.55
Melodic Contour	Instrumental	43	14.86	1.06
	Noninstrumental	48	13.97	.89
Tonal Center	Instrumental	43	4.35	.45
	Noninstrumental	48	3.80	.38
Melodic Interval	Instrumental	43	35.63	2.77
	Noninstrumental	48	34.35	2.32

The General Linear Model (GLM) procedure of the Statistical Analysis System (SAS) was employed for analysis of variance computation. The GLM procedure uses the least squares principle to fit linear models and performs analysis of variance for unbalanced data (Helwig & Council, 1979, p. 245). Significant differences among groups disclosed by the analyses were identified by *t*-test comparisons among the least squares means of appropriate groups.

The results of the analysis of variance of absolute pitching data are reported in Table 4. The analysis revealed no significant main effects for age, singing ability, or treatment on the variable of absolute pitching. The analysis, however, did indicate a statistically significant F ratio of 5.41 ($p < .02$) on the singing by treatment effect. Because a significant interaction was found, the F statistics for testing main effects due to singing ability and treatment had to be interpreted with caution. However, a subsequent two-way least squares analysis of variance of absolute pitching differences for treatment by singing ability levels

Table 4—The Least Squares Analysis of Variance Comparisons of Differences Among Groups on Absolute Pitching

Source	*df*	*SS*	*MS*	*F*	*p*
Singing	1	1.32	1.32	.81	.37 (*ns*)
Age	2	.78	.39	.24	.78 (*ns*)
Treatment	1	.01	.01	.01	.93 (*ns*)
Singing × Age	2	4.28	2.14	1.30	.27 (*ns*)
Singing × Treatment	1	8.87	8.87	5.41	.02
Age × Treatment	2	3.45	1.73	1.05	.35 (*ns*)
Singing × Age × Treatment	2	.62	.31	.19	.82 (*ns*)
Error	79	129.66	1.64		
Total	90				

disclosed that no significant differences existed for either treatment or singing ability groups on this variable.

The analysis of variance of melodic rhythm, reported in Table 5, revealed no significant interactions among the factors of age, singing ability, and treatment; consequently, an examination of the main effects results was appropriate. The analysis revealed that no significant difference existed between treatment groups. The results, however, did reveal a significant difference for the main effect of singing ability (F ratio of 16.48, $p < .0001$); a comparison of the least-squares means of the two singing ability groups indicated that the high-singing-ability group scored significantly higher on perception of melodic rhythm aspects of the three task-songs than did the low-singing-ability group. In addition, results of the analysis revealed significant differences for the main effect of age (F ratio of 4.98, $p < .009$). Through t-test comparisons of means, the melodic rhythm scores of the 3-year-old group were found to be significantly lower than those of both the 4-year-old group ($p < .04$) and the 5-year-old group ($p < .004$); however, the 4-year-old group and the 5-year-old group did not differ significantly from each other on the variable of melodic rhythm perception.

Table 5—The Least Squares Analysis of Variance Comparisons of Differences Among Groups on Melodic Rhythm

Source	*df*	*SS*	*MS*	*F*	*p*
Singing	1	215.41	215.41	16.48	.0001
Age	2	130.25	65.13	4.98	.009
Treatment	1	2.71	2.71	.21	.65 (*ns*)
Singing × Age	2	37.14	18.57	1.42	.24 (*ns*)
Singing × Treatment	1	.17	.17	.01	.90 (*ns*)
Age × Treatment	2	7.80	3.90	.30	.74 (*ns*)
Singing × Age × Treatment	2	.77	.39	.03	.97 (*ns*)
Error	79	1,032.65	13.07		
Total	90				

As reported in Table 6, the analysis of variance of melodic contour data revealed no significant interactive effects among the factors of age, singing ability level, and treatment. The analysis also revealed a nonsignificant F ratio of 1.06 for the treatment main effect, indicating that no significant differences on the variable of melodic contour existed between the two treatment groups.

A significant F ratio of 17.53 ($p < .0001$), however, was found for the main effect of singing ability. An examination of the least squares means of the two singing ability groups indicated that the high-singing-ability group scored significantly higher on perception of melodic contour than did the low-singing-ability group.

The analysis of variance of melodic contour data also revealed a statistically significant F ratio of 3.26 ($p < .04$) on the main effect factor of age, indicating that significant differences in melodic contour percep-

Table 6—The Least Squares Analysis of Variance Comparisons of Differences Among Groups on Melodic Contour

Source	*df*	*SS*	*MS*	*F*	*p*
Singing	1	587.55	587.55	17.53	.0001
Age	2	218.77	109.39	3.26	.04
Treatment	1	35.45	35.45	1.06	.30 (*ns*)
Singing × Age	2	55.73	27.87	.83	.43 (*ns*)
Singing × Treatment	1	4.30	4.30	.13	.72 (*ns*)
Age × Treatment	2	1.44	.72	.02	.97 (*ns*)
Singing × Age × Treatment	2	16.56	8.28	.25	.78 (*ns*)
Error	79	2,647.49	33.51		
Total	90				

tion did exist among the three age groups in the study. The *t*-test comparisons among the melodic contour least squares mean scores of the three age groups revealed that the 3-year-old group differed significantly from the 5-year-old group ($p < .009$). No significant differences, however, were found between the 3-year-old group and the 4-year-old group or between the 4-year-old group and the 5-year-old group on melodic contour perception.

Table 7 reports the results of the analysis of variance of tonal center data. The analysis revealed that (a) no significant interactive effects among the three factors of age, singing ability, and treatment existed, (b) no significant differences existed between the two treatment groups in the study, and (c) the three age groups did not differ significantly from one another on perception of tonal center.

The analysis, however, did reveal a significant *F* ratio of 11.50 ($p < .001$) for the main effect factor of singing ability level, indicating that significant differences in tonal center perception did exist between the two singing ability groups. An examination of the least squares means of the two groups revealed that the high-singing-ability group scored

Table 7—The Least Squares Analysis of Variance Comparisons of Differences Among Groups on Tonal Center

Source	*df*	*SS*	*MS*	*F*	*p*
Singing	1	70.26	70.26	11.50	.001
Age	2	33.34	16.67	2.73	.07 (*ns*)
Treatment	1	3.94	3.94	.64	.42 (*ns*)
Singing × Age	2	6.90	3.45	.56	.57 (*ns*)
Singing × Treatment	1	15.04	15.04	2.46	.12 (*ns*)
Age × Treatment	2	.69	.35	.06	.94 (*ns*)
Singing × Age × Treatment	2	.60	.30	.05	.95 (*ns*)
Error	79	482.81	6.11		
Total	90				

significantly higher than the low-singing-ability group on the variable of tonal center.

The analysis of variance of melodic interval data, reported in Table 8, revealed no significant interactive effects among the factors of age, singing ability, and treatment. Furthermore, the analysis disclosed no significant differences between treatment groups on this variable (F ratio of .44).

A significant F ratio of 20.56 ($p < .0001$), however, was found for the main effect factor of singing ability level, indicating that significant

Table 8—The Least Squares Analysis of Variance Comparisons of Differences Among Groups on Melodic Interval

Source	*df*	*SS*	*MS*	*F*	*p*
Singing	1	4,714.62	4,714.62	20.56	.0001
Age	2	2,798.31	1,399.16	6.10	.003
Treatment	1	100.14	100.14	.44	.51 (*ns*)
Singing × Age	2	244.69	122.35	.53	.58 (*ns*)
Singing × Treatment	1	21.51	21.51	.09	.76 (*ns*)
Age × Treatment	2	103.60	51.80	.23	.79 (*ns*)
Singing × Age × Treatment	2	62.91	31.46	.14	.87 (*ns*)
Error	79	18,119.26	229.36		
Total	90				

differences in melodic interval perception between the two singing ability groups did exist. An examination of the melodic interval least squares mean scores of the two groups indicated that the high-singing-ability group scored significantly higher than the low-singing-ability group on the variable of melodic interval.

The analysis of variance comparisons of difference among groups on melodic interval also indicated that significant differences among the three age groups did exist (F ratio = 6.10, $p < .003$). The results of t-test comparisons among age group least squares means revealed that significant differences existed between the 3-year-old group and the 5-year-old group ($p < .0007$) and also between the 4-year-old group and the 5-year-old group ($p < .006$), with the 5-year-old group scoring significantly higher on melodic interval perception than either of the younger groups. However, no significant difference in melodic interval mean scores was found between the 3-year-old group and the 4-year-old group in the study.

A secondary focus of the study was to provide descriptive analyses of the nature of the subjects' perceptual responses to specific pitch levels, melodic rhythm patterns, contour patterns, tonal center maintenance, and interval patterns within the three task-songs. Consequently, percentage tabulations of subjects' correct responses to specific melodic elements of the songs were calculated.

The descriptive analyses revealed the following:

1. ***Absolute pitching***—The subjects pitched melodies within a wide pitch

range, disregarding the original pitch level of songs. Only 23 (8.4%) of the total 273 task-song responses of the 91 subjects were pitched accurately (i.e., reproduced at the exact pitch level at which they had been presented during training sessions). Of the total song responses, 43 (15.8%) were accurate within a semitone of the presented pitch level. The range of beginning pitch levels for all three task-songs extended from a to a♭′ for the 3-year-old group; from a♭ to b′ for the 4-year-old group; and from b♭ to b♭′ for the 5-year-old group. Of the total, 59% of the song responses were initiated on pitches within the range c′ to e′. The most frequently used beginning pitches were e′ (12.8%), c′ (12.4%), d♭′ (12.1%), and d′ (11.7%).

2. *Melodic rhythm*—Correct perceptual responses within age groups, regardless of singing ability level, increased with age. For both singing and age groups, the greater percentage of correct responses was achieved on melodic rhythm patterns composed of notes of equal value. The most difficult patterns for the subjects were those that included half and whole notes or rests.

3. *Melodic contour*—High- and low-ability singers were most successful on descending melodic contour patterns. Ascending melodic contour patterns were the most difficult for high-ability singers, while low-ability singers had the most difficulty on patterns involving changes in melodic direction, particularly patterns composed of both ascending and descending melodic motion. The 3-year-old subjects achieved the greatest percentage of correct responses on contour patterns that combined both ascending and descending directions; 4-year-old subjects were more successful with descending contour patterns. The 5-year-old subjects responded with more accuracy on patterns combining stationary and descending melodic directions.

4. *Tonal center*—The greatest percentage of song responses of subjects contained three or more shifts in tonal center. This type of response was the most frequent one in both singing ability groups and in all three age groups. Furthermore, more than one-fourth of the tonal center responses within the low-singing-ability group, within the 3-year-old group, and within the 4-year-old group exhibited no evidence of ability to maintain the tonal center of a song.

5. *Melodic interval*—Within both singing and within all three age groups, the unison was the least difficult interval for subjects to perceive; the ascending minor seventh interval proved to be the most difficult. Greater percentages of correct responses were attained by all groups on small intervals such as the major second and the minor third.

DISCUSSION

The results of this study suggest that preschool children between the ages of 3 and 5 years do perceive rhythm, contour, and interval aspects of melody; however, those perceptions vary with age. In particular, the differences noted in preschool children's perception of melodic rhythm between 3 and 4 years and in their perception of intervallic aspects of melodies between 4 and 5 years suggest that perception of melodic

rhythm may precede perception of melodic intervals. Differences in the children's perception of melodic contour appeared, in this study, only between the 3-year-old and 5-year-old subjects. This suggests that preschool children's perception of this melodic component may develop at a more gradual pace over the 2-year period.

This study, however, found no conclusive evidence that differences in preschool children's perception of absolute pitch level or tonal center exist between 3 and 5 years. In particular, the poor performances of subjects on tonal center perception in this study suggest that the greater portion of the development of this perceptual skill may occur after preschool for the majority of children.

The results of this study indicate that singing ability does affect preschool children's ability to demonstrate melodic perception through vocal response. Future research employing vocal responses as measures of perception should be aware of this problem.

This study found no conclusive evidence that experiences with pitched instruments enhanced children's perceptual ability. These findings may have resulted from two factors: (1) the limited time the subjects were allowed to play the instruments, and (2) the limited manner in which the children could interact with the instruments. More exposure time with the instruments may be needed for such instruction to be effective. Furthermore, exploratory manipulation of instruments by children rather than guided manipulation may be a more effective approach for forming perceptions about pitch and melody among preschool children.

REFERENCES

Buckton, R. A comparison of the effects of vocal and instrumental instruction on the development of melodic and vocal abilities of young children. *Psychology of Music,* 1977, *5,* 36–47.

Carter, A. L., Ricker, K. S., & Corsini, D. A. Relational judgment of sound intensity by young children. *Perception and Psychophysics,* 1972, *11,* 1–4.

De Gainza, V. H. Absolute and relative hearing as innate complementary functions of man's musical ear. *Bulletin of the Council for Research in Music Education,* 1970, *22,* 13–16.

Goodnight, J. H., & Harvey, W. R. *Least squares means in the fixed effects general linear model* (SAS Tech. Rep. R-103). Raleigh, N.C.: SAS Institute, Inc., August, 1978.

Helwig, J. T., & Council, K. A. (Eds.) *SAS user's guide, 1979 edition.* Cary, N.C.: SAS Institute, Inc., 1979.

Hutchins, P. *Good-Night, Owl!* New York: Macmillan Publishing Company, Inc., 1972.

Lenz, S. M. A case study of the musical abilities of three- and four-year-old children (Doctoral dissertation, University of Illinois at Urbana-Champagne, 1978). *Dissertation Abstracts International,* 1978, *39,* 2809A. (University Microfilms No. 7820990, 382)

McDonald, D. T., & Ramsey, J. H. A study of musical auditory information processing of preschool children. *Contributions to Music Education,* 1979, 7, 2–11.

Michel, P. The optimum development of musical abilities in the first years of life. *Psychology of Music,* 1973, *1,* 14–20.

Moore, D. L. A study of pitch and rhythm responses of five-year-old children in relation to their early musical experiences (Doctoral dissertation, Florida State University, 1973). *Dissertation Abstracts International,* 1974, *34,* 6689A-6690A. (University Microfilms No. 7409488, 91)

Piaget, J. *Science of education and the psychology of the child* (D. Coltman, Trans.). New York: Orion Press, 1970.

Sergeant, D. Experimental investigation of absolute pitch. *Journal of Research in Music Education,* 1969, *17,* 135–143.

Sergeant, D., & Roche, S. Perceptual shifts in the auditory information processing of young children. *Psychology of Music,* 1973, *1,* 39–48.

Vernon, M. D. The development of perception in children. *Educational Research,* 1960, *3,* 2–11.

Williams, H. M. Studies of vocal control of preschool children. In G. D. Stoddard (Ed.), *The Measurement of Musical Development* (Vol. 7 of the University of Iowa Studies in Child Welfare). Iowa City: University of Iowa Press, 1932.

January 17, 1983