FROM HEARTBEAT TO STEADY BEAT

RESEARCH FINDINGS ON THE MUSICAL DEVELOPMENT OF CHILDREN FROM BEFORE BIRTH THROUGH AGE EIGHT

DEBORAH PRATT, M.A.
Dedicated to my husband, Jim,
whose deep walk with God
and unfailing love and support
enable me to follow and realize my dreams.
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Acknowledgements

A special thanks to my graduate advisor at The University of Iowa, Dr. Kenneth Phillips, who provided guidance and support throughout this project.

Thanks also to Dr. Don Coffman who helped me to understand the principals of behavioral research and to Dr. Carlos Rodriguez who was a source of insight and encouragement throughout my final year as a graduate student.

Finally, thanks to the staff of the Rita Benton Music Library and the Interlibrary Loan Office at The University of Iowa for their help and assistance.
From Heartbeat to Steady Beat provides “everyday language” summaries of 50 research studies published from 1976 through 1998 that focus on the musical development of children from before birth (pre-natal) through age eight, including singing, rhythm and listening skills and music literacy.

In 1996, while I was pursuing my Master of Arts in Music Education at the University of Iowa, I spotted an advertisement aimed at recruiting new Kindermusik teachers. I was intrigued with the information I read there and contacted Kindermusik International. What resulted was a complete turnaround in my goals and aspirations as a music teacher. I completed my Kindermusik training, founded “Kindermusik of Iowa City”, and began to focus my graduate education toward the young child. I devoured any information I could find about teaching music to young children, and began a search of research articles that could help me understand the musical abilities, needs, and preferred teaching methods for the young child.

The first hurdle that I encountered was the language in which these articles are written. Luckily, as a part of my graduate program I was required to take a course in behavioral research where I learned basic research principles and the meaning of the terms and abbreviations I encountered in the research that I was reading. However, even after I understood the background and the language, these studies were still not an easy read.

As a result of this experience, it became my goal to write a book that would provide the results of these studies in plain, everyday language. Some research terms remain, such as “research design,” “pre-test,” “post-test,” “experimental group,” and “control group” since these concepts are important to those who wish to evaluate the quality of the research.

Reading these studies provided me with many insights that have assisted me in my teaching. It is my hope that From Heartbeat to Steady Beat will prove to be valuable to many other early childhood music specialists as they seek to provide effective music programs for babies and young children.
Music and the Unborn Child

We're expecting!
Some Aspects Of The Foetal Sound Environment


Abrams reviews the results of research in humans and sheep regarding the ability of the fetus to hear sounds. This article, while not a detailed research report, is included because it provides a relatively accessible summary of a number of important technical medical studies.

- By 24 weeks, the cochlea and peripheral sensory end organs of the fetus have reached their normal development and by 26 weeks most fetuses will respond with increased heart rate to sound stimulation, indicating that they are able to perceive sounds. The inner ear of the fetus is fully functioning during the last trimester of pregnancy.

- The fetal sound environment is “heavily dominated by mother’s voice and other internal noises and permeated by rich and diversified rhythmic and tonal surrounding sounds.” The internal noises include the mother’s breathing, cardiovascular and intestinal activity, physical movements, “feotal cardiovascular pulsations,” and building vibrations of very low frequencies (below 50Hz).

- To be perceived by the fetus, outside sounds must be louder than the “noise floor” (sounds of the fetal environment). At frequencies below 60Hz (approximate frequency of the lowest note on the piano), the noise floor is about 80 decibels (dB). From 60-250Hz, the noise level is less than 60dB. Above 60Hz the noise floor is about 60dB.

- The fetus will probably not hear airborne sounds above 500-1000Hz unless the sounds are uncomfortably loud for the mother. However, lower frequency sounds are heard by the fetus at comfortable listening levels for the mother. Therefore, “the foetus is probably detecting only the fundamental frequencies of a musical passage. Very little high frequency information would be detected.”
Effects Of The Firstart Method Of Prenatal Stimulation On Psychomotor Development: The First Six Months


Research Design:

Posttest, Control Group, Longitudinal
N=172

Purpose:

“To determine the effectiveness of the Firstart prenatal stimulation method, which attempts to advance the intellectual and physical development of the fetus by means of musical stimuli.”

Procedure:

One-hundred-seventy-two maternity patients enrolled in a birth preparation course participated in this study. The mothers were separated into experimental and control groups. For an average of 70 hours from about 28 weeks to the end of pregnancy, the mothers in the experimental group wore small speakers attached to a waistband and connected to a tape player which played a series of eight tapes of violin sounds.

After birth, all mothers charted the onset of infant behaviors from zero to six months utilizing the Observational Scale of Development.

Results:

The behaviors of the experimental group babies were significantly advanced compared to the behaviors of the control group babies. The experimental babies were superior in gross and fine motor activities, linguistic development, some aspects of body-sensory coordination and certain cognitive behaviors.
Prelude To A Musical Life: Prenatal Music Experiences


Note: This was not a tightly controlled study. The author himself indicates that the study and its results are preliminary. However, in light of the fact that studies regarding the effect of prenatal music stimulation are few, I found the results interesting and worth including.

Research Design:

Descriptive, Case Study
N=16

Purpose:
To determine the effect of systematic prenatal musical stimulation by observing musical behaviors exhibited between birth and six years of age.

Procedure:

Sixteen babies and their parents participated in this study. Some of the babies (the article does not indicate how many) were serenaded before birth by “stimulative” or “sedative” types of music. For many, the home environment was rich with musical stimulation. After birth, the babies and their parents visited the investigator at least once every sixty days. The babies were observed and their responses and activities were documented. The babies listened to recorded and live sounds, including short rhythmic and melodic fragments. Echo or imitative responses were documented. Sounds made by the baby during free-play activities when “sound toys” were introduced were also noted. Children three years and older sang or played the piano and other instruments, and their activities were observed and documented. Developmental growth was also discussed with the mother and, in some cases, other family members.

Results:

The infants who received systematic prenatal musical stimulation exhibited “remarkable attention behaviors, imitate accurately sounds made by adults (including nonfamily members), and appear to structure vocalization much earlier than infants who did not have prenatal musical stimulation.”
Prenatal And Postnatal Responses To Music And Sound Stimuli: A Clinical Report


An update of this study also appeared in the *Bulletin of the Council for Research in Music Education* in Winter 1995/96 (volume 3), pp. 105-108, under the title “Comparison of fetal and newborn responses to music and sound stimuli with and without daily exposure to as specific piece of music.” The 1991 study utilized a control group of only six women. This update describes the comparison between the results of the 1993 study and a larger control group which was studied after the book article was published. The following summary combines information from both sources.

**Research Design:**

**Pretest-Posttest**
Experimental Group: N=32
Control Group: N=34

**Purpose:**
To determine the effect of daily listening of music on fetuses and newborns.

**Procedure:**
At 32 and 38 weeks gestation the test group fetuses were monitored for fetal movements and heart rate. Following ten minutes of monitoring without any stimulus, headphones were secured to the mother’s abdomen and covered with a pillow and a tape was played. The mother was also asked to write down the number and type of movements the fetus made for each item on the tape. (The mothers were prevented from hearing the tape to record a purely fetal response.) The four items on the test tape were each five minutes long:

1) White noise  
2) Piano solo: Beethoven’s piano sonata, Op. 31 No. 2 in D minor (The Tempest)  
3) Choral (a cappella): Palestrina’s Kyrie from Missa Pape Marcelli Mass  
4) Rock (instrumental): Emerson Lake and Palmer from “An Anthology of Rock”.

The test group was also were given a tape of either item two or three to play for their fetuses on a daily basis from 32 weeks gestation and for six weeks after birth. The content of the test tape and the home tape was not revealed to the women until a home visit at four-six weeks.
The control group of 34 pregnant women were given no specific listening tasks and were monitored at 38 weeks only.

At six weeks the babies of both groups were again monitored while the tape was played. They were scored on the following:

1) Number of movements
2) Eyes open
3) Still and listening
4) Frowning and anxious
5) Woke and/or cried
6) Nil response

Results:

A high percentage of test group fetuses had heart rate decelerations greater than or equal to five seconds duration during the playing of the audio test tape at 38 weeks gestation. This was highly significant in comparison with the test group, indicating that the daily playing of the music influenced fetal responses. At 32 weeks the fetuses did not appear to distinguish between the items on the tape. However, at 38 weeks the piano sonata and the choral piece elicited the most response from the test group fetuses. The largest deceleration effect and also the highest number of fetal movements was during the playing of the Beethoven sonata. The home listening did not have any significant influence on fetal responses during the 38 week monitoring.

The babies in the test group were more ready to listen, more receptive and alert, and more active in response to the music than the control group babies. They listened more attentively to the piano sonata and the choral piece. They were less disturbed than the control group by the rock music (though both groups demonstrated anxiety through facial and body tension). A number of the test babies appeared to recognize the sound of the piano within the rock music, relaxing the body and facial tension during the several bars in which it appeared; the tension quickly returned when the other instruments resumed.
Music and the Infant
Infant Research Techniques

Research with infants requires different techniques than research with older children and adults. Explanation of some research methods and terminology used in infant research follow.

**Infant head-turning technique**

Infants tend to look toward a sound source, especially when that sound is novel or new. This research technique capitalizes on that natural tendency. A repetitious sound stimulus is presented from one side, and the infant is trained through reinforcement to turn the head toward the sound when a change in the stimulus occurs. The stimulus change utilized for training is usually a decibel level change. The reinforcement is usually the illumination and activation of animated toys. The animated toys are illuminated and activated when the head is turned in response to changes in decibel level, but are not activated when the head is turned in absence of this change. Once the infants are trained, this method is used to determine whether infants recognize other changes in the sound source.

**Visual attending technique as developed at the Kansas Infant Research Laboratory (Tims, 1977)**

A visual stimulus known to be favored by infants (e.g., a black and white checkerboard pattern) is projected in front of the infant. The infant controls the presence of the stimulus by looking at it. When the infant looks away, the visual stimulus is removed. Once this behavior has been learned (habituated), a musical stimulus is added to the visual one. When the infant looks away, both the visual and musical stimuli are removed. This allows the infant to control how long the music plays. The researcher records the amount of time the infant continues to look at the visual stimulus.

Research at the laboratory indicates that changes in a musical stimulus will cause the child to look once again at a visual stimulus once this behavior has been habituated. This allows the researcher to determine whether the infant perceives changes in musical stimuli.

**Behavioral state**

Behavioral state of infants is usually described in terms of a four point scale:

1. Quiet sleep (eyes closed, body relaxed, movement generally absent)
2. Active sleep (eyes closed, frequent arm and leg movements, smiles and sucking may be observed)
3. Alert (eyes open, some activity is observed)
4. Crying (eyes open or closed, gross activity or little movement with overall tension, irregular breathing, marked color change, startles)
Early scales split the “alert” category into two labeled “inactive alert” and “active alert”. However, the scale was revised to the four-point version because agreement between observers is strongest with only one “alert” category.

*Children are least responsive to sound during “quiet sleep” and most responsive when “alert”.**
The Pitch Range And Contour Of Infant Vocalizations


Research Design:

Qualitative Study
N=12

Purpose:

To determine pitch range and contour characteristics of infant vocalizations from three months to nine months of age.

Procedure:

The infants were individually observed and their vocalizations recorded in their homes during seven sessions. Three representative samples from each session were analyzed using analog to digital conversion and computer graphics display procedures.

Results:

The composite range was G₃ to C₆. 82% of the contours were descending.
A Study Of Infant Musical Productivity


Research Design:

Qualitative/Case Study
N=3

Purpose:

To observe three children in three different family situations—parents who were professional musicians, parents who were musically orientated but not musicians by profession, and parents who were not musically oriented. The study sought to a) determine how musicality was differently expressed in these families, b) the distinctive features of the children's early musical response and performance, and c) the immediate context signaling the beginning and end of musical behavior.

Procedure:

This article reports on of three case studies. Each of the three children, in different family situations as noted above, were observed weekly for varied lengths of time ranging from 15 minutes to a half-day sessions. Each family was also interviewed concerning musical history, ways that musicality was transferred from one generation to the next, and favorite songs, records, instruments and occasions for musical behavior of the child.

Results:

The differences between the three children suggest a strong relationship between musical experiences at home and the speed and path of musical development of the child. The children from musical homes began their musical expression much earlier (6 months and 10 months), starting with melody, then proceeding to rhythm and words; the child from the non-musical home began with words (20-21 months) and then incorporated rhythm, never singing very much. The children from the two musical homes produced clearly distinguished pitches prior to age two whereas the child from the non-musical home did not—tones were more spoken than sung.

Musical environment observed in family with parents who are professional musicians included mother singing to infant beginning at one week (including lullabies), mother rocking, mother asking baby to sing, placing child near piano so child can play, father playing piano while child listens or plays one finger at a time, guitar or autoharp placed on floor for child to play (9 months). Parents play records and radio as well as rehearse and perform around the child.
The musical environment of the family with parents who had an avocational interest in music included mother singing to infant (including lullabies) at one month, mother playing music box, mother playing piano while child listens and sings along, toy xylophone used infrequently. Parents play records and radio; child also listens and sings along in church.

The “non-musical” environment did not include any musical behaviors except for infrequent tambourine, the introduction of a guitar by the observer at 24 months, and the playing of records, and watching TV (Mickey Mouse and Sesame Street).
Prototypical Representations Of Music Structure In Infancy: Theoretical Exploration And A Pilot Study


Research Design:

Descriptive
N=12

Purpose:

1. To determine whether western six-month-old infants can discriminate harmonic music intervals.

2. To determine whether infants have formed prototypical representations of the perfect fifth.

Procedure:

Twelve infants participated in the study. None of their parents were musicians, and only Western music was listened to in their homes.

The infant head turning technique was used. (To determine whether the children would turn their heads in response to a perceived change in the sound, the children had previously been tested for their response to changes in tuning accompanied by changes in decibel levels. All the infants performed head turns in this preliminary phase.)

During the testing procedure, the infant sat on the parent's lap playing with quiet, hand-held toys. Equal tempered harmonic perfect fifths (prototype) and intervals with the same lower note but the upper note raised in frequency by 2.5%, 3.5%, 4.5%, or 5.5 were played through a loud speaker for 30 trials. One half of these trials included a change in the interval to a mistuned interval (raising of the higher note by 4.5%) .

Results:

The infants' response to mistuned intervals was not significant, indicating that six-month-old infants cannot discriminate harmonic music intervals.
In examining false negatives (lack of headturn in response to a change), the tendency for 4.5% and 5.5% mistuned intervals to be perceived as equivalent to the prototype perfect fifth more often than to the mistuned perfect fifth approached significance. The author speculated that this may be due to the existence of prototypical representations of the perfect fifth in the infants.
An Analysis Of The Characteristics Of Infant-Child Singing Expressions


Research Design:

Qualitative
N=51

Purpose:

To analyze the singing of very young children (ages seven-32 months) for the following:

- length and style of vocalization
- range and frequency of pitches
- ascending and descending intervals
- use of rhythm and meter
- tonality

Procedure:

Fifty-one children ranging in age from six months 28 days - 32 months, two days were videotaped in their homes while parents and siblings provoked the children to encourage three types of singing: 1) familiar “standard” songs, 2) spontaneous songs, and 3) matching isolated pitches or intervals. The findings were grouped into four general age categories: seven months, 11 months, 19 months, and 30 months.

Results:

- Spontaneous songs such as sleep-songs and game-songs, snatches of standard songs, and occasional matched pitches were sung by a few seven month olds. By thirty months 75% sang spontaneous songs, 83% sang standard songs with varying levels of success, and 17% sang whole songs accurately and unassisted (with elisions).

- Overall, the average range was two octaves beginning at A below middle C and up. The most prevalent notes were between middle C and up a fifth (C-G) for the two youngest groups and D above middle C and up a fifth (D-A) for the two oldest groups.
- Children under thirty months sang mostly descending intervals. At thirty months, unisons, ascending and descending intervals were used about equally. At every age level the most used interval was the major second (descending and ascending).

- The younger children used simple rhythms, often with a two to one relationship. Brief segments of pulse and meter were present at 11 months, with pulse and meter becoming common (though the meter may change) by thirty months.

- At all ages, children sang notes harmonically related to the given pitch, either in addition to or instead of the given pitch. In the pitch matching tests 91% of the seven-month-old children either matched pitches or sang notes related to the pitch harmonically at least 50% of the time. 92% of the 11-month-old children either matched pitches or sang notes related to the pitch harmonically at least 55% of the time. 75% of the 19-month-old children either matched pitches or sang notes related to the pitch harmonically at least 70% of the time. The 30-month-old children matched or sang notes that related harmonically to 83% of all the pitches sung in the pitch matching tasks.
Categorization And Conservation Of Melody In Infants


Research Design:

Descriptive
N=38

Purpose:

To find behavioral evidence that six-month infants could categorize melodies by remembering (conserving) interval sequences when the melodies were transposed.

Procedure:

Summers used the infant head-turning technique. Correct responses were a head turn to a change in the melody with no turn if there was no change in the melody. The author noted difficulties in the use of formal testing situations with very young children.

Results:

Ten of 23 infants discriminated a melody from its Major seventh transposition. Eleven of 38 discriminated a melody from a variant that had different intervals but preserved the contour. The infants had difficulty discriminating two melodies with a contrasting contour that had the same pitch set. There was no difference in discrimination between close and distant transpositions of a learned melody. The author concluded that categorization and conservation can occur far earlier than previous much research suggests.
Contrasting Music Conditions, Visual Attending Behavior, And State In Eight-Week-Old Infants


Research Design:

Descriptive
N=36 (average age eight weeks and two days)

Divided into:
Six experimental groups N=4
Three control groups N=4

Purpose:

To examine the ability of different types of music to cause infants to exhibit visual attending behavior, to determine whether infants are able to discriminate among types of music, and to observe the effects different types of music have on the infants' behavioral state.

Procedure:

Thirty-six infants participated in the study--24 experimental subjects and 12 control subjects. Three types of music were played successively for the children as indicated below, and data was collected on visual attending and behavioral state (crying and sleeping).

1. sedative (traditional lullabies from a variety of cultures performed on the piano).
2. traditional stimulative (the *Vivace* of Copland's "Piano Sonata").
3. intermittent/nontraditional stimulative (an electronic piece "Agony" by Mimaroglu).

Results:

The children looked more often, demonstrated more discrimination, and cried and slept more in response to the sedative music. The author attributed this to the possibility that sedative music was easier for the infants to process. There was no observed difference in infants' response to stimulative and intermittent music types.
Infants’ Perception Of Melodies: The Role Of Melodic Contour


**Research Design:**

Descriptive

*Experiment 1:* N=92 (average age nine months, 15 days)

*Experiment 2:* N=85 (average age nine months, 12 days)

**Purpose:**

Overall: To determine what changes (transformations) can be made to a melody that is familiar to infants without resulting in the infants perceiving it as a new melody.

*Experiment 1:*

- To determine whether the infant headturn technique is viable in studies of melody discrimination in infants.
- To replicate previous research on melody perception by infants.
- To further explore the basis for the perception and recognition of melodies by infants.

*Experiment 2:*

To provide more detailed information regarding how infants process melodies by increasing the difficulty of the tasks in the first experiment.

**Procedure:**

*Experiment 1:* The infant head turn technique was used (see description on page 9). The infant sat on the parent’s lap during the testing procedure. One of three six-tone melodies (sinusoidal waveforms) were presented to the infant, paired with one of the following transformations. Except for #1, the transformed melodies all began and ended on the same note as the original. The sequences were separated by 800 msec. of silence.

1. Transposition of the sequence up three semitones, from the key of C to the key of E♭.

2. Change of intervals in the melody, preserving the contour (contour preserving).
3. Change of octave of some of the notes while retaining the note names and contour of the melody (octave change/contour preserving).

4. Change of octave and contour (octave change/contour violating).

These experimental trials were alternated with no-change or control trials to measure spontaneous head-turning. 20 trials were completed, 10 experimental and 10 control, in random order.

Experiment 2:

The tasks in Experiment 1 were made more difficult.

- A distracter sequence of three tones (262-Hz / C₄) was inserted between the standard melody and the transformed melody.

- A fifth transformation was added: Change of intervals in the melody, violating the contour (contour violating). The first and last notes of the melody were unchanged from the original (as in the other transformations).

All other procedures remained the same as in Experiment 1.

Results:

Experiment 1:

- The head turning technique was found to be effective in studying melody discrimination.

- Infants perceived the changes in every transformation of the melody—all transformations were seen as different from the original melody. However, recognition of the transposed melody and the contour preserving melody was significantly more difficult than recognizing the other transformations. Recognition of the two octave change transformations did not differ significantly.

Experiment 2: Infants were unable to perceive the transposition and contour-preserving transformations (these were equally difficult). The contour-violating transformation was significantly easier to perceive than the transposition and contour-preserving transformations, but significantly more difficult than the two octave-change transformations. The ability of the infants to recognize the two octave-change transformations was not significantly different.

The authors concluded that when infants hear a new melody, they do not remember absolute pitches. They perceive a melody as familiar if the contour and range is the same as a previously heard melody. They perceive it as a different melody if the contour or the range is different. Contour and range are remembered and perceived even when the absolute frequency or the sizes of the intervals is changed.
Infants’ Perceptions Of Melodies: Changes In A Single Tone


Research Design:

Descriptive
Experiment 1:  N=30 (average age seven months, three days)
Experiment 2:  N=30 (average age seven months, one day)

Purpose:

To determine whether infants can recognize the change in the frequency of a single tone in a short tonal melody.

Procedure:

Experiment 1:

The infant head turn technique was used (see description on page 9). The infant sat on the parent’s lap during the testing procedure. One of three six-tone melodies (sinusoidal waveforms) were presented to the infant, paired with one of the following transformations. The melodies were separated by 1500 ms of silence.

1. Frequency of first note is changed
2. Frequency of second note is changed
3. Frequency of third note is changed
4. Frequency of fourth note is changed
5. Frequency of fifth note is changed
6. Frequency of sixth note is changed

These experimental trials were alternated with no-change or control trials to measure spontaneous head-turning. 36 trials were completed, including 18 experimental trials (one for each transformation) and 18 control trials.

Experiment 2:

A distracter sequence of three tones (262-Hz / C4) with 900 ms of silence before and after it was inserted between the standard melody and the transformed melody. Other aspects of Experiment 2 remained the same as in Experiment 1.
Results:

Experiment 1:

Infants were able to recognize the change in the melody when a single tone was changed in any position—they turned their heads significantly more often in response to the change trials than the control trials for all transformations.

Transformations that extended the range (the new note was outside the range of the original melody) were significantly easier for the infants to identify as different.

Experiment 2:

Infants were able to recognize the change in the melody when a single tone was changed in any position—they turned their heads significantly more often in response to the change trials than the control trials for all transformations.

Unlike Experiment 1, transformations that extended the range were not significantly easier to identify than the other transformations.

Infants had significantly more difficulty recognizing the transformation in the first position compared to the third, fourth, fifth, and sixth positions. The difficulty of transformation in the first position compared to the second position approached significance.
Infants' Perception Of Musical Patterns


This article is a review of research regarding infants’ perception of musical patterns, including sections on “melodic processing: contour,” “melodic processing: diatonic structure,” “temporal processing: rhythm,” and “temporal processing: stream segregation.”

In summary, research reviewed in this article indicates that

- Infants are able to analyze complex combinations of sounds.
- Infants can recognize when melodies are different from one another, particularly when they are presented immediately one after the other.
- Infants can accurately perceive pitches, implied by their ability to imitate sung pitches after limited training.
- Infants respond to some aspects of underlying musical structure—they more readily detect changes in diatonic melodies than in nondiatonic ones and they more easily recognize sets of pitches that include relationships embodied in the major triad. (It is not known whether this is because of the ratio relationships between the tones, their relationship to the natural overtone structure, or some degree of familiarity with Western music and its diatonic structure.)
- Infants appear to group patterns of notes on the basis of similar frequency or similar overtone structure.
- Infants recognize differences in rhythm, even when tempos vary.
Music and Young Children
As with infants, research with young children poses unique challenges. One such challenge is the difficulty that children at this age often have in verbalizing their responses accurately. Therefore, it is worth noting that the Primary Measures of Music Audiation by Edwin Gordon, often used in music studies with this age group, utilizes nonverbal responses.
Young Children: Singing
Effects Of Melodic Perception Instruction On Pitch Discrimination And Vocal Accuracy Of Kindergarten Children


Research Design:

Orientation-Pretest-Posttest-Control Group
N=61 (three intact kindergarten classes)

Purpose:

1. To investigate the effects of instruction in melodic perception on pitch discrimination and vocal pitch matching accuracy.

2. To determine whether there is a relationship between gender and performance on pitch discrimination and vocal pitch matching tests.

3. To determine whether there is a relationship between vocal pitch matching ability and the home musical environment.

4. To determine whether there is a relationship between pitch discrimination and vocal pitch matching accuracy.

Procedure:

To determine each student’s musical background, a questionnaire was distributed to the parents with a return rate of 91.8% (56 questionnaires returned). The questions focused on three areas: (1) parent and sibling involvement in music both inside and outside the home, (2) the child’s involvement with music both inside and outside the home, and (3) the type of music equipment and instruments in the home.

Orientation: The orientation consisted of seven half-hour classes with the investigator over 3½ weeks. This instruction did not include any reinforced pitch training and all songs were learned by imitation only. Although the control group was taught by another music specialist, for consistency the investigator visited with the children in this group several times before the testing began.

Pretest: The pretest consisted of the *Primary Measures of Music Audiation* (PMMA) by Gordon, a test of vocal accuracy by Boardman (requiring the children to echo 20 melody patterns and sing a self-chosen song), and a rote-song test.

Instruction: Three intact kindergarten classes (61 children total) each were then randomly assigned to receive a different type of music instruction. The first experimental group (8 males, 16 females) received vocal instruction from the investigator that was reinforced with a focus on melodic perception through the use
of icons, physical movement, and playing stair-step resonator bells. The second experimental group (9 males, 13 females) received vocal instruction from the investigator that consisted primarily of imitation alone. The control group (six males, nine females) received traditional music instruction from another music specialist activity oriented with no emphasis on perceptual or conceptual development.

The experimental classes were 30 minutes in length and met twice a week for 11 weeks. Of the 30 minutes, one third of the period was devoted to song learning and the development of pitch (the first group) or duration (the second group). The remaining time was devoted to other music concept areas taught in an identical fashion in both groups. The control group met twice each week for 20 minutes plus a 30-minute recreational singing period.

Posttest: The post-test was administered during the week following the final music class. The post-test was identical to the pre-test with the exception that the rote-song measure included two songs taught to all three groups.

Results:

1. Instruction in melodic perception did not have an effect on pitch discrimination or vocal pitch matching accuracy. However, children in the experimental groups who received music concept instruction scored significantly higher on vocal pitch matching than the children in the control group who received only activity oriented instruction. It is possible that these difference may be the result of the different teaching styles of the music specialists rather than the difference in the instruction itself.

2. There was no relationship between gender and performance on pitch discrimination and vocal pitch matching tests.

3. “In general, better singers came from homes with high and medium musical environment levels whereas poorer singers came from homes with medium- and low-level musical environments.”

4. No relationship was found between pitch discrimination and vocal pitch matching accuracy.
The Effect Of Piano Accompaniment On Kindergartners' Developmental Singing Ability


Research Design:

Pretest-Posttest Control Group with additional Posttest
N=205 (kindergartners)

Purpose:

1. After a year of instruction is there a difference in singing ability between children who are taught songs without use of the piano and those who are taught songs with piano accompaniment?

2. After a year of instruction is there a difference between children in the above two groups who have high, moderate, or low musical aptitude as measured by the *Primary Measures of Music Audiation* (PMMA).

3. Is there a difference in the composite scores of the PMMA between children who are taught songs without use of the piano and those who are taught songs with piano accompaniment?

Procedure:

Fifteen kindergarten classes were randomly assigned to the experimental (taught songs without piano accompaniment) and control groups (taught songs with piano accompaniment).

*Pretest:* The pretest was administered after three weeks during which all children were taught by rote the song “Pinto Pony.” The pretest consisted of each child individually singing this song into a tape recorder during music class. The children were evaluated on the following scale:

1. Presinger: does not sing but chants song text.
2. Uncertain singer: sustains tones, uses both speaking and singing voice, when singing uses a limited range of about a third.
3. Partial singer: sings some phrases correctly but not entire song.
4. Singer: sings entire song correctly in one key.

*Instruction:* Music instruction was provided for 30 minutes once each week. The lesson plans and instructor were the same for both experimental and control groups with the exception of piano accompaniment during all singing in the control group classes. The weekly instruction included 10-12 minutes of activities promoting the
development of the children’s singing. The remaining instruction was conceptual based emphasizing register, duration, dynamics, and form. Activities included the playing of classroom percussion instruments, movement, and song stories with emphasis on the steady beat.

**Posttest:** The posttest was administered during the first week of June and consisted of the same “Pinto Pony” song as the pretest with the addition of the *Primary Measures of Music Audiation*. As a result of the PMMA, the children were placed in one of three musical aptitude categories: high aptitude, average aptitude, and low aptitude.

**Results:**

1. After a year of instruction there was no significant difference in singing ability between children who were taught songs without piano accompaniment and those who were taught songs with piano accompaniment.

2. Children with high musical aptitudes as measured by the *Primary Measures of Music Audiation* had significantly higher post-test song scores.

3. No significant difference was found in the PMMA composite scores between the children in the experimental and control groups.
Pitch-Pattern Accuracy, Tonality, And Vocal Range In Preschool Children's Singing


Research Design:

Descriptive
N=93 (ages three, four, and five years)

Purpose:

1. To evaluate the ability of young children to echo short pitch patterns in relation to maintaining a tonal center in self-chosen and taught songs.

2. To observe age differences in ability to maintain a tonal center and echo pitch patterns.

3. To observe the accuracy of vocal reproduction in echoing pitch patterns.

4. To determine the size of the vocal range used for different singing tasks.

Procedure:

Ninety-three children, three, four, and five years of age from two preschools, participated in the study. The children from both preschools had similar musical experiences, and no substantial differences existed between the preschools in any other significant aspect.

During at least four music sessions with the children, the experimenter taught them an unfamiliar song, “The Little White Duck” from *The Silver Burdett Centennial Songbook*, 1985. Following these sessions, each child was recorded singing a self-chosen song, “The Little White Duck”, and echoing 20 (tape recorded) four-beat pitch patterns. The pitch patterns consisted of equal numbers of 1, 2, 3, and four-note patterns with descending, ascending, combination, and single-pitch contours. The 20 examples spanned an octave, and they were recorded by a soprano at different pitch levels and sung at two different tempos. Children were presented with pitch patterns at a pitch level corresponding to the lowest pitch comfortably sung during the self-chosen song. Children at the first preschool (42 children) were given the pitch patterns with the slower tempo and the faster pitch patterns were given to the children in the second preschool (51 children).
Assessment of pitch pattern echoes included:

- Number of pitches sung accurately
- Number of patterns sung completely accurately
- Number of patterns with intervals sung correctly but at different pitch level
- Number of patterns with correct melodic contour, but incorrect pitches and intervals

Assessment of ability to maintain a tonal center included:

- Self-chosen song was identified as either “modulating” (more than three modulations), “somewhat modulating” (one to three modulations), and “not modulation” (none or one modulation with the song ending in the same key in which it began).

- The taught song was evaluated by measuring the interval between a single pitch from each of the six phrases and a pitch from the phrase preceding it (the pitch from the first phrase was compared with the starting pitch given by the experimenter). If all of the intervals were accurate, the child received a score of 6, if the child modulated once and maintained that tonal center, he would receive a score of 5.

Results:

1. Modulating singers in the self-chosen song had more difficulty matching pitches and contours than those who did not modulate. There was also a low but positive relationship in the singing of “The Little White Duck” between ability to maintain a consistent tonality throughout the song and the ability to echo pitch patterns accurately. In the self chosen songs, 47% of the children were classified as modulating, 38% as somewhat modulating, and 16% as not modulating. Only 14% of the children began three or more phrases of “The Little White Duck” in the same key as the previous phrase and 29% sang no two consecutive phrases in the same key. It was noted that modulations typically occurred when a pitch moved beyond the limits of the child’s comfortable vocal range.

2. In the self-chosen song, there was a significant relationship between age and modulation. 68% of three-year-olds, 33% of four-year-olds, and 46% of five-year-olds were classified as modulating singers. (It is important to note that these results were affected by the differing levels of difficulty of the songs chosen by the children.) There was no significant relationship between age and modulation in children’s performances of “The Little White Duck”.

3. Pitch accuracy was low, with the number of correct pitches ranging from 10% (three-year-olds at Preschool 2) to 35% (five-year-olds at Preschool 2). Older children were generally more accurate than younger children, especially at the faster tempo (Preschool 2). More children sang intervals correctly at different
pitch levels. A large gain was seen in the number of children who were able to sing the melodic contour correctly—the melodic contour of over 50% of the patterns were sung correctly by the four- and five-year-olds. The five-year-olds who were given patterns at the faster tempo were able to sing the correct melodic contour of 84% of the patterns.

4. The mean size of the vocal range in the self-chosen song was a sharp perfect fifth for three-year-olds, a flat minor sixth for four-year-olds, and a sharp major sixth for five-year-olds. Although “The Little White Duck” spanned the range of an octave, the mean vocal range sung by the children was a sharp perfect fifth for the three-year-olds, a sharp minor sixth for the four-year-olds, and approximately a minor seventh for the five-year-olds. Although the pitch patterns also spanned an octave, the children expanded their range a little more for the patterns than they did for the song. The mean vocal range sung when echoing patterns was a flat major sixth for the three-year-olds, a flat minor seventh for the four-year-olds, and a sharp major seventh for the five-year-olds.
The Relationship Of Pitch-Matching And Pitch-Discrimination Abilities Of Preschool And Fourth-Grade Students


Research Design:

Descriptive
N=144 (72 four- and five-year-old children and 72 fourth graders)

Purpose:

To determine whether preschool students and fourth grade students who are grouped by pitch-discrimination ability will demonstrate significant differences on vocal pitch-matching tasks.

Procedure:

Seventy-two four- and five-year-old children randomly selected from a large, ethnically mixed preschool and 72 fourth graders randomly selected from five public schools were tested for pitch discrimination ability and vocal pitch matching ability.

The pitch discrimination test items included a descending tritone, an ascending minor third, a descending quarter tone, one ascending and one descending eighth tone, and four unison pairs, all within the vocal ranges of the children. The children were asked to verbally state whether two tones were the same or different or whether they were uncertain. The children were grouped into three ability groups based on their performance on the pitch discrimination test.

The vocal pitch matching test consisted of recordings of an unaccompanied three-measure song with simple words on the pitches do, re, mi, do, presented in three different keys (C, E, and F# major). The children were played the recording in each of the three keys, each time being asked to sing the final sustained note after hearing the song.

Results:

Overall there was no significant difference in the vocal pitch matching ability between the three pitch discrimination ability groups. A moderate relationship was found between pitch discrimination ability and vocal pitch matching ability in the fourth grade children only.

Both the pitch discrimination scores and the vocal pitch matching scores of the fourth graders were significantly higher than that of the preschool children.
Factors Affecting Accuracy in Children’s Singing


Research Design:

Descriptive
N=165 (grades K,1,3)

Purpose:

To determine the effects of the following on accuracy in young children’s singing:

1. Singing with other children in unison compared to individual singing
2. Singing with a text compared to a neutral syllable

Procedure:

One hundred-sixty-five children in kindergarten, first, and third grades, participated in the study. The children were taught two similar melodic phrases. The investigator sang the phrases and the children were asked to imitate her in four situations:

1. Individually, singing the phrase with a text
2. Individually, singing the phrase on “loo”
3. In unison with five other subjects and the investigator, singing the phrase with a text
4. In unison with five other subjects and the investigator, singing the phrase on “loo”

The children’s singing was recorded and evaluated using a device that determined the frequency of each tone. Two scores were given for each task: accuracy of pitch level and the accuracy of the melodic contour.
Results:

1. Individual vs. group unison singing: The children sang more accurately individually than in a group.

2. The difference between the accuracy of singing individually and in a group was greater for boys than for girls.

3. Singing with text vs. on a neutral syllable:

   The children sang more accurately when singing on “loo” than with text.

   Kindergarteners and first graders benefited more from singing on “loo” than the third graders.

4. Additional findings:

   The children sang most accurately individually on “loo.”

   Third graders tended to sing more accurately than kindergarteners or first graders.

   Girls sang more accurately than boys, particularly in group unison singing.

   “…the largest gains in pitch level accuracy were made between kindergarten and first grade, and the largest gains in contour were made between first and third grade,” indicating that pitch level accuracy may be achieved before accuracy in contour.
A Comparison Of The Pitch Accuracy Of Group And Individual Singing In Young Children


Research Design:

Qualitative
N=100

Purpose:

- To compare the effects of individual and group singing on the pitch accuracy of children in kindergarten through first grade.
- To determine whether these effects differ by gender and grade level.

Procedure:

Nine kindergarten, first, and second grade classrooms (100 children) participated in the study. The researcher visited the classroom to teach the students the melodies used in the data collection sessions. The children came to a separate room in small groups of three to record their responses. Individuals were asked to echo each melody after the researcher performed it. This was done twice—once with words and once on “loo”. After each individual had been recorded, the next group of three children joined the group and the six subjects practiced the song together, the three new children practiced the song individually, and then the group was recorded singing the song with words and then on “loo”. Only phrase two of four phrases was evaluated. If a subject failed to sing phrase 2, phrase four was substituted.

Results:

- Children sang more accurately when singing individually.
- In general more third graders sang accurately than kindergartners or first graders.
- Girls sang more accurately than boys, especially in group singing.
- The difference in boys’ accuracy between individual and group singing was more pronounced that that of the girls.
The Identification Of And The Training Of The Vocal Range Of Three-Year-Old Preschool Children


**Research Design:**

1. Qualitative Study
   - N=60

2. Treatment-Posttest
   - Experimental Group A (N=20?)
   - Experimental Group B (N=20?)
   - Control Group (N=20?)

**Purpose:**

To identify the three-year-old child's vocal range and determine the effects of training on this age group.

**Procedure:**

1. Qualitative Study
   - b. Children sang songs taught by the researcher.
   - c. Children's vocalizations were observed when left alone in a room with several toys.
   - d. Same as “c” above with the addition of the recording of a female vocalist being played in the room.
   - e. Same as “c” above with the addition of the recording of a male vocalist being played in the room.

2. Treatment-Posttest Study

   Children were divided into two experimental groups and one control group and received instruction noted below. All children were asked to sing the songs for the researcher following the period of instruction.
a. Children in group A (control group) were taught four songs, each in a different key and range for ten 15-minute sessions.
b. Children in group B were taught the four songs in a standard key and range (high) each period.
c. Children in group C were taught the four songs in a standard key and range (low) each period.

3. Results

a. When singing favorite songs, the children’s “practical” range spanned B\textsuperscript{b} - G\textsuperscript{b1} which is lower than most previous research. The vocal quality was also heavier than the researcher expected.

b. The presence of the vocal stimulus in the unstructured situations had no effect on the range of the children’s spontaneous singing, but it did affect key choice.

c. Children who were taught to sing songs in a high or low key reflected that training when asked to sing the songs for the researcher.

d. The children were more accurate in rhythm than pitch.

e. 65% of the children sang in at least one of the situations where they were left alone (1.c, d, e above).
Toward A Theory Of Music Syntax: Some Observations Of Music Babble In Young Children


**Research Design:**

Qualitative
N=125 (five months to five years)
N=25 (three to five years), longitudinal study over two years

**Purpose:**

“To gain insight into the nature of music syntax as it develops in young children.”

**Procedure:**

Two groups of children participated in the study. The first group included 125 children ages five months to five years (five age groups) were enrolled in a day care center. They participated in informal music activities and were observed twice a week for 30 minutes for four months. The investigator made observations based on large group interactions with the children ages 3-5 and small group and individual interactions with the younger children.

The second group consisted of 25 3-5 year old children enrolled in a nursery school. The children participated in informal music activities one day each week for two academic years. The investigator made observations based on participation with the children throughout the day during play, work and mealtime activities.

The investigator provided both groups with informal music instruction including singing songs in major, minor, and modal tonalities with and without accompaniment on a guitar or autoharp. The children sang familiar songs of their own choosing and created songs. Children were encouraged to move to music using movements suggested by the investigator as well as their own movements. The music included duple, triple and unusual paired meters (e.g. 5/8 meter).

The informal nature of the instruction allowed children to listen and participate without restrictions or demands imposed by the investigator. Rote teaching was not utilized. No attempt was made to teach musical concepts. The children were never told that a response was inadequate or incorrect. “Recorded music and music instruments were never used as substitutes for use of the human voice and body in music activities.”
Results:

The observations suggested three levels of music babble:

1. The first level of babble occurs only with musical stimulation. At this first level, children perform a pitch, a tonal pattern, or a rhythm pattern synchronized with a musical stimulus.

2. Children at the second level of music babble perform combinations of music elements (pitch, melodic pattern, rhythmic pattern) without tonal or rhythmic organization. They may perform these “babbles” apart from any musical stimulus. The fact that these are spontaneous performances indicates that children at this level can represent musical sounds mentally.

3. At the third level, children’s spontaneous and creative performances utilize a recurring pitch center and a consistent tempo, indicating a tonal and rhythmic syntax. A performance of a familiar song resembles but is not identical to the characteristics of the song. Children at this level are becoming aware of relationships between sounds in music.
Pitch Pattern Instruction And The Singing Achievement Of Young Children


Research Design:

Posttest
Treatment 1 Group (T₁): two first grade classes
Treatment 2 Group (T₂): two first grade classes
Treatment 3 Group (T₃): two first grade classes

The classes represented two different elementary schools—a black school and a white archdiocesan school—which differed in respect to socioeconomic status, teachers, and music instructional time.

Purpose:

1. To determine the effects of the instructional use of pentatonic or diatonic melodies on the rote-singing achievement of young children.

2. To determine the effects of socioeconomic status on the rote-singing achievement of young children.

3. To determine the effects of musical aptitude on the rote-singing achievement of young children.

Procedure:

The children in six first grade classes, representing two elementary schools were given the Tonal test of Gordon’s *Primary Measures of Music Audiation* (PMMA).

Four months all classes received regular music instruction from a music specialist. One school received 45 minutes of instruction once a week and the other school received two 30 minute periods of instruction each week. Each school received 10-14 minutes of diatonic (T₁), pentatonic (T₂), or combination (T₃) pitch pattern instruction each week, consisting of the children echoing the teacher singing the patterns *a cappella* on a neutral syllable or with syllable names. The same diatonic and pentatonic song was also taught to the children each week, and they participated in rhythmic, listening, and movement activities determined by each teacher.

At the end of the four months, the children were individually recorded singing two diatonic and two pentatonic songs which were taught during the third month of instruction. A five point rating scale was used to evaluate the performances.
Results:

1. The combination group achieved significantly higher ratings than either the diatonic or pentatonic groups. No significant difference was found between the diatonic and pentatonic groups.

2. No significant difference was found between the two schools which represented different socioeconomic backgrounds.

3. Children with high tonal aptitude test scores on the PMMA achieved significantly higher ratings than those with low aptitude scores.

The authors suggest that the diatonic pattern instruction may have aided the development of tonal center and the pentatonic pattern instruction may have contributed to in-tune singing or sense of melodic contour, so that the combined instruction would offer the children the best of both methodologies and thus the higher ratings.
An Experimental Study Of The Comparative Effects Of Singing Songs With Words And Without Words On Children In Kindergarten And First Grade


Research Design:

Pretest-Posttest
N=? (not indicated in abstract)
Three classes each of kindergarten and first grade children

Purpose:

Determine the effects of song instruction with and without words on

1. Levels of developmental music aptitudes
2. Singing achievement of children in kindergarten and first grade

Procedure:

Pretest: Three classes of kindergarten children and three classes of first grade children were administered the Primary Measures of Music Audiation (PMMA).

Instruction: The six classes receive one of three types of song instruction for one academic year:

1. Primarily sang songs with words.
2. Primarily sang songs without words.
3. Sang all songs with words.

Post-test: The children were all administered the PMMA and were also individually tape recorded singing two songs.

Results:

1. Song instruction with and without words enhances the audiation of young children with low developmental music aptitudes.
2. None of the three types of song instruction was more effective than the other in developing audiation of children with high developmental music aptitudes.

3. None of the three types of song instruction was more effective than the other in developing children’s singing achievement.
An Investigation Of Preschool Children's Comparative Capability To Sing Songs With And Without Words


Research Design:

Descriptive
N=35

Purpose:

To determine whether a child performs rote songs with words better than rote songs without words and whether any differences found may be related to language development.

Procedure:

Thirty-five four and five-year-olds in two classes in a nursery school participated in the study. Both classes received thirty minutes of music instruction once a week for five months. The activities included rhythm, movement, and rote singing. Half of the rote songs in any one class had words, the others were sung on a neutral syllable.

During the final month, the children in both classes learned two songs by rote--one with words and one on a neutral syllable. At the end of the final month, the children's performance of these two songs was tape recorded and rated according to tonal and rhythm criteria. Language development was assessed using the Peabody Picture Vocabulary Test (PPVT).

Results:

- There was no significant difference between the performance of rhythm in the song with words and the song without words.
- The tonal performance of the song without words was significantly better than that of the song with words.
- No relationship was found between the children's language development and their performance of songs with or without words.
A Study Of Musical Auditory Information Processing Of Preschool Children


Research Design:

Pretest-Posttest
N=26

Purpose:
The authors cite a hypothesis by two British researchers, Sergeant and Roche, that "a critical time exists for the development of absolute pitch" because at some point children shift from a focus on the dominant property of a melody (e.g. absolute pitch) to its organizational relationships. The purpose of this study, was to determine if similar results would occur with American preschool children.

Procedure:

Pretest: The spontaneous musical vocalizations of 26 children in four age groups--two years, three to four years, five years, and six years--were recorded on tape for two-hour periods twice each week for three weeks.

Instruction: The children received six 30-minute training sessions over a period of three weeks during which they were taught to sing four songs by rote at the same pitch level each time without harmonic accompaniment. Each song was taught utilizing a different motivating activity: A) the children played the opening phrase on individual tone bars, B) the children learned to trace the melodic contour with their hands, C) a "song game" was played while singing the song, D) circular "rolling" hand motions accompanied the singing.

Posttest: One week after completion of the training sessions, the children sang the four songs plus a self-chosen song which were recorded, transcribed, and rated for pitch and melody (direction, tonality, and interval).

Results:

- Pitch scores were not significantly related to age. However, the mean pitching scores revealed a slight decline at age 6. Also, the most accurate pitchings occurred on song A (35 compared to two or three for the other songs) for which the children accompanied the first phrase with tone bars.

- Changes were not significant between consecutive age groups, but were significant over the total span of two to five years and two to six years.
A Comparison Of Musical Performance Accuracy Between Teacher-Taught And Peer-Taught Kindergarten And First Grade Students


Research Design:

Posttest
N=46 (24 kindergartners and 22 first graders)

Purpose:

To determine the effect of peer teaching by very young children on musical performance and on the ability to generalize learning.

Procedure:

Forty six children from a public elementary school (24 kindergartners and 22 first graders) participated in the study.

Instruction 1 (teacher taught): Twenty one of the children were taught by an adult music teacher to play “Row, Row, Row Your Boat,” on an Omnichord (using music with color coded blocks representing the chords to be played) while singing the song. The child was given two practice trials after being taught how to play the Omnichord and then performed the song while being taped on a tape recorder. The adult sang along quietly with the child.

Instruction II (peer taught): A day or two later, each child was randomly assigned a partner. The teacher explained that the child was going to show her classmate how to play the Omnichord. The teacher briefly reviewed how to play the song and then stepped back to let the child teach her classmate. The teacher stayed in the room, interfering only when necessary to assure that the child being taught was given the opportunity to play the instrument. As before, the peer-taught child was given two practice trials and then performed the song while being taped on a tape recorder, with the adult singing quietly with the child.

Posttest: A day or two following instruction, each child returned to the music room individually to play the song again. This performance was not taped. The child was then asked to sing “Are You Sleeping?” (generalization song) and play it on the Omnichord following the color coded chart with the teacher singing along quietly as before. The child was given one practice trial; the second time the performance was taped.
Results:

The peer-taught children in this highly structured setting were as effective as the adult music teacher.

The number of correct chords played by the teacher-taught and peer-taught children did not differ significantly either on the original song or the generalization song.

Peer-taught scores on the generalization song were significantly higher than their scores on the initial song. Teacher-taught scores did not differ significantly between the original and generalization songs.

Twenty three students received perfect scores on the generalization song; 15 of these were peer-taught children.

Teacher-taught students were more likely to remember to give four initial strums when performing both the original and generalization songs.
The Effects Of Vocal Modeling And Melodic Direction On Development Of Head Voice Placement In Four-Year-Old, Nonsinging Children (Abstract)


Research Design:

Posttest
N=87 (age four years)

Purpose:

To investigate the effect of the following three variables on incidence of head voice singing in four-year-old children:

1. the gender of the children
2. the voice placement (head voice or chest voice) used by the teacher
3. an ascending or descending melodic line

Procedure:

*Instruction*: 84 four-year-old non-singers (in prescreening they could not get into singing quality, but remained in speaking range) were divided into two treatment groups. One group (21 boys and 24 girls) received instruction from a certified vocal music teacher who used only head voice throughout the teaching period, the other group received instruction from a vocal teacher using only chest voice. Each group was further divided to receive two different types of instruction—the first type utilized predominantly ascending melodies, the second type utilized predominantly descending melodies.

Classes of no more than four children received 12 15-minute lessons over a period of one month. The lessons consisted of:

- three minutes of musical dialogues with the children
- vocal warm-ups on the syllable “loo”
- teaching songs to the children

*Posttest*: The children were each asked to sing two songs. Judges rated whether the children used head voice or chest voice.
Results:

1. The gender of the student did not have a significant effect on the use of head voice or chest voice.

2. The number of children who sang with head voice after instruction from the teacher who used head voice was significantly higher than the number singing in head voice after instruction from the teacher using chest voice.

3. Melodic direction had no significant effect on the used of head voice by the children who received instruction from the teacher who used head voice. However for those children who received instruction from the teacher who used chest voice, the number of children who sang in head voice after receiving ascending melodic instruction was significantly higher than those who received descending melodic instruction.
The Effect Of Restricted Song Range On Kindergarten Children's Use Of Singing Voice And Development Attitude


Research Design:

Pretest-Posttest Control Group
N=? (not indicated in abstract)

Purpose:

- To examine the effectiveness of two types of instruction on singing achievement and developmental music aptitude of kindergarten children:
  - instruction using a restricted song range found to be natural to children
  - instruction using song ranges utilized by basic music series texts.

- To determine whether differences exist between boys and girls in the use of singing voice and developmental music aptitude.

- To determine whether differences exist between boys and girls in the effectiveness of the two types of instruction.

- To determine whether teacher differences play a role in the effectiveness of the two types of instruction.

- To evaluate the relationship between the use of the singing voice and developmental music aptitude before and immediately after the instruction is received.

Procedure:

The two types of instruction were randomly assigned to six intact kindergartens taught by three teachers. Children received music instruction once each week for 30 minutes for 15 weeks. The control group received no music instruction from a music specialist.

Children were administered the Primary Measures of Music Audiation (PMMA) and The Singing Voice Development Measure (SVDM) immediately before and immediately following the 15 week instruction period.
Results:

1. No significant differences were found between the effectiveness of the two types of instruction.

2. No differences were found between boys and girls regarding the use of singing voice and developmental music aptitude.

3. No significant differences were found between boys and girls regarding the effectiveness of the two types of instruction.

4. There was a significant difference in the effectiveness of the two teachers.

5. There was a small relationship between use of the singing voice and developmental music aptitude.

The author also concluded that the amount of music instruction given may not be sufficient for kindergarten children and that the curriculum utilized may have been ineffective.
The Singing Of Selected Tonal Patterns By Preschool Children


Purpose:
To determine the level of difficulty of 48 four-tone patterns for preschool children to sing and to compare these findings to the following five hypotheses based on Kodaly and other prevalent methodologies:

- Half steps are more difficult to sing than whole steps.
- Large intervals are more difficult to sing than smaller ones, except for the minor second.
- The descending minor 3rd is the easiest interval to sing.
- Descending patterns are easier to sing than ascending ones.
- Successive leaps are difficult to sing.

Procedure:
Ninety-six children from ages three through five were asked to echo patterns sung by the investigator on a neutral syllable. The children's singing was recorded and rated on a five-point scale. The patterns were within the range of d to b above middle c. They represented typical motives found in children's songs with a variety of contours, ranges, pitch sets, and textures.

Results:
The author noted that factors not examined in the study, such as children's familiarity with a pattern, would affect children's ability to sing the patterns correctly.

- Half-steps were not consistently more difficult to sing than whole steps or thirds.
- Patterns consisting of only step-wise motion and thirds were sung more correctly than those containing sixths.
- The majority of the easiest items contained the descending minor third.
- The findings partially support the hypothesis that descending patterns are easier to sing than ascending ones. Of the ten easiest items, three were descending and two were down-up-down.

- Performance was not consistently affected by repeated leaps in the same direction.
An Investigative Study Of Young Children's Vocal Problems And Remedial Needs


Research Design:

Descriptive/Case Study, Longitudinal
N=82 (first grade)

Note: The term investigator is used to refer to the investigator, the children’s music teacher, and two music education students, all of whom participated in carrying out this research.

Purpose:

For first grade children determined to be conversational and/or inaccurate singers:

1. Identify types of vocal problems.
2. Identify the patterns and ranges sung most easily.
3. Explore a variety of materials and approaches and determine their remedial value.
4. To gather information regarding the outcomes of individual remedial help.

Procedure:

This study was done in three phases over two school years.

*Phase I:* Eighty-two children (47 boys and 35 girls from ten first-grade classrooms) participated in this phase. The investigators met with two or three children at a time in a private testing area during the children’s regular music class period. The investigators met weekly with the children for three successive weeks for approximately ten minutes at each session. The sessions were tape recorded. The sessions included the following:

The investigators used songs familiar to the children containing patterns of two to five pitches. The patterns were sung in the keys of C, D, and Eb. The investigators used several approaches including humming, singing vowels and words, indicating pitch and direction with visuals and body movements and playing step bells. During the final session, some of the children were taught to play the kazoo with varying degrees of success.
Phase II: Fifty-six of the original group of children participated in this phase the following year (second grade). Responses to activities similar to Phase I were recorded. Most children had learned to sing reasonably well by this time.

Phase III: Of those children in Phase II who still needed help, eight were chosen for intensive, individual instruction and met with the investigators for 15 minutes each day for two weeks in succession.

Results:

1. Types of vocal problems observed:
   - confusing speaking and singing in the low register
   - don’t hear direction correctly
   - confuse loud and high
   - poor vocal control—switch back and forth between speaking and singing
   - little vocal flexibility—no head tones
   - speaking voice low pitched, heavy quality

2. Patterns and ranges sung most easily:
   - The easiest pattern and the one most accurately sung was ascending sol-do, particularly in the range a-d1 (c1 is middle c) where 70% matched the pitches. The children were less accurate in the d1-g1 range (44%).
   - 61% of the children accurately sang an ascending stepwise pattern in the c1-g1 range. 40% sang a descending pattern in the same range accurately. The children were less accurate in the d1-a1 range (33 1/3%).
   - The tonic chord (do-mi-sol) was sung correctly by 51% of the children in both the c1–g1 and e1-b1 ranges.
   - Conclusion by investigators: the range of c1-a1 is the easiest for young children to sing.

3. Most Successful Approaches:
   - Approaches to Singing
     - Squeak (finding head tones) phrases from Goldilocks and the Three Bears.
     - Humming (echoing patterns) then play on kazoo.
   - Speaking versus Singing—
Echoing (say then sing) names, conversations, phrases from *Goldilocks and the Three Bears*, nursery rhymes.

- Developing Flexibility
  - Conversation using puppets—Grouch (low), Duck (high), Mouse (high), Dog (both).
  - Imitations of animal sounds—Rooster and baby duck (easiest for high), duck, pig, lamb, cow.
  - Imitations of environmental sounds—train whistle, telephone, jingling money.

- Tone Matching
  - Short familiar tonal patterns in a variety of keys.

4. Conclusions regarding the outcome of remedial help:

- Some non-singers are unable to learn to use their singing voice in regular classroom activities and need much individual help over a long period of time.

- The problem of the non-singer needs to be addressed before the end of the first grade. There should be a focus on helping children learn to sing in pre-school and kindergarten.

- A variety of approaches must be tried (see successful approaches listed above).

- The ability to match tonal patterns does not always transfer to singing the songs from which they were taken. Tonal memory for longer phrases must be developed.

- Children having vocal problems need positive reinforcement for their willingness to try and for any success they have in matching pitches and patterns.
The Singing Competencies Of Five-Year-Old Developing Singers


Research Design:

Longitudinal study
N=180

Purpose:

To determine the effect of four different types of singing tasks on children’s observed singing competency and relate the findings to a model of pitch matching development compiled from a review of previous research.

Procedure:

A sample of 186 children were drawn from 10 primary schools in the Greater London area with ages ranging from 4.58 to 5.83 years (including a mixture of social class, ethnicity, and urban/suburban locations). The children were asked to perform four different types of singing tasks as follows:

1. Six glissandi (glides). The glides were designed to assess ability to match direction of pitch change.
2. Pitches.
4. Two songs which contained the melodic patterns in #3.

The children were taught the songs by their teachers from an audio tape during the two weeks prior to testing. The glissandi, pitches, and melodic patterns were recorded on audio tape and played for the children at the time of testing. All subjects were assessed individually and their responses were tape recorded and evaluated according to a seven point scale utilizing clearly defined criteria.

Results:

- A hierarchy of vocal pitch matching competence in the four singing tasks were determined, from highest rating to lowest rating as seen below. Overall, the songs were rated lower than the other three tasks.
- Pitches/simple glides (maximum of two directions such as up/down)
  Melodic fragments
  All glides
  Songs
  Complex glides (four changes of direction)

- Ability to change pitch direction was better on the melodic fragments than the glides, possibly indicating that it is easier for the children to respond to direction changes when there are discrete pitches.

- Significant differences were found between schools on children’s competency in vocal pitch matching. These differences were only partly due to the difference in average age at the different schools, indicating that differences in the educational environment and teaching strategies may be important.

- No significant difference were found between the singing competencies of boys and girls.

- The words of the songs were matched more accurately than the melodic contour. Without the words, children were more accurate in matching pitches and melodic fragments.

The authors concluded that developing singers should be taught words and music separately.
Young Children:

Rhythm
A Study Of The Effects Of Two Types Of Movement Instruction On The Rhythm Achievement And Developmental Rhythm Aptitude Of Preschool Children


Research Design:
Pretest-Posttest
N=51

Purpose:
To gain information about the influence of movement instruction upon rhythm achievement and developmental rhythm aptitude in three- and four-year-old children. Specifically,

• to determine the comparative effects of Dalcroze-based and Laban-based movement instruction on rhythm achievement.

• to determine the comparative effects of Dalcroze-based and Laban-based movement instruction on the rhythm achievement of children with high and low levels of rhythm aptitude.

• to investigate the effect of movement instruction on developmental rhythm aptitude.

Procedure:
Pretest: A rhythm aptitude test was administered to fifty-one children in two private preschools prior to and following the movement instruction.

Instruction: Intact classes were randomly assigned to receive either Dalcroze-based or Laban-based movement instruction, receiving ten thirty-minute lessons.

Posttest: During the tenth lesson, all children were asked to perform micro-beats and macro-beats to a song. These performances were videotaped and evaluated.

Results:
Post-instructional rhythm aptitude scores were significantly higher than pre-instructional scores, however no differences were found in the effectiveness of Dalcroze-based and Laban-based movement instruction. The authors conclude that any type of movement instruction is beneficial for the musical development of preschool children.
Rhythmic Tasks With 3-, 4-, And 5-Year Old Children: A Study Made In Argentine Republic


Research Design:

Descriptive
N=45 (ages 3, 4, and five years)

Purpose:

To discover what rhythmic tasks may be done by young children.

Procedure:

This research project was a duplication of the research design used by Edward Rainbow in his three-year investigation of the rhythmic ability of pre-school aged children (cited below).

This study included 15 three-year-olds, 15 four-year-olds, and 15 five-year-olds. The children participated in regular music classes from April 18 to September 15. The three-year-olds were in class for 20 minutes twice a week; the four-year-olds had class twice a week, one for 20 minutes and one for 40 minutes; and the five-year-olds met twice a week for 40 minutes.

The children were tested individually or in groups of two in the normal classroom situation. None of the tasks tested had been specifically taught. The rhythmic patterns presented to the children increased in difficulty for each age level. The tasks included

Steady beat (to the beat of a drum)
- Clapping hands with the beat
- Walking with the beat
- Playing a rhythm instrument with the beat
- Chanting vocally with the steady beat
- Stepping and clapping to the beat
- Keeping the steady beat with other parts of the body (i.e., slapping the thighs)
Rhythm Echo
• Echoing rhythm patterns with the hand
• Echoing rhythm patterns using speech patterns
• Echoing rhythm patterns using singing patterns
• Echoing with the feet
• Echoing with an instrument (drum and stick)
• Echoing vocally within a melodic context

Discrimination
• Determine orally whether two rhythm patterns are the same or different
• Determine visually whether two rhythm patterns are the same or different

Ostinato
• Clapping a simple four-beat pattern as accompaniment to a song with and without the aid of visual cue
• Clapping a simple three-beat pattern as accompaniment to a song with and without the aid of visual cue

Memory
• Clapping the melodic rhythm of a song

(Additional tasks not discussed in this summary involve the effect of meter and tempo on the ability to maintain a steady beat.)

Results:
• For the three-year-olds, the easiest steady beat tasks were keeping a steady beat with other parts of the body (93% of the children were able to do this) followed by clapping hands to the beat (87%), walking with the beat (73%), playing a rhythm instrument with the beat (67%), chanting vocally (33%), and stepping and clapping with the beat (33%). The easiest echo task was echoing vocally within a melodic context (93%), followed by using singing patterns (73%), using speech patterns (67%), and echoing with an instrument (13%). Three-year-olds were unable to echo rhythm patterns with the hands and feet or to perform the discrimination, ostinato and memory tasks.
- The steady beat tasks were all of equal difficulty for the four-year-olds (80% being able to accomplish this) with the exception of stepping and clapping with the beat which was more difficult (47%). The easiest echo task, which all of the four-year-olds were able to accomplish, was to echo rhythm patterns using speech patterns. This was followed in difficulty by echoing with an instrument (87%) and echoing vocally within a melodic context (87%). Slightly more difficult were echoing rhythmic patterns with the hand (80%) and using singing patterns (80%). The most difficult echo task was to echo with the feet (27%). Most four-year-olds were able to determine aurally whether two rhythm patterns are the same or different (93%), but only half of them could perform the same task visually (53%). 60% of the four-year-olds were able to clap the melodic rhythm of a song from memory. None of the four-year-olds were able to perform the ostinato tasks.

- All of the five-year-olds were able to clap hands with the beat and keep the beat with other parts of the body. Playing a rhythm instrument with the beat was slightly more difficult (93% of the children could do this) followed by walking with the beat (87%), chanting vocally with a steady beat (87%), and stepping and clapping with the beat (87%). The easiest echo tasks were echoing rhythm patterns using speech patterns and echoing with a rhythm instrument (100% of the children could do this), followed by echoing using singing patterns (93%), echoing vocally within a melodic context (93%), echoing using singing patterns (80%), and echoing with feet (60%). Most five-year-olds were able to determine visually whether two rhythm patterns are the same or different (93%), but only half of them could perform the same task aurally (53%). Clapping four-beat ostinato patterns with or without the aid of a visual cue was easier (33% could do this) than clapping three-beat ostinati without a visual cue (13%). None of the five-year-olds were able to clap the three-beat ostinati patterns with the aid of a visual cue. 87% of the five-year-olds were able to clap the melodic rhythm of a song from memory.
A Validation Of The Weikart Sequence Of Levels Of Beat Coordination For Children Aged 3-7 (Weikart, Phyllis, Motor Development, Rhythm Development)


Research Design:

Descriptive
N=20

Purpose:

A revised Test of Nonlocomotor Rhythmic Movement (rTNRM) was constructed to validate the order of difficulty of the five levels of beat coordination proposed by Phyllis Weikart (1987, p. 101).

Procedure:

Twenty children ages three-7 were given the rTNRM. The results were arranged from high achievement (least difficult) to low success (most difficult) as follows:

<table>
<thead>
<tr>
<th>Mean (Average)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>41.11</td>
<td>Level IB. Single-side motions. A motion is repeated in a steady beat on one side of the body</td>
</tr>
<tr>
<td>40.45</td>
<td>Level I A. Single bilateral symmetrical motions. A motion is repeated on both sides of the body for each steady beat.</td>
</tr>
<tr>
<td>39.07</td>
<td>Level II. Single predictable alternating movements. A movement is performed on one side of the body to the first beat, then on the other side to the second beat. Repeat several times.</td>
</tr>
<tr>
<td>37.36</td>
<td>Level III. Sequenced bilateral symmetrical patterns. Paired limbs move to one location for the first beat and another for the second beat. Repeat.</td>
</tr>
<tr>
<td>34.64</td>
<td>Level V. Sequenced bilateral asymmetrical motions. Paired limbs move together to a point on one side of the body for the first beat and a place to the other side of the body for the second. Repeat.</td>
</tr>
</tbody>
</table>
23.97 Level IV. Sequenced bilateral symmetrical motions combined. Paired limbs perform four motions in four steady beats. Repeat.

22.58 Level VI. Sequenced bilateral asymmetrical motions combined. Paired limbs move together in a series of four different directions for four steady beats. Repeat.

Results:

- Lower body movements were more difficult than upper body movements.
- Movements without an endpoint were more difficult than those with an endpoint.
- Movements with music were more difficult than those without music.
- Scores improved for each age group.
- Factors which increased the difficulty of movement patterns were 1) adding motions, 2) using bilateral rather than one-sided movements, 3) employing asymmetrical as opposed to symmetrical motions, 4) adding music, 5) eliminating endpoints, and 6) using the lower instead of the upper body.
A Longitudinal Investigation Of The Rhythmic Abilities Of Pre-School Aged Children


**Research Design:**

Descriptive

N=40

**Purpose:** This article outlines a three-year project to determine the ability of preschool aged children to learn specific rhythm tasks. The article also reports the results of a pilot study. Two other articles by the same author cited in this bibliography provide a progress report at the end of the first year and the final report at the end of the three-year research project.

**Procedure:** The pilot project involved 40 children ages four and five years old who were observed in music classes over a period of 16 weeks. The ability of these children to perform specific rhythm activities was inventoried and the date each child was able to accomplish a task was recorded to determine the relative difficulty of the tasks.

**Results:** It was noted that many rhythmic tasks were more easily and accurately accomplished by vocally chanting the rhythm instead of stepping and clapping to the rhythm which appeared to be more difficult. This indicated that the rhythm was perceived by the children, but could not be performed by clapping or stepping. The hypothesis was proposed that perception of rhythm may occur earlier than was previously thought due to the widespread use of clapping and stepping tasks for evaluating the rhythmic abilities of young children. Also, these findings call into question the accuracy of previous thinking (e.g. the writings of Aronoff in *Music and Young Children* published in 1969) that keeping a steady rhythmic beat by clapping or marching is the first task a young child must learn.
A Progress Report On A Three Year Investigation Of The Rhythmic Ability Of Pre-School Aged Children


Research Design:

Longitudinal
Posttest
N=52 (ages three and four years)

Purpose:

This article is a progress report at the end of the first year of a three-year project, the purpose of which is to

- determine how many selected rhythm tasks could be learned by three- and four-year old children in the course of one school year
- compare the ability of three- and four-year old children to learn these tasks
- estimate the difficulty of each task for each age level
- compare how the mode of response affected the level of difficulty of the tasks for each age level

Procedure:

27 three-year-olds and 25 four-year-olds were provided regularly scheduled 15-minute music classes two or three times per week. Rhythmic instruction was included as part of the lessons, but it was not the sole emphasis of the music instruction. The rhythmic tasks utilized simple patterns with quarter and eighths notes performed at mm=104. Students were taught to:

- keep a steady beat to recorded piano music using hands or feet or a combination of the two.
- Keep a steady beat to recorded music using rhythm sticks.
- Speak a rhythm pattern and immediately clap that pattern
- Echo clap various rhythms
- Read an ostinato rhythm pattern while performing it with a recording

Children began instruction at the beginning of the school year and were tested in February and May in small groups and individually in the same classroom in which lessons were given.
Results:

- Speech rhythms were the easiest for the three-year-olds to perform. Keeping a steady beat with rhythm sticks and clapping a steady beat was the second easiest task. Other tasks were more difficult, however speaking a rhythm prior to clapping it made the clapping more accurate. The two most difficult tasks were reading an ostinato figure while performing with a piano and clapping in time while marching.

- The four-year-olds were more successful in all the rhythm tasks. Again, the speech rhythm tasks were the easiest, followed by keeping a steady beat with rhythm sticks and clapping a steady beat to a recorded performance. Reading an ostinato rhythm and clapping while marching to music were, again, the most difficult tasks.
A Final Report On A Three-Year Investigation Of The Rhythmic Abilities Of Pre-School Aged Children


**Research Design:**

Longitudinal
Posttest
N=150 (ages three and four years)

**Purpose:**

- To estimate the ability of three-year-old children to successfully learn selected rhythmic tasks during the course of one school year
- To estimate the ability of four-year-old children to successfully learn selected rhythmic tasks during the course of one school year;
- To compare the ability of three- and four-year-old children to learn selected rhythmic tasks
- To estimate the learning difficulty rate for each rhythmic task for each age level
- To estimate the effect of training on the ability of preschool aged children to learn the selected rhythmic tasks

**Procedure:**

Over three years 77 three-year-olds and 73 four-year-olds were taught by an experienced music teacher at a school in Texas. Each student attended music classes for 15 minutes two or three times each week. Rhythmic activities were only part of the many activities included.

Method books were reviewed to develop a list of 30 recommended rhythmic activities for young children. After a pilot study and the first year of research, 16 tasks were eliminated, leaving 14 that were used throughout the three years of the study. These tasks, which were performed at a quarter note tempo of mm=104, include:

1. Keeping a steady beat to recorded piano music by
   a. Clapping hands
   b. Slapping hands on knees
   c. Marching
   d. Clapping hands while marching
   e. Tapping rhythm sticks
2. Echoing vocally words presented in a rhythm pattern (syllables below were not used, they are included for the purpose of indicating the rhythm patterns presented to the children)
   a. ta ta ta (rest)
   b. ta ti-ti ta (rest)
   c. ta ta ti-ti ta

3. Immediately clapping rhythm patterns after vocalizing them
   a. ta ta ta (rest)
   b. ta ti-ti ta (rest)
   c. ta ta ti-ti ta

4. Reproduce by clapping a pattern that was clapped by the teacher (without verbal cues)
   a. 12. ta ta ta (rest)
   b. 13. ta ti-ti ta (rest)
   c. 14. ta ta ti-ti ta

Students were assessed in groups of six to seven children within the classroom during the course of the music lessons.

Results:

- Tasks that were easiest for three-year-olds were echoing vocally words presented in a rhythm pattern (approximately 50% could accomplish this). Approximately 10-14% of the three-year-olds could clap a rhythm pattern after vocalizing the pattern, clap a steady beat, and tap a steady beat to recorded music using rhythm sticks. Only 4-15% of the three-year-olds could perform the echo clapping or march in time to music. The most difficult task was marching and clapping in time to music—less than 4% could accomplish this.

- Four-year-olds were significantly better than three-year-olds in all tasks except echoing vocally words presented in a rhythm pattern. The relative difficulty of the tasks remained the same for four-year-olds: The easiest tasks were echoing vocally words presented in a rhythm pattern (70-90%) followed by keeping a steady beat to recorded music by clapping and using rhythm sticks (40-60%), and echo clapping (30-40%). Marching and clapping to music was again the most difficult with less than 15% of the four-year-olds able to accomplish this task.

- The author concludes that rhythmic tasks utilizing a vocal response are the most effective for young children and that marching in time to music as a means of teaching rhythm or tempo relationships to young children appears questionable.
The Relationship Of Grade Level And Sex Differences To Certain Rhythmic Responses Of Primary Grade Children


Research Design:

Posttest  
N=99 (grades K-3)

Purpose:

To examine the relationship of grade level and sex differences with the rhythmic responses of clapping, chanting, and stepping after one year of school music instruction.

Procedure:

*Instruction:* Ninety-nine children in grades kindergarten through grade three at a parochial school participated in the study. The children received general music class instruction totaling one hour per week for eight months from one of the investigators. This was the first regular music instruction by a music specialist for most of the children. The instruction included development of tonal and rhythmic concepts through singing and eurythmics, utilizing the three rhythmic responses to be examined—clapping, chanting, and stepping.

*Posttest:* The instructor constructed a Rhythm Response Test which was given to the children following instruction. The test consisted of 12 tape-recorded rhythm patterns, six in duple meter and six in triple meter recorded in random order. The children were asked to echo-clap, echo by chanting on “loo,” and echo by stepping the pattern with one or both feet while standing.

Results:

- All three rhythmic responses were more accurate as grade levels progressed.
- Kindergarten children responded most accurately with chanting.
- First and second grade children responded most accurately with chanting and clapping.
- Third grade children responded most accurately with clapping.
- Stepping was the most difficult task for all grade levels.
Girls in grades one through three received consistently higher rhythm response scores than boys. The boys in kindergarten received higher rhythm response scores than girls, but this may have been due to the relatively small number of girls in the class.
The Relationship Of Rhythm Response Tasks And Pmma Scores With Music Training, Grade Level, And Sex Among K-3 Students


Research Design:

Pretest-Posttest-Control Group
N=103

Purpose:

To chronicle the accuracy of clapping, chanting and stepping responses from kindergarten through grade three and to determine the effect of music training on the performance of these tasks.

Procedure:

103 students from one school received music instruction including clapping, chanting, stepping rhythm patterns and movement activities twice a week for a total of an hour each week. 96 students from a second school sang once a week but received no formal music instruction.

All children were evaluated in the fall and the spring using the *Rhythm Response Test (RRT)* developed by the authors during an earlier study and the *Primary Measures of Music Audiation (PMMA)* developed by Edwin Gordon.

Results:

**RRT**

- The group receiving regular music training scored higher in vocal chanting of rhythms whereas the group without regular musical training received highest scores in clapping. Stepping was generally the most difficult task for all grade levels.

- Vocal chanting scores for kindergarten children (both schools combined) were significantly higher than the stepping and clapping scores. For grades one through three (combined schools) the stepping scores were significantly lower than clapping and chanting. Stepping scores did raise significantly at each grade level with the exception of kindergarten to first grade. The authors note
• The children who received music training scored higher than the control group on all tasks in all grades except for stepping in grade three. Music training did not have an effect on \textit{RRT} scores within each grade level. Average scores increased at each grade level on all tasks for both groups except for clapping in grade 3.

• Girls scored higher than boys in the school that received training while boys scored higher than girls in the control group.

• Maturation was definitely a factor -- scores of all groups raised at each grade level, especially in the first two years.

\textbf{PMMA}

• Scores were significantly different between grades, but not between schools or boys and girls. A significant gain was seen between fall and spring with girls gaining more than boys overall, more due to maturation than school music training.
Young Children:

Music Literacy
Children's Rhythmic Development From Age 5 To 7: Performance, Notation And Reading Of Rhythmic Patterns


Research Design:

Descriptive, Longitudinal (three-year study)
N=39

Purpose:

- To find out whether the context of a rhythmic example (e.g. presence of a text, total length, and rhythmic complexity) played a role in the children’s performance and perception of it.

- To test Gordon’s (1980) findings of discrepancies between skill types on identical items (examples of skill types include 1) responding to a same/different task in identifying meters; 2) matching a pattern to its printed notation; and 3) completing the notation of a given pattern by adding note heads, flags, beams, ties, and rests).

- To determine whether the tendency for children to maintain the same position in relation to their peers throughout grades 1-6 with regard to rhythmic development (the findings of a 1966 study by Petzold) is also true for students in kindergarten, first, and second grade.

- To determine to what extent children’s invented notations depict features of musical events and whether the children could use their notations as symbolic aids for performance.

Procedure:

This was a three year study of children from working class backgrounds without any special training in music (some children began instrument lessons during the course of the study). 51 children were tested the first year; due to attrition 46 remained for the second year, and 39 remained for the third year.

The tests consisted of the following:

Session I:

1. The child was played a tape of all four clapped patterns, then asked to clap each pattern after hearing it a second time. A pattern was repeated one more time if necessary.
2. The child was asked to perform each pattern again, this time after each performance notating it on paper “so that someone else could clap it back just by looking at what you’ve written”.

3. After notating all four patterns, the child was asked to perform form their invented notations, first in their original order and then in random order.

4. The child was then asked to explain how their notation helped in remembering the patterns.

Session II:

1. The child was asked to listen to the tape of an entire song (Row, Row, Row Your Boat the 1st year, and also a unfamiliar song the 2nd and 3rd years).

2. The child was asked to sing the song back exactly as heard on the tape and then to notate the song on paper.

3. The child was then asked to sing the entire song using the notation as a guide. The child was then asked to sing portions of the song as the researcher pointed to the corresponding notation.

Results:

This study produced many interesting findings. Those related to the goals listed above are included here.

- Text played a strong role in the responses of five- and six-year-olds, but not seven-year-olds who were better able to separate a text from its rhythm. The nature of the text may play a role in the ability to recall items accurately (“Row, row, row your boat” was easier than “merrily, merrily, merrily, merrily”). Decoding of items with a text was easier than items without a text for five- and six-year-olds, but this difference diminished considerably by age seven.

- The results supported Gordon’s findings that rhythmic ability does not remain constant across various types of skills.

- The predictability of children’s standing in relation to their peers from year to year is stronger for recall tasks than for notation of decode tasks.

- The accuracy of children’s notation of five syllables (within four pulses) grew substantially from age five to age seven, but notation of 12 syllables within four pulses was still difficult for the seven-year-olds. Recall of a rhythmic pattern was easier for all children than decoding the same pattern.
A Comparison Of Three Approaches To Teach Note-Reading And Note Location On The Piano Keyboard To Children, Ages Four To Six (Abstract)


Research Design

Posttest
N=89

Purpose:

1. To determine the effectiveness of three methods of teaching note reading and note location on the piano.

2. To gain information regarding the ability of young children to read notes on the staff.

Procedure:

Eighty-nine students in seven pre-schools (four to six years of age) completed one of three seven-week curricula designed to test three methods of teaching note reading and note location at the piano. Following completion of the course, the children were tested on their accuracy and response time in note naming and note location tasks.

Results:

1. No significant difference was found in the accuracy or response times of the children who participated in the three different curricula.

2. “The aggregate mean skill levels at note-naming/location was 67%,” indicating that young children are able to develop the ability to read notes on the staff.
Young Children: 

Listening
Effect Of Timbre And Register Modifications Of Musical Stimuli On Young Children’s Identification Of Chord Changes


Research Design:

Pretest-Posttest  
N=117 (grades K-1)

Purpose:

To determine whether modifying the timbre and register of an accompaniment will help kindergartners and first graders focus on the harmony when listening to an accompanied melody.

Procedure:

*Pretest*—Four children from each of six classes (three kindergarten and three first grade) were selected randomly to take the pretest. The children listened to two different midi files played on a synthesizer and recorded on cassette tape: a simple block chord progression consisting of the tonic and dominant seventh of C Major and a simple melody superimposed over the same progression. Four versions of the midi file were utilized, but each child listened to only one of the versions:

1. Both progression and accompanied melody were played with a piano sound

2. Timbre modified: chords were played with a synthetic oboe sound while melody was played with the same piano sound

3. Register modified: Both were played with the piano sound, but melody was played on the octave below middle C and the chords were played on the octave above middle C.

4. Both timbre and register modified: Chords were played with the oboe sound on the octave above middle C; the melody was played with a piano sound on the octave below middle C.

The children were told that the music could sometimes change and were asked to say “change” whenever a change occurred.

*Instruction:* Following the pretest, all 125 children participated in three 10-minute lessons given on consecutive days, including activities on harmonic discrimination including:
1. Describing the movement of the instructor’s hands on the keyboard when playing a melody accompanied by a chord progression.

2. Learning the word “chord” and applying it to the music played by the teacher.

3. Imitating the instructors left hand (chord) movements on an imaginary piano.

4. Playing an imaginary chord on one leg and changing to the other leg when the chord changed.

5. Saying the word “change” whenever they heard a chord change.

The six classes were randomly assigned to one of four types of instruction which differed in the number of lessons that used #5 above (verbal response).

Posttest: The same recorded synthesizer files as in the pretest were used. The children were told that they would play the same “guessing” game that they played during their lessons. They were asked to identify chord changes either by saying “change” or by switching an imaginary chord played on the leg from one leg to the other (whichever method they preferred).

Results:

- Most children were silent during the playing of the examples in the pretest, indicating that they did not recognize any chord changes.

- Following instruction, both kindergartners and first graders identified more than half of the chord changes of the chord progression without melody indicating that young children have the ability to detect changes in harmony when provided adequate instruction. However, identifying the same chord changes in the accompanied melody was very difficult for both age groups. Even first graders who scored significantly higher on this task identified less than half of the chord changes in the accompanied melody.

- The modification of timbre was the most effective in assisting the children to identify chord changes in the accompanied melody. However, even though they were improved as a result of the timbre modification, the scores were still low. Modification of register was even less effective. The modification of both timbre and register was not effective.

- There was no significant difference between the abilities of kindergartners and first graders to identify chord changes in the chord progression without melody, but first graders were significantly better and faster than kindergartners at identifying chord changes in the accompanied melody.
• Over half of the children who were instructed to respond verbally in two or three of the instruction sessions did so in the posttest, indicating that young children are capable of responding verbally if provided adequate instruction.
Mode Discrimination Abilities Of Young Children


Research Design:

Pilot Study: Pretest-Posttest
- N=8 (preschool, average age 4.3)
- N=16 (kindergarten, average age 5.6)

Main Study: Posttest
- N=32 (kindergarten, average age 5.5)

Purpose:

**Pilot Study**
- To investigate whether young children can tell the difference between major and minor modes.
- To determine if young children are able to label major and minor modes using appropriate musical terms.
- To compare children’s ability to identify major and minor modes verbally and non-verbally.

**Main Study**
- To examine whether kindergarten children can tell the difference between major and minor mode.
- To compare the children’s use of verbal and non-verbal responses in the mode identification task.

Procedures:

**Pilot Study**

Half of the children were given a pretest to determine whether the children could focus on mode changes in music without being directed to do so. Half of the children listened to a song known by them and half listened to a new song. Each song included eight changes of mode. The children were asked to listen for changes in the music and to clap when they heard a change.
All the children were then given four 10-minute group lessons where they learned the terms “major” and “minor” and applied them to music during listening activities. All children were then given a post-test including two activities. The first activity was the same as the pretest. In the second activity, the children were asked to listen to the same song again and apply the terms “major” and “minor” to the changes in the music.

**Main Study**

The study took place in Buenos Aires, Argentina. The main study did not include a pretest. All children received four 10-minute lessons where they learned the terms “mayor” (major) and “menor” (minor) and applied them to music during listening activities. After the training, each child was tested individually. The children were told that they would listen to a new song that was sometimes major and sometimes minor. Half of the children were asked to make a movement when they heard a change in the music during the first listening and to indicate whether the mode was “mayor” or “menor” the second time through. The other half of the children were asked to label the mode changes the first time through and to make a movement when they heard a change the second time they listened to the song.

**Results:**

**Pilot Study**

- The results of the pretest versus the posttest indicates that the children’s attention must be drawn to the changing aspect of the music (in this case, the mode) in order to perceive it readily. They will not spontaneously focus on mode changes, but they can do so when their attention is drawn to it.

- Preschool children’s scores on identifying major and minor modes were in general very low. However the kindergarten children identified more than half of the mode changes.

- The preschool children had difficulty using the terms major and minor to describe the music. The kindergarten children labeled accurately half of the major and minor fragments of the songs.

- The children’s verbal scores (using the terms “major” and “minor” to identify the changes in the music) were higher than the non-verbal scores (clapping when hearing a change in the music).
Main Study

- The children identified more than half of the mode changes when responding verbally, but less than half when responding through movement. This indicates that kindergartners can tell the difference between major and minor mode.

- The children scored significantly higher using verbal responses (labeling the mode changes) than using non-verbal responses (moving when they heard a mode change).
The Development Of Emotional Responses To Music In Young Children


**Research Design:**

Descriptive  
N=96 (40 children three to four years of age, 28 children seven to eight years of age, and 28 young adults)

**Purpose:**

To determine whether children’s emotional response to major and minor mode are innate—a result of the perception of concordant or discordant sounds—or whether the emotional associations are culturally learned.

**Procedure:**

Forty three to four year olds, 28 seven to eight year olds, and 28 young adults, all from Great Britain, participated in the study.

Eight tunes from the *Oxford Nursery Song Book* not used in school music classes were selected—four in major mode and four in minor mode. “Four versions of each tune were prepared: the original, its transposition into the opposite mode, and each of these with or without harmony.” Four tapes were created. All of the songs appeared on each tape in the same order, with each tape containing two of the tunes in each of the four versions. The same number of children within each age group heard each of the four tapes.

Two pictures of facial expressions were used to symbolize happy and sad emotions.

The youngest group was tested individually. They were asked to point to “the face that goes with each tune.” The older children were tested in groups of seven spaced throughout the room to avoid copying other responses. They were given a response sheet with eight pairs of faces and asked to mark the appropriate face for each tune. The young adults were tested in one group in the same manner as the older children.

**Results:**

Significantly more happy responses were given for tunes in the major mode.

The three to four year olds showed almost no difference in response to major and minor modes. There was, however, a large difference in response to major and
minor modes by the seven to eight year olds and an even greater difference in the young adults. “This suggests that the emotional response to major and minor modes develops between the ages of four and seven years.” It was noted, however, that while selecting the nursery rhymes for the study the investigators found several familiar sad nursery rhymes set to major mode tunes and happy rhymes set to minor mode tunes. This may delay the major-happy/minor-sad associations. In any case, the results support the theory that the association is culturally learned.

Other interesting findings:

The three to four year olds gave significantly more happy responses overall than the other two groups.

All groups gave significantly more happy responses when harmony was added to the tune.
The Effects Of Picture Book And Instrument Pictures During Music Listening On The Attentiveness, Attitude, Instrument Identification Ability, And Memory For Classical Themes In Pre-Kindergarten Children (Abstract)


Research Design:

Posttest
N=60 (three to five years of age)

Purpose:

To examine the effects of using a picture book and instrument pictures during music listening lessons on prekindergarten's attentiveness, attitude, instrument identification ability, and memory.

Procedure:

*Instruction:* Sixty children ages three through five participated in two small-group listening lessons based on *Peter and the Wolf*. The children were randomly assigned to one of six groups. Two of the groups received instruction using instrument pictures only, two groups received instruction using instrument pictures and a picture book, and two groups received instruction using no visuals. The lessons were videotaped and the tapes were reviewed to determine the length of attending time by the children.

*Posttest:* The children were tested to obtain data regarding memory for classical themes, identification of instruments, and attitude.

Results:

The use of pictures and/or the picture book did not have a significant effect on attentiveness, attitude, instrument identification ability, or memory for classical themes.
The Influence Of Movement Activities On Achievement In Melodic Pitch Discrimination And Language Arts Reading Readiness Skills Of Selected Kindergarten Music Classes


Research Design:
Posttest
N=145

Purpose:
To determine if the use of locomotor movement activities while singing action songs influences kindergarten test scores on melodic pitch discrimination and language arts reading readiness skills.

Procedure:
The Simons Measurements of Music Listening Skills (SMMLS), a standardized music test, and Smith's Picture-Word Recognition Test (PWRT) were given to 145 kindergarten children following a six-week period of instruction including movement while singing action songs.

Results:
Kindergarten students who received instruction through movement while singing action songs scored significantly higher on the SMMLS than students who did not receive this instruction. The students who received instruction did not score significantly higher on the PWRT.
The Effect Of High Versus Low Teacher Affect And Passive Versus Active Student Activity During Music Listening On Preschool Children's Attention, Piece Preference, Time Spent Listening, And Piece Recognition


Research Design:

Posttest
N=94 (Ages three-six years)

Purpose:

1. To examine the effects of high and low teacher affect on preschool children's attention, piece preference, time spent listening, and piece recognition. [High affect is defined as maintaining eye contact and using facial expressions indicating excitement, happiness, and enthusiasm. Low affect is defined as no eye contact and maintaining a bored facial expression. Attention is defined as visual attention to the teacher.]

2. To examine the effects of active and passive student activity on preschool children's attention. [Active student listening consists of directing the children to use small hand movements corresponding to characteristics in the music. Passive student activity consists of listening with hands placed in the lap. Attention is defined as visual attention to the teacher.]

Procedure:

*Instruction:* Ninety-four children, three-six years old, were divided into 12 groups of eight students each. Each group received four 15-20 minutes of instruction on four consecutive days. Instruction included four listening activities with a singing activity interspersed after the second listening activity for variety. The listening pieces were professionally recorded piano versions of “The Ballet of the Unhatched Chicks” by Modest Mussorgsky and “Leapfrog” from Jeux d’enfants by Georges Bizet.

Each group was assigned to one of four sequences of instruction utilizing the same combinations of high and low teacher affect, active and passive learning experiences, and the two pieces of music. Therefore, each instruction sequence was given to three different groups of children.

Each day each group participated in both passive and active learning experiences. For the first two days the teacher alternated between high and low affect in each group, so that all children received instruction with both high and low teacher
affect in each lesson. The last two days six of the groups received instruction with high teacher affect and the remaining six groups received instruction with low teacher affect.

Posttest: Each child was tested individually one to two days following the last lesson. The test consisted of the following tasks, with children randomly assigned to one of four different ways of ordering the test items. Each listening selection used in the instruction phase was paired with a similar, unfamiliar piece.

- The child was played excerpts from each piece in one pair and asked to choose the “song you liked to listen to the most.” This was repeated for the second pair of excerpts.

- Each of the four pieces were presented so that the child could listen to each piece until he pushed a button to stop the music. The amount of time spent listening to each piece was noted.

- Excerpts of each of the four pieces were played for the child who was asked if she knew the song or didn’t know the song. If the child responded that she knew the piece, she was asked what the song was about and to demonstrate “what we did with our hands for that song.”

Results:

1. Teacher affect resulted in higher levels of attention by the students. The was particularly evident when the high affect was followed by low affect on the days when children received instruction in both teaching modes (days one and two). The differences between students’ on-task behavior did not appear so large when the teacher affect did not change within the class period (days three and four). Teacher affect did not have a significant effect on piece preference, time spent listening to pieces, or piece recognition.

2. The level of on-task behavior tended to be higher during an active listening activity and lower in the passive activity when the active listening was presented first. In lessons where the passive activity was presented first, the differences appeared slight.
Discrimination And Categorization Of Pitch Direction By Young Children


Research Design:

Descriptive
N=70 (ages three, four, and five years)

Purpose:

1. To develop a method that would provide the children with a means of responding that is nonverbal and does not require the child to make visual-spatial associations (e.g., up/down arm movements) to indicate pitch direction.

2. To identify whether children focus on the set of pitches used or the first note of the aural examples rather than on pitch direction. (Previous studies have shown an inability for preschool children to discriminate pitch direction, and it has been suggested that perhaps children are focusing on these other features rather than on the relationship between consecutive pitches.)

3. To explore children’s abilities in both the discrimination and categorization of pitch direction.

Procedure:

Seventy-five preschool children participated in the study. The children were grouped into four age categories at the first session: 3.5 years, 4 years, 4.5 years, and 5 years.

The children were asked to complete the three tasks described below. For each task, three visual designs (each representing an aural example, except for the Visual Oddity Test) were presented to the children on the computer screen. The children responded by touching the corresponding visual design on the screen.

- Visual Oddity Test: Each of twelve trials presented pictures of objects familiar to the children. The child touched the picture that was different from the other two.

- Discrimination Test: Each of twelve trials presented three aural examples. Two of the examples were identical. In six of the trials, the third example included the same pitches (pitch set) but with the opposite pitch direction (e.g., do-re-mi, do-re-mi, mi-re-do). In the remaining six trials, the third example utilized different pitches, but began with the same note as the other two
examples. (e.g., do-re-mi, do-re-mi, do-ti-la). The child touched the picture associated with the aural example that was different from the other two.

- **Categorization Test:** Each of twelve trials presented three aural examples. For each trial, two of the examples could be categorized together by either sharing the same pitch direction, sharing the same note, or sharing the same pitch set. Therefore, any of these categories could be chosen within each trial. The child identified the example that did not fit the category chosen as being different by touching the associated visual design on the computer.

**Results:**

1. Nearly all of the children (95%) responded correctly on all 12 trials of the Visual Oddity Test, indicating that they understood the concept of same and different when applied to familiar visual objects and were able to respond correctly in this testing situation. The children were comfortable with the computer and seemed to enjoy their interaction with the screen. The children were highly interested in participating in the testing and many expressed disappointment when the study was concluded.

2 and 3. (The results corresponding to these two purposes were difficult to separate.)

**Discrimination Test:** Fifty-seven percent of the children did not discriminate pitch direction—24% focused on the first note or the pitch set in their responses and 33% responded randomly. The five-year-old children discriminated pitch direction more accurately than the children in the three younger age categories. Of the children who were able to discriminate pitch direction, 61% were five-year-olds. There was no significant difference between the three younger age categories in ability to discriminate pitch direction. The younger children focused on the first note or the pitch set rather than pitch direction. However, it should be noted that individual younger children were able to outperform individual older children. One child of three years and nine months discriminated pitch direction with a score of 11 out of 12 while a five-year-old scored only at a chance level of 6.

**Categorization Test:** Categorization was found to be a more difficult task than discrimination. Ninety-three percent of the children did not categorize on the basis of pitch direction. Only 13 of the 69 children (19%) responded to the Categorization Test in a consistent manner. Of those children, 62% categorized the aural examples on the basis of pitch set and 38% categorized them on the basis of pitch direction. None of the children categorized the examples on the basis of the first note. The responses were not age related.
Multi-age, Multi-task Studies
A Case Study Of The Musical Abilities Of Three And Four-Year-Old Children


**Research Design:**

Descriptive
N=27

**Purpose:**

To determine the following:

- Validity and reliability of evaluation tools designed to obtain information in the areas of pitch, rhythmic and melodic patterns, melodic contour and modality.

- Range of abilities in response to aural discrimination tasks.

- Difference in response of three-year-olds as compared to four-year-olds on aural discrimination tasks.

- Difference in response of boys as compared to girls on aural discrimination tasks.

- Difference in response of children from enriched music backgrounds as compared to children from lesser music backgrounds on aural discrimination tasks.

**Procedure:**

A list of musical tasks was devised on the basis of a study of several early childhood music textbooks. The ten tasks included singing, playing and same/different verbal responses. The children were also given a separate singing test consisting of singing responses, pitch matching, and rhythmic discrimination. The children were tested in 20-minute sessions at the University of Illinois’ Child Development Laboratory. A questionnaire was also completed by parents to gather data on home musical environmental factors and on children’s musical behavior outside of school.
Results:

- There was a strong positive correlation between singing scores, music discrimination test scores, and child background data.

- The song with minor chords and a stepwise descending pattern at the end was sung more accurately than others. Ascending-descending patterns were easier to identify than either ascending or descending examples. Low pitch examples were easier to identify than high pitch examples. There was little difference in the difficulty of identifying rhythmic and melodic, short and long, and ascending and descending patterns.

- There was a negative correlation between age and child data ratings and age and singing scores and a positive correlation between age and music discrimination test scores.

- There was a positive correlation between home musical environment and both singing scores and music discrimination test scores.

- Older children scored higher on the music discrimination test, but younger children scored higher on the singing test.

- No relationship was found between sex and music discrimination scores or sex and singing scores.

- Children from a musical home background scored higher than those from a less musical background.
The Development Of Musical Experience In Children Of Pre-School Age


This article combines findings of research studies (primarily German) with the author’s own findings. While not a detailed research report, it is included here due to its frequent citation in other studies and the inaccessibility of the German language references.

“The findings described in this paper are based on observations, individual tests and particularly on tape recordings of the singing of 500 children who were the subjects of the experiments. In addition the observations and comments of their parents were noted and evaluated.”

Findings:

- In the last months of pregnancy, when a mother listened to music the fetus reacted by becoming particularly active.

- Beginning about the time of the baby’s first smile, soft music of any kind had a calming effect on infants. This change between four and six months of age when babies begin to turn toward the source of music and listen to it, “often with an unmistakable expression of astonishment and joy”.

- High pitched voices and instruments (such as recorders and glockenspiels) had a soothing effect on babies.

- Between four and six months children began to respond to music with clear, repetitive movements, usually made with the whole body, such as bouncing and swaying. These movements were not in time with the music and were seldom synchronized with it, but they were rhythmic within themselves due to their repetitive nature. Between 15 and 18 months about 10% of children began to match their movements to the rhythm of the music for short periods of time.

- Shortly after they began overt movements, children began to make vocal sounds—crowing or chuckling—in response to music. Musical babbling—sounds of varied pitch—began in response to singing to the infant. These vocalizations were not diatonic or rhythmic. The intervals were mostly descending, moving in micro-intervals, and the range was about an octave centered around f’.

- At 18 months, children begin to want to dance with others.
At about two years of age children, even lively ones, began to exhibit attentive listening to music for several minutes at a time. They may also responded to music by spontaneously dancing about the room.

30% of the children aged one to two began to imitate songs they have heard. Children imitated the words of a song before rhythm and pitch. (16% matched the rhythm and pitch first and began to include the words between the ages of two and three). About 50% of three-year-olds could imitate words, rhythm, and pitch of a whole song more or less correctly.

Less than 50% of children aged three to five made spontaneous movements in response to music and the variety of these movements also decreased. By the age of six most children no longer responded to music with repetitive movements. However, there was still a connection between movement and music through learned movements like singing games and dances.

The number of children between the ages of four and six who could match movement to the rhythm of music doubled in this time period. Considerable progress was also noted in the length of time a child could maintain this coordination.

When played on an instrument (no words) only about 40% of four-year-olds recognized a song they knew. This rose to 75% by age five.
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