A TEACHING TECHNIQUE TO AID
THE DEVELOPMENT OF VOCAL ACCURACY
IN ELEMENTARY SCHOOL STUDENTS

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

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1997

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ABSTRACT

This study reviewed a teaching technique aimed at aiding the development of vocal accuracy for inaccurate singers in Grades 1, 3, and 5. The study involved 78 children from an urban school district who were identified by their music teachers as being vocally inaccurate. Matching games (card game, sound jar game, and voice-matching game) were developed to explore transfer of knowledge of the term "match" from a visual understanding to an aural understanding as an aid in the development of vocal accuracy. The teaching technique was administered individually to students. Two groups were randomly assigned. Group I students played all three matching games. Group II played only the voice-matching game. Students were asked to make self-assessments of their singing. Students took a pretest, a posttest, and a repeated posttest one week later. Their responses were recorded on audio tape and rated by three music educators.

Results of the study revealed that all grade levels in Group I had an immediate significant gain in vocal accuracy from the Pretest to the Initial Posttest (p < .02). All grade levels in the study showed a significant gain in vocal accuracy from the Initial Pretest to the Repeated Posttest. In comparing Group I scores of the Initial Posttest and
Repeated Posttest, no significance was revealed, suggesting that there was retention of the skill one week later.

The independence of test and correctness of student self-assessment was explored through a chi-square analysis, which showed no significance. Student self-assessment (correct assessment, incorrect assessment or did not know) was unrelated to test (pretest, initial posttest, repeated posttest). Percentages of students' correctness were reviewed for each group in each grade. Data showed that 63% of the inaccurate singers were correct in their self-assessments.
Dedication

to my father ...
ACKNOWLEDGMENTS

I wish to thank my husband, Joel, for all of his patience, silence, and emotional support. I thank my daughters, SallyJane and Jill, for their encouragement and support toward completing this degree.

I also wish to acknowledge my adviser, Dr. Patricia Flowers, for all her wisdom, guidance, and help throughout this degree and final project. I want to thank elementary music educators: Christopher McManus, Deborah Forsblom, Nonon Mooney, Kathy Rapp, Carol Welk, and Joanna Porreca, who made it possible for this project to happen in their schools. I also wish to thank Jayne Wenner, Beth Reece, and Elizabeth Hulsey for their time spent in serving as judges of my data. I extend a thank you to all the elementary school classroom teachers who graciously let me work individually with their students.

I would like to express a special thank you to the members of my committee for their guidance, compassion, and professional thoughts throughout this project: Dr. Hilary Apfelstadt, Dr. Judith Delzell, and Dr. David Butler.
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PUBLICATIONS


# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>ii</td>
</tr>
<tr>
<td>Dedication</td>
<td>iv</td>
</tr>
<tr>
<td>Acknowledgments</td>
<td>v</td>
</tr>
<tr>
<td>Vita</td>
<td>vi</td>
</tr>
<tr>
<td>List of Tables</td>
<td>ix</td>
</tr>
</tbody>
</table>

## Chapters

1. INTRODUCTION
   - Need for the Study                     1
   - Problem Statement                      3
   - Research Questions                     5
   - Limitations of the Study               6
   - Operational Definitions                7

2. REVIEW OF LITERATURE
   - Music-Related Literature               9
     - Vocal Range and Patterns             9
     - Modeling Consideration              12
     - Teaching Sequence and Technique     15
     - Group/Individual                     20
     - Feedback                             20
     - Accompaniment                        23
     - Vocabulary                           23
     - Summary                              24
   - Learning-Related Literature          25
     - Perceptual/Conceptual                25
     - Learning Modality                    27
     - Discrimination                       30
     - Transfer Learning                    33
LIST OF TABLES

Table                                                                                         Page
3.1  Dispersion of Children ........................................................................................................ 38
4.1  Comparison of Test Scores by Grade and Group ..................................................................... 50
4.2  Composite Comparison of Test Scores .................................................................................... 51
4.3  Chi-Square Analysis for Correctness of Self-Assessment for Students Who Remained in the Study .......................................................... 53
4.4  Percentage of Correctness of Self-Assessment by Group and Grade Across All Three Tests .................................................................................. 54
4.5  Percentage of Correctness of Self-Assessment of Students Who Were Dropped from the Study due to a Perfect Score on the IPR .................................... 55
CHAPTER 1

INTRODUCTION

It is important to develop the skill of singing in music education programs. There is a predominance of singing in elementary general music classes. Music series books contain many songs for classroom singing. While most children learn to sing in tune on their own, some encounter difficulty. Teachers work with all levels of singing skill in group settings. Pitch matching is one aspect of tuneful singing. It is a skill that teachers hope to develop in each student and a topic of interest for researchers. In their article, "Recent Research on Singing in the General Music Classroom," Goetze, Cooper, and Brown (1990) synthesized findings reported in several succinct studies on the topic of pitch matching. From the research reviewed, the authors categorized the studies and drew the following conclusions and implications (Goetze et al., 1990):

1. There is a positive relationship between age and singing ability. [Older children sing with greater accuracy.]
2. The relationship between pitch discrimination ability and vocal accuracy remains unclear. [Those who sing in tune have a high rate of pitch discrimination. However, those who have problems are not always weak at pitch discrimination.]
3. [The vocal range ... may be affected by the vocal register used and thus,] range can be affected by the presence, pitch, and quality of the vocal model.
4. Researchers and teachers wishing to eliminate the complexity of the singing task might choose short patterns encompassing a small range and containing intervals of a 4th or smaller.

5. There is inconclusive evidence regarding the effects of harmonic accompaniment on children’s singing. Simple harmonic accompaniment appears to be more beneficial than complex harmonic accompaniment.

6. In both research and in teaching general music, the timbre and pitch of the vocal model must be considered. [Goetze et al. suggested that children of male teachers may ‘take longer in achieving’ the skill to match pitch and suggest that male teachers ask a child to be the vocal model.]

7. Young children may sing more accurately alone than with a group. Music teachers should assess children in both settings.

8. There is insufficient evidence to conclude whether children sing more accurately with or without text.

9. Singing accuracy may be improved with attention to training the breath control.

10. [While verbal and/or visual feedback following performance has been beneficial,] individual or small group responses may be necessary [to provide] qualitative information.

11. Individuals do benefit from vocal instruction. Specific techniques such as ... sequenced activities ... have been shown to be effective. (p. 30)

The authors concluded that children can be taught to be more accurate singers. They suggested that focused instruction is needed.

The focused instruction used in the current study was first employed in a kindergarten music class of 25 students. Due to a positive response, a pilot study was conducted with individual children from three public schools – two urban and one suburban. Positive results led to the desire to conduct a study designed from previous research in vocal accuracy and educational theory.
Need for the Study

This study explores a solution to the need for effective techniques to help inaccurate (out of tune) singers in the elementary music class. Such techniques are needed because:

1. These students do not learn the skill spontaneously.
2. Group instruction is the approach used by most teachers.
3. These students need simple, reinforcing activities that are fun and not frustrating.
4. Documentation of effectiveness of techniques is needed when the effectiveness of many approaches is not demonstrated in the literature.

A technique was designed using the following systematic guidelines.

Range. The present technique used a comfortable singing range as indicated by literature.

Length of patterns and size of intervals. The present technique used short patterns with intervals no larger than a fourth.

Vocal model. The present technique used a female vocal model.

Individual vs. group singing. The present technique worked with children individually.

Text vs. no text. The text was selected for its general appeal to participants, as well as the natural, rhythmic flow of the words with the rhythm and melody of the examples.
Feedback and assessment. Each participant in the present study verbally assessed his/her own performance with reinforcement from the investigator. This means of assessment on vocal accuracy was not found to have been used in the literature reviewed for the study. Welch, Howard, and Rush (1989) used equipment that visually showed children the movement of their voices so they could see when they matched the pitch, but they did not aurally make the decision for themselves.

Use of sequenced activities. The present technique involved children in sequential activities (card game, sound jar game, voice-matching game).

It is hoped that teachers will be interested in a new technique that will be applicable to their classroom. The technique in the present study used materials easily accessible to teachers (three pairs of matching picture cards, three pairs of sound jars, and three sung phrases).

Teachers often times use vocabulary in terms understood by adults, but not by children. McMahon (1982) pointed out that the vocabulary problem is compounded by the frequent mismatch between words used by adults and the meaning attributed to them by children. Nierman (1985) believed that vocabulary needed to be understood, or a musical test could measure the presence or absence of vocabulary, rather than musical skill. Hair (1977) concluded that 1st-grade children appeared to understand the concept of tonal direction but did not know the terminology. She further suggested that the terminology could be learned with the proper training technique. Flowers (1983) recommended that future research be conducted which would study methods to best
facilitate correct application of vocabulary to music. The current study focused on the understanding of the word “match” as it is used in an aural context to aid vocal accuracy.

Sometimes, when teaching an element, teachers do not focus instruction on visual, aural, and kinesthetic experiences for students. This study actively involved students in focused activities that involved a matching card game, a matching sound jar game, and a voice-matching game.

**Problem Statement**

Much research has been conducted in the area of children’s vocal accuracy. Recommendations from previous studies were used in assembling the technique explored: nonvibrato soprano voice for a vocal model; range within C4 - A4, short, melodic patterns containing only steps and skips within the interval of a fourth; attention to learning modality; and feedback in vocal accuracy. In the current technique, sequential games (card game, sound jar game, and voice-matching game) were played. Whenever children sang, they were asked to make a self-assessment of their singing performance. This form of feedback was not found to be used in studies related to vocal accuracy which were reviewed for this study.

The problem in this study was to determine if the teaching technique (playing a card game, a sound jar game, and a voice-matching game) helped vocally inaccurate singers in Grades 1, 3, and 5 become more vocally accurate and to determine if singers could correctly assess their singing performance.
Research Questions

1. After completing a sequential series of matching games (a card game, a sound jar game, and a voice-matching game), will children in Grades 1, 3, and 5 improve their vocal accuracy when a teacher asks, “Can you match my singing voice?”

2. Will children’s vocal accuracy improve when they complete only a voice-matching game?

3. Will children correctly assess their own singing performance, and will their assessment be related to test (pretest, initial posttest, and repeated posttest)?

4. Will the lapse of time (one week) have any effect on vocal accuracy as recorded on the repeated posttest?

Limitations of the Study

This study did not test the long-term retention of pitch-matching skills after the technique had been administered. The initial treatment took place in a 15-minute time span. A week later, the posttest was repeated. Data collected from this time span were used in writing results of the study.

The teaching and testing techniques were developed and implemented as a total package. Claims about any isolated aspect of the study may not be made because of its holistic nature. Each grade level within each group was studied as an independent cohort. Group or grade level comparisons were not made.
Operational Definitions

Comfortable Starting Pitch (CSP). This study used F4 (see “Vocal Range and Patterns” in Chapter 2.

Curwen Hand Signs. Hand positions for each note of a scale. These positions were first used by John Curwen and have become widely used by music educators as a visual/kinesthetic representation of pitches.

Inaccurate Singer. A child who does not consistently sing on pitch.

Initial Posttest (IPO). The test given to participants at the end of their initial meeting. Scores of the posttest are compared with the initial pretest (IPR) and repeated posttest (RPO).

Initial Pretest (IPR). The initial test given to participants to (1) validate the music teachers’ selection of participants as inaccurate singers and (2) compare scores with the initial posttest (IPO) and against the repeated posttest (RPO) one week later.

Matching Games. (1) Card matching game - matching picture cards by turning cards over and making the sound of the animal on the card. (2) Sound jar game matching sounds by shaking covered jars. (3) Voice matching game - matching voice to the video examples.

Repeated Posttest (RPO). The posttest given to all subjects one week after the initial testing.
Vocal Accuracy. The “ability to reproduce, with a high degree of accuracy, melodic contour, melodic intervals, and melodic rhythm, while maintaining tonality” (Apfelstadt, 1983).
CHAPTER 2

REVIEW OF LITERATURE

The review of literature is divided into two major categories: music-related and learning-related as it pertains to vocal accuracy. Within each category, areas of study are analyzed that relate to vocal accuracy, teaching technique, and learning. Relationships to the current study are made at the close of each section.

Music-Related Literature

Vocal Range and Patterns

What is the best range to use when testing elementary school-aged singers? While most of the research read indicated the best range to use is an interval of a sixth from C4 to A4, there are some new thoughts from research that indicate range is dependent upon the register to be used.

Vaughan (1980) reported that the natural range of children’s singing voices appeared to be lower than suspected by series’ books and teachers. She tested children from Canada, Argentina, Colombia, Denmark, and England. Her findings showed an initial pitch for 4-year-olds to be around E4. Howle (1992) suggested that one of the
causes of poor singing in children's voices was the result of too high a tessitura of many songs in series' books. She suggested that the comfortable level of pitch for children needed to be met and kept to the interval of a sixth, i.e., C4 to A4.

While her study focused on the effect of a female vocal model, Small (1983) kept her study in the keys of D flat, D and E flat as she worked with different orders of do, re, mi. These keys kept participants within the C4 to A4 range. While studying pitch pattern accuracy of pre-schoolers, Flowers and Dunne-Sousa (1990) used tapes of different starting pitches so that the subjects could sing in their most comfortable ranges.

Goetze et al. (1990) expressed that the range of pitches depended on the register to be used - chest or head. Atterbury (1984) suggested vocal exploration of whispering, speaking, singing, chanting, and imitating environmental sounds to make children aware of all the sounds their voices can make as they exercise their different vocal registers.

Davidson's (1985) longitudinal study explored the development that occurs between structures of earliest songs and the beginning use of such tonal structures as scales. He found that children began their pathway to song with vocal exploration and observed that children between the ages of 1 to 5½ years old gradually widened the intervals that they could control, yielding tonal frames, which they used as templates for standard songs and inventions. He found that contour schemes featuring leaps preceded those of steps. By the age of 3 years, all participants were comfortably using melodies from a scale comprised of a minor third with a step on the top or bottom. This scale can
translate as one that could contain the tonal grouping of so, mi, and la or do, low la, and low so.

Tatem (1990) tested pitch accuracy at three levels: single tone, interval, and tonal pattern. His findings supported Davidson’s (1985), in that he found more accuracy with tonal patterns using combinations of intervals of thirds and seconds than with a single tone or interval. He also found the most comfortable range of his subjects to be C4 to F4.

Heaton (1992) found the spontaneous singing of “air ball” by fans at basketball games to consistently be F4 falling to D4. He checked the pitches at basketball games with a pitch pipe, viewed videotaped games, and replayed the chants from those games to check the pitch. In each instance, pitches were closely above or below F4 and D4, with the majority using the exact pitches of F4 and D4. This could lead one to conclude that these pitches seemed to be the most natural and comfortable for people when they used their singing voice. Heaton’s findings agreed with Howle (1992) and Tatem (1990), as to the comfortable area of the voice.

Using results and suggestions from the literature, the current study gave students in Group I the opportunity for vocal exploration in the chest, middle, and head registers by making the sounds of a lion, cat, and cuckoo, respectively (Atterbury, 1984; Goetze et al., 1990). The study also aimed for a level of naturalness and familiarity by using patterns only encompassing the interval of a fourth and built on thirds and seconds as suggested by Davidson (1985), Howle (1992), and Tatem (1990). Pitches selected were
D4, F4, and G4 to correlate with the natural tendency of pitch level found by Heaton (1992) and Tatem (1990).

**Modeling Consideration**

Many studies have been conducted to determine which voice, male or female, is the best model to use when developing a child’s voice. Goetze et al. (1990) found that most of the literature in this area came from male teachers who were hoping to find the best vocal model to use with their students. Studies have shown that children have difficulty matching pitch when the model is a different timbre or in a different octave from their own voice (Price, Yarbrough, Jones, & Moore, 1994; Sims, Moore, & Kuhn, 1982; Tatem, 1990).

Most studies researching the best vocal model indicated that the female voice was the best model for children. Green (1990), Howle (1992), Petzold (1969), Tatem (1990), and Yarbrough (1992) found that children responded better to a female vocal stimulus than to other stimuli in their studies. Yarbrough (1992) studied the effect of vibrato on pitch-matching accuracy of certain and uncertain singers. Children in kindergarten through Grade 3 responded to either a child, female non-vibrato, or female vibrato voice. Her results showed that vibrato did affect pitch-matching of uncertain singers and that the children responded more accurately to the female non-vibrato voice. Working with children from the same grade levels as Yarbrough, Tatem (1990) used instruments (oboe, piano, resonator bells, trumpet, and violin) and the soprano voice as
models. Results showed that the children responded better to the soprano voice than to any of the other instruments.

Some studies have found that a different octave or another timbre affects a child’s ability to be vocally accurate. Price et al. (1994) studied the “Effects of Male Timbre, Falsetto, and Sine-Wave Models on Interval Matching by Inaccurate Singers.” The interval of a minor third was sung by a tenor and bass in their registers (G3 - E3) and in falsetto (G4 - E4). They found that the children did not make the octave transfer when singing in response to a male vocal model. The high octave generated responses above middle C, while the low octave resulted in responses below middle C. The results suggested that children did not make the octave transfer to sing in the treble range when the stimuli were in the lower octave male model. While the authors suggested that more data are needed to support modeling in the same octave as children, the results indicated support for such a model. The authors further concluded that “it may be that students who are identified as inaccurate singers are more a function of our lack of understanding how best to teach singing and pitch matching, than the result of some innate ability or physically limiting condition” (Price et al., 1994, p. 282).

Montgomery (1988) investigated 3rd-grade students’ responses to a normal male voice and a falsetto male voice. He wanted to determine if one model was more effective than the other in teaching vocal accuracy to 3rd-grade children. His results indicated that the means of instruction did not make a significant difference in vocal accuracy. He also found that the interaction of means of instruction with mode of testing
was not statistically significant. He did find that the vocal model used in testing did make a difference in vocal accuracy within the two groups. Montgomery concluded that, while there was no difference in vocal accuracy by use of instruction, the use of falsetto in test patterns did yield greater accuracy in student response.

Sietto (1992) found that subjects responded most accurately to soprano and falsetto models than to a male tenor. The soprano and falsetto models were in the children’s octave. Tatem (1990) found the same octave displacement problems when children tried to match pitch with resonator bells which sound one octave higher than the children’s comfortable singing octave.

Some studies have used the child voice as the vocal model. Hanser (1982) used student high scorers on her pretest as tutors for other students. Cooper (1992) used a tape-recorded child’s voice in her study to measure vocal pitch and vocal contour accuracy. Green (1994), following her 1990 finding of children matching a child model best, did not use an adult voice in her 1994 study. In her study entitled, “Unison versus Individual Singing and Elementary Students’ Vocal Pitch Accuracy,” children sang a familiar song alone and with a group. She concluded that children sang more accurately with their peers than when they sang alone. Because the result conflicted with findings of recent studies on group versus individual singing by Goetze (1985), Goetze and Horii (1989), and Smale (1988), Green hypothesized that the difference in her study was the absence of the adult voice in unison singing. She suggested that the lack of the
additional vocal timbre made it easier for the children to hear their own voices and sing accurately with a similar timbre.

Based on the results of literature read, the current study used a non-vibrato female voice. The child sang alone so that the timbre of the female voice would not enter the aural field as the children listened to their own singing and assessed if they had made a match.

**Teaching Sequence and Technique**

The teaching sequence and technique used by teachers to teach vocal accuracy may hold the key to the learner's success. Price et al. (1994) alluded to this by saying that "it may be that students who are identified as inaccurate singers are more a function of our lack of understanding how best to teach singing and pitch matching, than the results of some innate ability or physically limiting condition" (p. 282). Goetze et al. (1990) concluded that, while children could be taught to sing accurately, teachers could not assume that this skill would develop simply from classroom singing and should have involved direct instruction. "We hope that future research will clarify further those techniques and conditions that are most effective with particular age groups or populations" (Goetze et al., 1990, p. 32).

Davidson (1985) studied the development that occurred between structures of earliest songs and the beginning use of those structures as scales. Levels of Contour Schemes (p. 367) were created and graphed according to children's ages to show sequence of levels on contour schemes of leaps and steps. Patterns of skips and steps
occurred in the majority of children tested between 1 and 3 years old. The tonal development recorded by Davidson could indicate a possible sequence of teaching melodic patterns.

Gould (1969) investigated the singing problems of elementary school children and developed ways of helping them find and learn to use their singing voices. The first phase of his study consisted of visiting successful teachers of singing in their classrooms. The second phase involved pilot studies where teaching techniques emerged. The third phase consisted of experiments in classrooms using sequences discovered in phase 2. The many observations of teachers working with their students led to a focus on the dual importance of concept formation of tonal images and the skill development of vocal responses. Gould believed that, to understand the concept of singing, a student needed to develop a vocabulary of aural and mental skills as well as vocal motor skills. When these two vocabularies combined to form a single concept, the mind should be free to expand its vocal ability. Gould (1969) investigated the singing problems of elementary school children by conducting a nationwide survey of singing problems. He led pilot studies wherein techniques emerged and conducted experiments in classrooms using techniques gathered from pilot studies. He determined the following sequence to accurate singing: speech activities, moving from speech to individual singing, experiencing unison singing, and finding one's true singing voice as one's singing vocabulary developed.
In her study of the effects of melodic perception instruction on pitch discrimination and vocal accuracy of kindergarten children, Apfelstadt (1983) found that both experimental groups gained significantly in vocal accuracy on pitch patterns. She concluded that such a gain may have been because both groups received conceptually-based instruction while the control group did not. Because the first experimental group emphasized melodic direction, contour, and rhythm and the second experimental group emphasized only melodic rhythm, she said that “general focus on musical elements, rather than specific focus on melodic direction or contour, may have contributed to the fact that significant gains were made by both experimental groups” (p. 113).

Howle (1992) presented findings from literature and professional journals concerning characteristics of uncertain singers. She found prevalent issues to be gender, motivation, and age. She named the causes of poor singing to have been home environment, pitch perception, melodic content, social factors, listening skills, and accompaniment. She suggested the following remedial techniques for children with pitch problems: (1) become aware of the voice by touching the throat and doing vocal exploration, (2) begin early, (3) use new material, and (4) employ feedback.

Further suggestions from Howle (1992) were to use easy, unison songs, surround uncertain singers with strong singers, model correct sounds, encourage soft singing, do echoes and games, put a hand up to one ear, and use imagery such as a floating cloud, a bullseye, or hand motions.
In addition to the use of short descending patterns, Goetze et al. (1990) suggested the following as possible "requisite skills for accurate singing":

1. Pitch discrimination, including the abilities to tell one pitch from another and to recall successions of pitches.
2. Pitch production, vocalizing over a wide range of pitches.
3. Pitch monitoring or the ability to attend to vocal pitch.
4. The motivation to attempt to sing. (p. 19)

While there were no significant differences in learners' scores, Pautz (1988) tried to match teaching technique with the learner's perceptual learning preference. There was a tendency in scores to suggest that matching instructional strategy with the student's learning preference did have some positive effect on student learning.

Apfelstadt (1983) and Persellin (1993) studied the effects of visual and kinesthetic activities on vocal accuracy. Apfelstadt had students manipulate icons, move their bodies, and play bells. She found that her modes of instruction made a difference in vocal accuracy on performance of pitch patterns. Persellin used aural, visual, and kinesthetic experiences separately, to see if one was stronger than the other. The study found that the visual mode had greater results than the aural or kinesthetic modes did with 1st-grade students. Scott (1977) had children first complete a visual activity before doing an aural one. They compared the appearance of balls to find the same and different ones before being asked to listen and compare the sounds from "sound boxes" to find the same and different ones.

Paladino (1991) studied the "effect of aural feedback on the singing accuracy and melodic perception of children in grades one and three." Activities utilized for
perceptual understanding included verbal labeling, kinesthetic mapping of melodic contour, and some reading of iconic notation. Experimental groups improved significantly in their melodic perception.

In an attempt to understand how best to teach for vocal accuracy, the current study used suggestions from these reviewed studies. Following suggestions from studies by Apfelstadt (1983), Pautz (1988), and Persellin (1993), children in Group I completed one visual and two aural activities while Group II participants completed only one aural activity. The activities were administered in a sequential manner beginning with familiar games and activities. The teaching technique began with a visual activity as supported by Persellin's findings. The instruction was direct, involving motivational games, and used short descending patterns, as suggested by Goetze et al. (1990). The melodic content of the patterns came from leaps and steps within the intervals of a third and second contained in a fourth as used in patterns sung by children between the ages of 1 and 3 years as charted by Davidson (1985) and reported by Tatem (1990). These tonal images combined with a vocabulary of aural and mental skill to merge with vocal motor skill. This process was supported by Gould (1969). The activities in the current study involved children in concentration, memory, discrimination, and motivational games. Howle's (1992) work suggested that these processes are important to the development of vocal accuracy.
Group/Individual

Is vocal accuracy best developed in group or individual settings? Marx (1982) found that singers of junior high age improved significantly in an individual setting rather than in a group setting. The individual singer received the individual feedback and greater attention than did the group. Goetze and Horii (1989) worked with primary grade children and also found greater vocal development from working individually with primary grade children than from working with them in a group. They suggested that younger children could not entertain two things at once as they must do in group singing.

Green (1994) found just the opposite of most group/individual studies. Her study revealed that children sang more accurately in groups of 8, rather than individually. There was no attempt to mix strong singers with weaker singers. Using findings of her previous research, she did not use an adult voice in the study, but limited the singing to just children’s voices. The absence of the adult timbre seemed to make a difference. She also noted that children sang with more ease in the group situation than they did individually.

In the current study, the investigator worked with children individually. This format enabled the child to receive greater attention as supported by Marx (1982) and not to entertain two things at a time, as suggested by Goetze and Horii (1989).

Feedback

The means in which feedback on pitch matching skill has been completed in past studies could have had an effect on the development of the skill. Hanser (1982) used
pretest high scorers as tutors who provided verbal feedback to their peers. Her work showed that peers may have been effective in the learning process.

Welch et al. (1989) based their study on visual feedback to aid in the development of pitch accuracy in singing. Welch (1985) found the quality of feedback to be a function of the singer’s mentally-processed interaction between external and internal feedback systems. Welch et al. (1989) stated, “The efficiency of error labeling schema for vocal pitch matching was dependent on the degree of meaningfulness that the individual was able to attribute to the pitch model and vocal response” (p. 147). This belief could play an important role in the uncertain singer’s internal feedback. The SINGAD (Singing Assessment and Development) microcomputer-based system developed by Howard and Welch (Welch et al., 1989), was devised to provide meaningful visual knowledge of results to the developing singer. The program gave the children visual feedback by showing them the contour of their singing in comparison with the contour of the model given. Some of his groups also received verbal feedback from adults, in addition to the visual feedback. These groups showed a significant difference in their abilities to be vocally accurate. A test was conducted 6 months later, and these groups demonstrated that their improvement had been maintained. Welch et al. (1989) concluded that the verbal and visual feedback were the optimum forms of qualitative feedback when compared with visual feedback only.

Paladino (1991) used a self-monitored, aural feedback device (a plastic gallon jug, cut in half, and used as a telephone receiver). This allowed children to focus on
listening to themselves. While the experimental group in tested grades improved significantly in melodic perception, there was no improvement in singing accuracy during the 6-week experimental period. Perhaps the study needed to focus on discussions of what the children heard through the “receiver.” Sims (1991) asked preschoolers to respond to their own singing when asked to make a song louder/softer and/or faster/slower. She found that children had a higher percentage of correct responses to their singing than to recorded excerpts.

Goetze et al. (1990), Howle (1992), Paladino (1991), and Welch et al. (1989) strongly supported the need for feedback in developing vocal accuracy. The current technique expanded the area of feedback to include the individual singer verbally providing his own feedback by assessing his singing performance. The self-assessment was then reinforced and discussed with the investigator. Studies reviewed made wide use of external feedback, i.e., feedback from a source other than the singer. The present study asked the child to decide if his/her singing performance was accurate or inaccurate before receiving feedback from another source. If the response was inaccurate, the investigator asked the child if his/her singing was above or below the model. In responding to whether his/her voice was above or below the model, the child was again assessing his/her own performance. This self-assessment involved using the skill of memory, recall, and inner hearing, three skills that Goetze et al. (1990) believed to be necessary to developing vocal accuracy. This aspect of the technique is a major difference from the reviewed literature. Perhaps personal feedback (self-assessment) is
one of the links to understanding how best to teach vocal accuracy (an idea expressed by Price et al., 1994).

**Accompaniment**

Stauffer (1985) tested children in Grades 1, 2, and 3 and found that 1st-graders improved in singing ability without any harmonic context provided. She suggested that it would be better to save harmonic context for use when developing singing in children from Grade 3 and up. Goetze et al. (1990) concluded that, if the addition of other voices (second sound source) could affect pitch accuracy, it stood to reason that accompaniment would have had the same effect. Sims (1990, 1991) studied preschoolers’ abilities to make single and double discriminations. In both studies, she concluded that young children were more successful if asked to concentrate on one element at a time. Using results of studies by Goetze et al. (1990), Stauffer (1985), and Sims (1990, 1991), the current study did not make any use of accompaniment so that children were free to focus on the single, aural stimuli and response that they heard.

**Vocabulary**

Hair (1977) investigated the “ability of first-grade children to communicate their awareness of differences in tonal direction through verbal and nonverbal tasks” (p. 198). Because of greater accuracy on nonverbal tasks, she concluded that children appeared to understand the concept but didn’t know the terminology. She suggested that children could learn the correct terminology with proper training.
Flowers (1983) studied the effect of music vocabulary instruction as it applied to describing recorded musical selections. She concluded that “it appears that ability to describe musical events may increase through the study of music terminology and its application to excerpts” (p. 186). Nierman (1985) stated, “The important function of vocabulary is to serve as an objective guide to the listener’s actual encounter with a musical event” (p. 157). Nierman also believed that vocabulary needed to be understood, or a musical test could measure the presence or absence of vocabulary, rather than musical skill. McMahon (1982) pointed out that the vocabulary problem was further compounded by the frequent mismatch between words used by adults and the meaning attributed to them by children. Following suggestions from Flowers (1983), Hair (1977), McMahon (1982), and Nierman (1985), the current study focused on transferring a visual understanding of the word “match” into an aural understanding. The study sought to discover if the focus on vocabulary understanding aided children’s abilities to match the pitches of a sung example.

**Summary**

Music-related research was read to design a technique that might prove beneficial to teaching vocal accuracy. Each musical aspect of the technique was related to findings in research, i.e., range of notes, selected melodic patterns and pitches, vocal model, sequential motivational activities involving visual and aural experiences, individual setting, form of feedback, lack of accompaniment, and focus on vocabulary.
Learning-Related Literature

Perceptual/Conceptual

Gelman (1978) and Halford (1982) studied the cognitive capacities of young children. Halford named stages that were important to cognitive development in children:

1. Concepts are equivalent in structural complexity to binary relations, binary operations and univariate functions (two year olds).
2. Concepts are equivalent to compositions of binary relations, binary operations, and bivariate functions (five year olds).
3. Concepts are equivalent to compositions of binary operations (eleven year olds). (p. 1)

Simply stated, this means that, as children matured, they could entertain more than one idea at a time. Zimmerman’s (1982) ideas concurred with Halford’s (1982) in that preschoolers could arrange timbres of sounds on the basis of one dimension, and could classify on the basis of a criterion. Sims (1991) concluded that preschoolers were better at making single discriminations and that the ability to make double discriminations developed as one grew older. These ideas also concurred with Stauffer (1985) and Goetze and Horii (1986) who believed that children learned to sing with accuracy when they did not have to attend to two things at the same time, thus allowing them to concentrate on only one thing at a time, i.e., the singing.

Scott (1977) studied pitch concept formation in preschool children. She asked each child to find the “sound boxes” that sounded the same. A correct choice was reinforced by the nose lighting on “Squeaky the Mouse.” Scott found that preschoolers were capable of forming concepts of pitch register, melodic contour, and interval size
using the criterion of selecting like sounds. This study also asked children to concentrate on one thing at a time, finding the sounds that were identical.

To enable participants to focus on and perform one concept, the author of the current study asked participants to play related games, one after another, which hopefully provided a foundation for success in the game to follow. Visually, they attended only to finding the cards that matched. Aurally, they attended only to finding the sounds that matched and finally tried to match their singing voice to the singing of one, unaccompanied person.

Halford (1982) and Fyk (1985) found that short-term memory was important in reproducing ideas and understanding concepts. Halford's theory of representations states that, in order to understand, one must be able to apply a representation which matches the structure of the problem. Thus, he made two conclusions: (1) more complex concepts needed more complex representations, and (2) more complex representations needed more space in working memory. Halford stated, "It follows then that the concepts which children can understand, and the thinking they can perform, are limited by working memory" (1982, p.3). Goetze et al. (1990) suggested that the first requirement for accurate singing was to attend to and remember kinesthetic sensation and aural feedback. Joyner (1969) also suggested that memory was a component of vocal accuracy.
Learning Modality

Classrooms contain students who learn in different ways. Some students learn visually, some kinesthetically, others aurally, and some through a combination of all three modes. Modality can be defined as any of the sensory channels through which an individual receives and retains information. An important component of this definition is the phrase “receives and retains,” because it implies that sensation, perception, and memory constitute what is termed “modality” (Barbe & Milone, 1981).

Green (1985) completed a review of literature in cognitive style. In her article, she summarized Brumby’s conceptualizations of cognitive style and espoused that there were different cognitive styles which could all be present in individuals in differing degrees and that the individual selects the cognitive style appropriate to the task. It would seem logical then, that teachers should plan for each cognitive style in their lessons.

Woodward (1984) studied “literacy learning in early childhood” and found experience to be a key to learning. Before schooling, children learned language naturally in their environment. She suggested that the use of graphics (a visual approach) helped children learn language. Because pictures were content specific, they provided the known context for the children to make sense of what they saw in print. Barbe and Swassing (1979) created classroom charts for visual, aural, and kinesthetic words that also provided picture association with the printed word. Woodward (1984) found that children also used other knowns of a visual/aural nature (singing a song or saying a chant) when checking for answers to questions about the number of fingers they had or
the number of toes on each foot. These ideas concurred with Halford’s (1982) theory of representation.

Schevill (1971) examined time-ordering skills: high/low (pitch), red/green light (visual), and light or tone for combined modality. She found significant differences in all tasks when the two kindergarten samples were compared, and she concluded that a relationship existed between cognitive development and perceptual acuity in kindergarten. She found that visual acuity developed earlier than did auditory acuity.

Lamberts (1979) involved mentally-handicapped and nonmentally-handicapped children between the ages of 3 and 6 years in a study to explore memory span. Children were involved in auditory and visual matching activities. Children heard words on tape and were asked to find the picture. All children performed equally well when the stimuli were visually perceptual. The handicapped children performed less well when the stimuli were linguistic (aural). The results supported Lamberts’ hypothesis of memory span growing with age. Again, one is reminded of Halford’s theory of representation.

Hodges (1981) suggested a teaching technique to help students learn and retain new concepts from verbal presentation. From his readings in the field of cognitive psychology, he concluded that people heard a concept and thought of a prototype, similar to Halford’s theory of representation. If people thought of a concept in terms of a concrete prototypical example (which was often a visual image), then they were not thinking of a word definition of it. Thus, teachers needed to help students think of prototypes so that they could link known concepts to unknown concepts. One example
of a good prototype would be pictures or real experiences that children could have with concepts.

Some studies in music education researched the effect of utilizing learning modalities in the music classroom. Pautz (1989) investigated the effect of instructional strategies designed to match specified perceptual modalities on the ability of 3rd- and 4th-grade students to sing a song. While no significant differences were found in scores among learners, treatments, or matching instruction with the students' learning modality, Pautz did find a tendency to suggest that matching mode of learning with students had a positive effect on their abilities to sing songs.

Apfelstadt (1983) worked with three groups of students: one emphasized the development of melodic perception through visual and kinesthetic means, another had vocal instruction that was primarily aural imitation, and the third had traditional instruction without emphasis on perceptual or conceptual development. She found that visual and kinesthetic instruction appeared to help vocal accuracy in pitch patterns but not pitch discrimination or accuracy on rote songs.

Persellin (1993) examined whether the ability to match pitch vocally could be improved through learning visual, auditory, and kinesthetic modalities. Results showed that first graders with the visual model sang significantly more accurately than did those with the auditory or kinesthetic model. Persellin's study relates to Schevill (1971), whose subjects demonstrated acquisition of visual acuity earlier than auditory acuity.
While these studies showed that attention to modality did not result in significant differences, they did reveal that attention to modality had a positive effect on issues being tested. These studies, along with Scott (1977), also revealed that many learners used the visual modality first, when going from a known to an unknown. Based on these findings, the current study began with a visual activity and then moved to aural activities. Activities moved sequentially from a familiar visual one of matching picture cards, to a concrete aural one of shaking jars to find the sounds that matched, and finally progressed to a more abstract, less familiar aural activity of matching the investigator’s sung pattern. If pictures help children comprehend printed words, then perhaps a visual experience would help children comprehend a word in its aural context and influence their aural response.

**Discrimination**

The process of discrimination involves building up and refining categories which are defined as rules for grouping objects on the basis of criteria (Tighe & Tighe, 1968). These authors produced evidence which suggested that perceptual learning played a critical role in the discrimination processes of a young child. Children were asked to find an object that was the same or different from an object they already had. The children were involved in 2-dimensional and reversal work. When doing a reversal with same and different objects, the children had to make comparative perceptual judgments of the stimuli, thus aiding the development of their discrimination process. Scott (1977) made
use of involving children in finding the same and different sounds as she researched preschoolers' formation of the concept of pitch.

Joyner (1969) and Bentley (1968) found that monotone singers were deficient in pitch discrimination. Joyner suggested that, in order to sing in tune, a person must be able to tell one pitch from another (pitch perception), recall a succession of pitches (memory), and have a vocal instrument capable of the task (healthy voice).

Geringer (1983) examined the relationship between pitch discrimination and vocal pitch matching abilities of pre-schoolers and 4th-grade students. He showed relative lack of correlation of the two skills and suggested that the two skills were independent abilities and that perhaps maturation and training were necessary to develop an interrelationship of the two. Apfelstadt (1983) found that instruction directed toward modality of learning had no significant effect in auditory discrimination of pitch patterns but did have an effect on vocal accuracy of pitch patterns.

Doyle, Wolery, Ault, and Gast (1989) defined conditional discrimination as discrimination which "involves reliable and differential performance to multiple stimuli" (p. 350). They described concurrent instruction as a technique which involved two or more behaviors being taught simultaneously in one session. Panyan and Hall (1978) found that generalization to new stimuli was greater following the concurrent training sessions. Data reviewed by Doyle et al. (1989) suggested that teachers should structure their instruction to teach conditional discriminations from the beginning rather than teach simple discriminations first.
Yu, Martin, and Williams (1989) reviewed the Auditory-Visual Combined (AVC) discrimination test developed in 1977 by Kerr, Meyerson, and Flora. Kerr et al. (1977) examined curricula for people with mental retardation in many training settings and found numerous tasks that assumed that learners could readily acquire skills involving basic discriminations. Yu et al. (1989) found that the AVC Discrimination Test assessed outcomes rather than discriminations that were required to learn such activities. Kerr et al. (1977) set out to develop a practical, behavioral assessment instrument for measuring the ease with which people with mental retardation could acquire discriminations. Their assessment was restricted to a 2-choice discrimination skill. Tasks completed were: (1) imitation, (2) position discrimination, (3) visual discrimination, (4) match to sample discrimination, (5) auditory discrimination, and (6) combined auditory and visual discrimination. Participants included 117 children and adults with mental retardation, age 3 to 36 years. During the testing, errors were followed with a correction procedure. The pass-fail patterns completed revealed the clear, hierarchical order as listed above. Yu et al. (1989) concluded that more research was needed to develop teaching techniques that would rapidly teach basic discrimination levels that have been failed.

Sims (1990, 1991) studied music concept discrimination in preschoolers. In her 1990 study, she examined responses of children that required only one discrimination at a time. In 1991, she completed two studies to investigate preschoolers’ abilities to do single and double discrimination. In all studies, she worked with developing the ability to discriminate between loud and soft, fast and slow, and smooth and choppy. She
found, in each study, that young children were better at performing and recognizing single discrimination than double discrimination. She found some improvement in double discrimination in older preschoolers, which led her to concluded that the ability to use double discrimination developed with age.

Because one of the requirements for vocal accuracy is pitch discrimination, the current study tested a teaching technique that may decrease the time it takes for inaccurate singers to become accurate. Students became involved in many of the tasks listed by Kerr et al. (1977). Because these tasks were found to be hierarchical, the activities of the current study followed steps 1 through 6 in order.

In summary, it would appear that elementary school students could have greater success in forming generalizations if teachers employed concurrent instruction in individual sessions which involved students in making multiple discriminations. The current study aimed to involve students in concurrent instruction using some of the tasks from the AVC, as they matched cards, jar sounds, and vocal patterns.

**Transfer Learning**

Dempsey (1990) postulated that there were two types of transfer learning: vertical and horizontal. In vertical transfer, learners moved from one level to another when a "chunk" of knowledge in a skill facilitated the acquisition of a superordinate skill. Horizontal transfer is the attainment of related concepts and involves discrimination learning. If the horizontal axis yielded levels of progressive difficulty, a provision for increasing generalization on another axis was created.
Smeets (1994) compared two procedures for establishing and reversing stimulus control transfer across simple discriminations in children. Children saw Greek letters in different colors and were asked questions on a color discrimination task. Match to sample training was found to be superior in establishing and reversing emerging simple discriminations. Transfer was tested in the same context in which the task was introduced. This approach might explain why match to sample training is such a powerful procedure for generating new conditional relations between stimuli. Smeets concluded that transfer through conditional discrimination training could be improved if the matching task were replaced by two simultaneous discrimination tasks. This idea related to Doyle et al. (1989), who supported concurrent instruction.

Porter (1977) examined the effect of multiple discrimination training on aural pitch discrimination, vocal pitch matching, and instrumental pitch matching, as well as any transfer between these variables. Students matched one tone at a time at a comfortable starting pitch, utilizing a stroboscope. They would go one step above, two steps above, then one step lower and two steps lower. Porter found that students did well when they were trained on task. She concluded that one must teach for a certain desired outcome and not expect automatic transfer of learning without teaching for transfer. In her study, transfer did not occur. She believed that perhaps the tasks were too dissimilar for any transfer to occur.

The current study employed ideas expressed by Dempsey (1990) by combining horizontal transfer with vertical transfer to enable an increase in generalization on
another axis. The study used match to sample training based on findings of Smeets (1994). It is hoped that transfer will be enhanced through conditional discrimination by the use of three similar (Porter, 1977) simultaneous discrimination tasks (Smeets, 1994).

Summary

Learning-related research was read to design a technique for teaching vocal accuracy that incorporated pedagogical ideas found to be successful in past studies. Every pedagogical aspect of the technique was related to findings in research, i.e., perceptual and conceptual development, learning modality, discrimination, and transfer learning.

Conclusion

It is essential to create teaching techniques that are research-based in the field of education as well as motivational for students. Support and design for the current study have come from conclusions of research and suggestions for future research. In the current study, vocal range was limited to a natural, comfortable location of D4 - G4. A cappella melodic patterns were only four beats long with simple rhythmic patterns and used only the pitches so, mi, and la. Sung examples used a non-vibrato female voice. Children in Grades 1, 3, and 5 worked individually with the investigator. The children were randomly assigned to two groups.

Group I did sequential visual, aural, and singing activities encompassing each modality of learning. Group II did only the singing activity. Children were asked to give
their own feedback on their singing performance after each example, which was then reinforced or addressed as incorrect by the investigator. Children who were incorrect were asked if they thought they were above or below the model. Children were involved in concurrent instruction to promote the development of greater generalization as it applies to discrimination and memory. The teaching technique was designed to teach for transfer by utilizing similar tasks within one session.
CHAPTER 3

METHODS AND PROCEDURES

Subject Selection

Subjects for the study were 1st-, 3rd-, and 5th-grade students from five urban public schools in Columbus, Ohio. Elementary music teachers in the system were contacted to inquire if they wanted to take part in the study. Teachers who responded positively were asked to select children in Grades 1, 3, and 5 whom they considered to be uncertain singers (those having problems with vocal accuracy). Written descriptions of the study and a consent form were sent home to the children’s parents (Appendix A). One hundred children returned their consent forms and entered the study; 20 of them received a perfect score on the pretest and thus were not eligible to continue. Two more students left the study for other reasons. The total number of children remaining in the study was 78.

Subjects were randomly placed into two groups according to the results of a coin toss. The dispersion of children across groups is shown in Table 3.1. Grades are shown followed by the total number of children. Perfect Score indicates the number of children who sang accurately and received 100% on the pretest and did not continue in the study.
at that point. Other refers to other reasons that a child was dropped from the study. I refers to children who played all three games. II refers to children who played the voice-matching game. T equals totals. A indicates children who were absent for the repeated posttest. F refers to the number of children that fully participated in every aspect of the study.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Total</th>
<th>Dropped from Study</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Perfect Score</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>on IPR</td>
<td>Other</td>
</tr>
<tr>
<td>1</td>
<td>34</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>31</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>35</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Totals</td>
<td>100</td>
<td>20</td>
<td>2</td>
</tr>
</tbody>
</table>

IPR = Initial Pretest
Other = Those selected who did not take the IPR due to a school picture and one who did not want to sing
I = Group I, which played all 3 games
II = Group II, which played only the voice-matching game
T = Total number of participants
A = Number who were absent for the RPO (Repeated Posttest)
F = Number of participants who took all tests (IPR, IPO, and RPO)

Table 3.1: Dispersion of children.

Procedure

The music teacher at each school arranged a testing location, prepared a list of students and their room numbers for the investigator, and suggested the best time for the investigator to come to the school. The investigator went to each school and met
individually with each student. This meeting began with the investigator completing the
top of the response sheet noting the subject’s number in the study, age, and grade. The
meeting then followed the following format.

**Pretest**

Students were told that the investigator had made a video tape of her singing.
They would see her on the video singing short phrases that they would be asked to
repeat, and their responses would be tape recorded. The investigator started recording
on the audio tape and recorded the student’s number on tape and stage of testing. The
investigator then began the video. The student listened to the first example. The
investigator paused the video tape but kept the audio recorder going while the student
sang. The investigator then asked the student if it was a match, and the student
answered. The investigator reinforced the student if his/her response was correct as
related to what was actually sung. If the response was incorrect, the investigator told
the student it was not a match and asked the student if he/she thought he/she sang above
or below the example on the video tape. If the student knew he/she did not match, the
investigator still asked the student if he/she thought his/her voice was above or below the
example he/she heard. If the student could not give any response, the investigator told
the student whether he/she were above or below the pitch. The investigator then paused
the audio tape. This process was followed for the remaining two examples. Those
students who matched their voices correctly with each example were thanked, invited to
choose a sticker, and returned to the classroom. The investigator made note of the
perfect score on the response sheet. Students who received a perfect score on the
pretest were excused from the remaining part of the study at that point. Those students
who did not sing all responses correctly remained for the teaching aspect of the study.

Teaching

The student tossed a coin to “see what games he/she would play” with the
investigator (Appendix B). The results of the toss determined if they would be in Group
I or Group II. The investigator then marked the appropriate group on the response
sheet.

Group I. These participants were shown the pictures of the animals on the
laminated cards and asked to make the sound of each animal. The students were then
asked if they knew how to play the card-matching game where cards are turned over and
mixed up and matches found by turning them over one at a time. Every student knew
how to play this game. The investigator turned the cards face down and instructed the
student to turn one card over and make the sound of the animal on the card. The student
then turned a second card over and made the sound of the animal on that card. The
investigator asked the student if they were a match. The student answered. The
investigator reinforced the child’s response if he/she was correct and instructed the
student to turn the cards face down if he/she was incorrect and continue playing. If the
cards were a match, they were removed from the playing field and the game continued.
The game continued until all matches were found.
Next, the student played the sound jar game. The investigator told the child that, because the jars were covered, he/she would be using his/her ears rather than eyes to find the matches. Two jars were filled with pennies, two with rice, and two with popcorn kernels. The child was allowed to shake each jar to become acquainted with the sounds. The investigator mixed up the order of the jars and set them in a line. The child was then asked to select one jar, shake it, and set it out in front of the others. The child was then asked to shake another jar and decide if it was a match with the first one. If it was a match, the investigator reinforced the student’s answer, and both jars were removed from the playing field. If it was not a match, the student put both jars back in line. This game continued until all matches were found.

Next, the student played the voice-matching game. The student was told that this game was on the video. The student watched as the video asked if they could match the hand movement and the singing they heard on the video. The hand movements were the Curwen hand signs that correlated to the solfeggio syllables in the pattern that was sung. The patterns sung contained the same set of pitches as the pretest, but the words and the rhythms were different (Appendix B). Again, the video was paused after each example for the student to give his/her own self-assessment regarding his/her ability to match what was heard and seen on the video. The investigator reinforced a correct response. If the student was incorrect, the investigator told the student he/she was incorrect and asked if his/her singing was above or below the model given. If the student did not vocally match the pitch but knew it was not a match, the investigator still asked if
his/her singing was above or below the example heard. The investigator kept data on the correctness of the performance as well as the student’s ability to evaluate his/her own singing. In initial pilot testing, the investigator observed that students found the hand movements difficult to do and that they caused the student to lose focus on their singing. As a result of this observation, students were told they did not have to do the hand movements in the voice matching game, but just listen and match the singing. Because this was discovered during pilot testing, it should be noted that none of the children in the study reported here used hand movements.

Immediately after the singing match game, each student took the posttest, consisting of watching a repeat of the pretest video and trying to match the same examples heard in the pretest. The pretest was copied to the end of the tape to ensure exact replication with regard to pitch, tempo, and visual appearance to the child. Again, the video tape was paused for the student’s singing, self-assessment, and reinforcement.

After the posttest, the child was told that the investigator would come back in one week to hear him/her again, but only for a short time. The student was invited to select a sticker after working with the investigator. The investigator walked the child back to his/her classroom and asked for the next participant.

One week later, the investigator returned and met with each student to readminister the posttest. The investigator asked the student what they remembered doing the previous week and then readministered the posttest. Again, an audio tape was made of the student’s singing, and the video was paused while the student sang and gave
his/her self-assessment of his/her performance. The child was thanked for working with the investigator and returned to the classroom.

**Group II.** These participants did not play the card or jar game. They played the voice matching game immediately following the coin toss. Group II did the same posttest following the voice matching game and completed the repeated posttest one week later.

**Development of the Technique Through Pilot Testing**

During the past 10 years, the idea for this teaching technique was created and informally tested in elementary music classes. Aspects of the technique implemented in this study were based on practical outcomes of informal pilot testing as well as knowledge of the research literature. The relationship of existing research and the present technique are discussed in Chapter 2. Modifications of the technique based on practical experience include:

1. Hand movements were dropped because they were unfamiliar to the children and distracted them from focusing on the task of matching pitches.

2. Pictures on cards began as Santas, train engines, and cuckoos. These were changed to lions, cats, and cuckoos to keep sounds in one category (animals) and to allow for a wider range of vocal exploration.

3. Resonater bells were originally used for the sound-matching game. These were replaced by the sound jars because of the octave displacement in resonator bells, the visual cue presence of length of the bell, and engraved letter names on the bells.
Because of initial results with the teaching technique, a formal study using the modifications and knowledge from research was begun.

**Materials**

1. Melodic and rhythmic patterns of the following 4-beat phrases.

**Pretest Phrase #1.**

\[
\begin{array}{c}
\text{so} & \text{mi} & \text{so} & \text{mi} \\
\text{air} & \text{ball,} & \text{air} & \text{ball}
\end{array}
\]

**Pretest Phrase #2.**

\[
\begin{array}{c}
\text{so} & \text{la} & \text{so so} & \text{mi} \\
\text{I} & \text{- like} & \text{bas-ket} & \text{ball.}
\end{array}
\]

**Pretest Phrase #3.**

\[
\begin{array}{c}
\text{so so} & \text{mi la} & \text{so so} & \text{mi} \\
\text{Piz-za} & \text{is my} & \text{fav’rite} & \text{food.}
\end{array}
\]

**Singing Game Phrase #1.**

\[
\begin{array}{c}
\text{so} & \text{mi mi} & \text{so so} & \text{mi} \\
\text{This} & \text{is my} & \text{sing-ing} & \text{voice.}
\end{array}
\]

**Singing Game Phrase #2.**

\[
\begin{array}{c}
\text{so so} & \text{la la} & \text{so so} & \text{mi} \\
\text{Play-ing} & \text{ball is} & \text{lots of} & \text{fun.}
\end{array}
\]

**Singing Game Phrase #3.**

\[
\begin{array}{c}
\text{so} & \text{mi la} & \text{so} & \text{mi} \\
\text{Who} & \text{has the} & \text{thim – ble?}
\end{array}
\]
Posttest phrases were the same as the Pretest, and Repeated Posttest phrases were the same as the Pretest. Patterns are based on studies by Davidson (1985), Flowers and Dunne-Sousa (1990), Goetze et al. (1990), Heaton (1992), Small (1983), Tatem (1990), and Vaughan (1980).

2. Game Instructions (Appendix B).

3. Picture cards of animals (3 pairs) used in Group I. Atterbury (1984) and Goetze et al. (1990) supported the idea of doing vocal exploration when learning to sing accurately. Three pairs of laminated visual cards were made: two cats (for vocal exploration in the middle range), two lions (for low voice exploration), and two cuckoo clocks (for head voice exploration).

4. Three pairs of sound jars (six baby food jars, covered with aluminum foil) used in Group I. Goetze et al. (1990) suggested that pitch discrimination was one of the “requisite skills necessary for accurate singing” (p.19). Scott (1977) reported on the effectiveness of manipulatives. Each jar was half-filled with contents: two with pennies, two with rice, and two with popcorn kernels. Substances were selected for their sound discrimination factors. Because the jars of rice and popcorn kernels sounded similar, a finer discrimination skill was needed to match those jars.

5. One Marantz audio cassette tape recorder (Model PMD201) for evaluation.
6. Two video tapes (one back-up) of the investigator singing were produced and used for the pretest, the Voice Matching Game, the posttest, and the repeated posttest.

7. One portable VCR and monitor.

8. Six 60-minute audio tapes were used.

9. Age-appropriate stickers were offered to each participant to thank them for their work.

10. Each testing site was requested to provide a small quiet area for testing participants. The researcher requested an area with a small table or two student desks, two chairs, and one electrical outlet.

**Reliability of Evaluations**

Three sets of the audio response tapes were made and distributed to three judges (two elementary vocal music teachers and one senior music education major), along with three response forms for each student – one for the pretest, one for the posttest, and one for the repeated posttest. The judges had no information on the response forms as to the grade, age, or group of the student. The sheet only listed the student’s assigned number in the study. The judges compared this number with the number given before each student’s response on the audio tape.

The judges listened to each student’s pretest, posttest, and repeated posttest and rated each response using the Boardman scale. Boardman described the ratings 7 to 1 as (1964):

46
a. A score of 7 indicated accurate matching of all tones in the pattern, without hesitation.
b. A score of 6 indicated that the child "slid" into one or more of the pitches in the pattern, but eventually sang all accurately.
c. A score of 5 was given for an exact transposition of the pattern.
d. A score of 4 was given when a child maintained the general contour of the pattern, but sang incorrect intervals.
e. A score of 3 indicated that the child maintained the general direction of the pattern but not the exact contour.
f. A score of 2 was given for responses which ignored the contour of pitches.
g. A score of 1 was given when the child spoke rather than sang a response or did not respond at all. (p. 36)

Each judge completed a response form for each test (Appendix D). Evaluation was anonymous and independent. When the judges had independently listened to each participant and scored sung responses, they returned all tapes and response sheets to the investigator.

The information on the judges' response sheets was then transferred onto a master response sheet for each child. This sheet contained group, grade, age, number tally of trials, judges' scores, and correctness of self-assessment. After testing for interjudge agreement, judges' scores were averaged for each task on each test. The averages for each task for each test were added together to create a score for vocal pitch matching for each test. Seven points were possible for each task, making a possible perfect score of 21. Data were also collected on correctness of self-assessment for subsequent analysis.
CHAPTER 4

RESULTS

When all the data were collected from the participants, the investigator asked two elementary music teachers and one senior music education major to listen to taped singing responses of the students. These judges listened independently to all of the audio taped responses of the subjects and completed a response form for each student (Appendix D). Judges rated the students on each sung response using the Boardman scale (discussed in Chapter 3). The judges knew the students only by the number given on the tape. They did not know from which group the student came.

Interjudge Agreement

After all judges' responses were completed, the investigator compared their responses for interjudge agreement. To find the percentage of agreement among the judges, the following procedure was used. The range of the three judges' scores for each task for each participant was recorded by finding the difference between the lowest and highest score of the three scores. For example, ratings of 6-6-6 equaled 0
difference, ratings of 4-5-4 equaled 1 difference, ratings of 3-5-6 equaled a difference of 3, and so on.

The percentage of judgments in total agreement or within one difference was tallied. There were 42% in perfect agreement (0 differences among the three judges), and 77% that fell within the criterion of one difference on the Initial Pretest (IPR). The Initial Posttest (IPO) showed 43% were in perfect agreement, and 80% fell within the criterion of one difference. On the Repeated Posttest (RPO), 58% were in perfect agreement, and 83% fell within the criterion of one difference. These percentages of agreement averaged to 48% perfect agreement among the judges and 80% agreement among the judges within the criterion of one difference.

Singing Performance

Ratings of the three judges were averaged for the three component tasks on each test. Then, a summative score was produced for each test (Table 4.1). Scores were based on 21 possible points. Table 4.1 presents average scores for each group, even though non-parametric statistics (i.e., ranked data) were used for within group comparisons.
<table>
<thead>
<tr>
<th>Grade</th>
<th>n</th>
<th>IPR Average Score (21 possible)</th>
<th>IPO Average Score (21 possible)</th>
<th>RPO Average Score* (21 possible)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>13.64</td>
<td>16.06</td>
<td>15.52 (n = 12)</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>13.85</td>
<td>14.96</td>
<td>17.13 (n = 12)</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>14.56</td>
<td>19.33</td>
<td>16.83 (n = 12)</td>
</tr>
<tr>
<td>Group I Total</td>
<td>40</td>
<td>14.01</td>
<td>16.78</td>
<td>16.49</td>
</tr>
<tr>
<td>Group II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>13.01</td>
<td>15.20</td>
<td>15.78 (n = 11)</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>13.19</td>
<td>15.07</td>
<td>15.93 (n = 10)</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>11.24</td>
<td>12.66</td>
<td>14.47 (n = 9)</td>
</tr>
<tr>
<td>Group II Total</td>
<td>38</td>
<td>12.47</td>
<td>14.31</td>
<td>15.39</td>
</tr>
</tbody>
</table>

* Number of students may be smaller due to absences.

Table 4.1: Comparison of test scores by grade and group.

It should be noted that, even though the groups had been randomly assigned, preliminary examination of data on the Initial Pretest indicated unequal performance among groups. For that reason, change from test to test was examined within each group to determine if there was a significant difference. The Wilcoxin Matched Pairs Signed-Ranks Test was chosen for the analysis of changes in singing accuracy from the IPR (Initial Pretest) to the IPO (Initial Posttest), the IPR to the RPO (Repeated Posttest), and the IPO to the RPO. Table 4.2 is a composite view of these results.
<table>
<thead>
<tr>
<th>Grade</th>
<th>IPR to IPO</th>
<th>IPR to RPO</th>
<th>IPO to RPO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>p &lt; .01</td>
<td>p &lt; .05</td>
<td>ns</td>
</tr>
<tr>
<td>3</td>
<td>p &lt; .01</td>
<td>p &lt; .01</td>
<td>ns</td>
</tr>
<tr>
<td>5</td>
<td>p &lt; .02</td>
<td>p &lt; .05</td>
<td>ns</td>
</tr>
<tr>
<td>Group II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>p &lt; .01</td>
<td>p &lt; .01</td>
<td>ns</td>
</tr>
<tr>
<td>3</td>
<td>ns</td>
<td>p &lt; .05</td>
<td>ns</td>
</tr>
<tr>
<td>5</td>
<td>ns</td>
<td>p &lt; .01</td>
<td>p &lt; .01</td>
</tr>
</tbody>
</table>

Table 4.2: Composite comparison of test scores.

All grades in Group I showed an immediate significant gain from the IPR to the IPO, which was maintained one week later. Group II, Grade 1 showed the same immediate significant gain. Group II, Grades 3 and 5 showed no immediate gain. Group II, Grade 5 showed a significant gain on the RPO. This result may have been due to repeated testing on the same material or simply their being older than the other students.

The IPR to IPO comparisons were statistically significant for both groups in Grade 1 (Group I: T = 8, n = 14, p < .01; Group II: T = 4.5, n = 13, p < .01), Group I, Grade 3 (T = 7, n = 12, p < .01), and Group I, Grade 5 (T = 13.5, n = 14, p < .02). The IPR to RPO comparison was shown to be significant for Group I and Group II in all grades. Group I, Grade 3 (T = 1.5, n = 12, p < .01) and Group II, Grade 5 (T = 0, n = 9, p < .01) showed significance of p < .01, while the Group I, Grades 1 and 5 moved to the .05 level: Grade 1 (T = 12, n = 12, p < .05) and Grade 5 (T = 7, n = 10, p < .05).
It is interesting to note that Group II for all grades were found to be significant in this comparison: Grade 1 (T = 5, n = 11, p < .01), Grade 3 (T = 6, n = 10, p < .05), Grade 5 (T = 0, n = 9, p < .01). At some point in the study, all groups showed significant growth in their singing accuracy.

The comparison of IPO to RPO showed nonsignificant change for all grades in Group I and for Group II, Grades 1 and 3. Only Group II, Grade 5 showed a level of significance (T = 2, n = 9, p = .01). These results indicate that most of the grades in both groups retained their initial immediate improvement from the IPO to the RPO. In comparing T-scores involving repeated testing, the IPR to RPO showed a probability of .05 or less for all grades in both groups. These results show that there was a greater change from the IPR to the RPO than from the IPO to the RPO. While the probability was not as high as the IPR to IPO, both groups improved from IPR to RPO. However, the groups did not improve significantly from the IPO to the RPO. This result would point to the strength of the teaching technique from the IPR to the IPO and the inference of retention from the IPO to RPO.

**Self-Assessment**

The independence of test (IPR, IPO, RPO) and correctness of student self-assessment was tested through six separate chi-square analyses, one for each grade within each group. Each student’s self-assessment for each test was recorded on a grid as being **correct** (+), **incorrect** (-), and **didn’t know** (o). To receive a check in the **correct** column, students had to give a correct assessment to two of the three tasks on
the test given. As an example, if they did not match pitch and said they did not match pitch, they were correct in their self-assessment. To receive a check in the incorrect column, the students gave an incorrect assessment of two of the three tasks. If they responded to their self-assessment with "I don't know," the third column was checked.

The checks of self-assessment put in each category were counted for each test of each group. A 3 (IPR, IPO, RPO) by 3 (correct, incorrect, don't know) matrix was created for each grade within each group. Then, a chi-square analysis was performed to determine independence of test and correctness of self-assessment. Results in Table 4.3 show that the chi-square analysis for each group was not significant. Apparently, the pattern of self-assessment (correct, incorrect, don't know) was not related to the test (IPR, IPO, RPO). In other words, the students' self-assessment abilities did not change with repeated testing in the present study.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Chi-Square</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>$\chi^2 (4, N = 14) = 4.356$</td>
<td>ns</td>
</tr>
<tr>
<td>3</td>
<td>$\chi^2 (4, N = 12) = 7.216$</td>
<td>ns</td>
</tr>
<tr>
<td>5</td>
<td>$\chi^2 (4, N = 14) = 3.382$</td>
<td>ns</td>
</tr>
<tr>
<td>Group II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>$\chi^2 (4, N = 13) = 2.816$</td>
<td>ns</td>
</tr>
<tr>
<td>3</td>
<td>$\chi^2 (4, N = 13) = 6.360$</td>
<td>ns</td>
</tr>
<tr>
<td>5</td>
<td>$\chi^2 (4, N = 12) = 1.508$</td>
<td>ns</td>
</tr>
</tbody>
</table>

Table 4.3: Chi-square analysis for correctness of self-assessment for students who remained in the study.
The investigator looked at the percentages of correct, incorrect, and don’t know responses for each group in each grade (Table 4.4). The “number of students across tests” is the sum of students completing each test within a group/grade level. Due to the lack of relationship between test and correctness, self-assessment is expressed in percentages across all three tests.

<table>
<thead>
<tr>
<th>Grade</th>
<th># of Students Across Tests</th>
<th>Knew They Were Correct in Self-Assessment</th>
<th>Gave Incorrect Answer</th>
<th>Did Not Know if They Matched or Not</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>40</td>
<td>16 (40%)</td>
<td>17 (42.5%)</td>
<td>7 (17.5%)</td>
</tr>
<tr>
<td>3</td>
<td>36</td>
<td>30 (83%)</td>
<td>2 (6%)</td>
<td>4 (11%)</td>
</tr>
<tr>
<td>5</td>
<td>40</td>
<td>25 (63%)</td>
<td>5 (12%)</td>
<td>10 (25%)</td>
</tr>
<tr>
<td>Total</td>
<td>116</td>
<td>71 (62%)</td>
<td>24 (21%)</td>
<td>21 (17%)</td>
</tr>
<tr>
<td>Group II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>37</td>
<td>16 (43%)</td>
<td>12 (32%)</td>
<td>9 (25%)</td>
</tr>
<tr>
<td>3</td>
<td>36</td>
<td>24 (67%)</td>
<td>5 (14%)</td>
<td>7 (19%)</td>
</tr>
<tr>
<td>5</td>
<td>33</td>
<td>22 (67%)</td>
<td>7 (21%)</td>
<td>4 (12%)</td>
</tr>
<tr>
<td>Total</td>
<td>106</td>
<td>62 (59%)</td>
<td>24 (22%)</td>
<td>20 (19%)</td>
</tr>
</tbody>
</table>

Table 4.4: Percentage of correctness of self-assessment by group and grade across all three tests.
These data show that the greatest percentage of student self-assessments was correct in all grades in all groups with the exception of Group I, Grade 1. Grade 3 and Grade 5 were above 63%. In addition, responses of those children who were dropped from the study based on their pretest singing accuracy were observed (Table 4.5). The purpose was to make an informal comparison with Groups I and II from the study.

<table>
<thead>
<tr>
<th>Grade</th>
<th># of Responses</th>
<th>Knew They Were Correct</th>
<th>Gave Incorrect Answer but Matched</th>
<th>Did Not Know if They Matched or Not</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>5 (83%)</td>
<td>0</td>
<td>1 (17%)</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>5 (83%)</td>
<td>1 (17%)</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>6 (75%)</td>
<td>0</td>
<td>2 (25%)</td>
</tr>
</tbody>
</table>

Table 4.5: Percentage of correctness of self-assessment of students who were dropped from the study due to a perfect score on the IPR.

The data from both Table 4.4 and Table 4.5 show that most of the students in this study made a correct self-assessment of their singing and that percentages were higher in Grades 3 and 5. Sims (1991) found younger students (age 3½) to be correct 61% of the time and the older students (age 5) to be correct 72% of the time when assessing if they sang songs faster/slower, louder/softer, and smoother/choppier.
CHAPTER 5

DISCUSSION

Summary

Purpose of the Study

Much research has been conducted in the area of children’s vocal accuracy. Recommendations from previous studies were used in assembling the teaching technique explored: nonvibrato soprano voice for a vocal model; range within C4 - A4; short, melodic patterns containing only steps and skips within the interval of a fourth; attention to learning modality; and feedback in vocal accuracy. In the current technique, sequential games (in playing order – card game, sound jar game, and voice-matching game) were played. Whenever children sang, they were asked to make a self-assessment of their singing performance. This form of feedback was not found to be used in studies related to vocal accuracy which were reviewed for this study.

The problem in this study was to determine if the teaching technique tested (playing a card matching game and a sound jar matching game) helped vocally inaccurate singers in Grades 1, 3, and 5 become more vocally accurate and to determine if singers could correctly assess their singing performances. The specific research questions were:
1. After completing a sequential series of matching games (a card game, a sound jar game, and a voice-matching game), will children in Grades 1, 3, and 5 improve their vocal accuracy when a teacher asks, "Can you match my singing voice?"

2. Will children's vocal accuracy improve when they complete only a voice-matching game?

3. Will children correctly assess their own singing performance, and will their assessment be related to test (pretest, initial posttest, and repeated posttest)?

4. Will the lapse of time (one week) have any effect on vocal accuracy as recorded on the repeated posttest?

**Procedures**

The current study involved 100 children from six elementary schools in the Columbus City Schools in Grades 1, 3, and 5 who were identified by their music teachers as being vocally inaccurate. Each child met individually with the investigator. The initial meeting consisted of a video taped initial pretest (IPR) that asked children to match the singing they heard and to make a self-assessment of their performance. Children who received 100% on the pretest did not continue in the study. Children who did not correctly match patterns on the pretest were asked to flip a coin to determine which group they would be in: Group I, which completed three matching games; or Group II, which completed only the voice-matching game.

Following the Initial Pretest, a child in Group I first played a matching card game. The child had to use his/her memory and voice to find the matching pair of cards.
The investigator showed the child the animal pictures on the cards and asked the child to make the sound of each animal. The cards were then turned over and mixed up before putting them in two rows of three each. The child turned over a card and was asked to make the sound of the animal on the card. The child turned over a second card and made the sound of that animal. The investigator asked the child if it was a match. If it was a match, the pair was removed from the playing field. If the cards were not a match, they were turned face down again and left in their original spot. This game continued until all matches were found.

Following the card game, the child played the sound jar game. The child was invited to shake each jar (baby food jar wrapped in aluminum foil). Each jar was half filled with rice or with pennies or with popcorn kernels. After shaking the jars, the investigator mixed them up before arranging them in a straight line. The child was asked to shake a jar and place it out in front of the others. The child then shook another jar and was asked if it was a match. The child responded. If it was a match, the two jars were removed from the playing field. If it was not a match, the two jars were put back in their original spots. This game continued until all matches were found.

Groups I and II played the voice-matching game. Each child watched the same prepared video tape of three sung examples. Each example asked the child to match his/her voice with the sound heard. After singing each example, the child was asked if he/she thought his/her singing had made a match. If the child answered “no,” he/she was asked if his/her singing was above or below the example sung. If the child said “yes” and
did not match, the child was told if he/she were above or below the example sung on the video tape. If the child said “yes” and did match, the child was reinforced for a correct answer by the investigator. After the voice matching game, each child completed the initial posttest, which was a repeat of the pretest. One week later, each child took the repeated posttest. Each child’s singing and self-assessment of pretest, initial posttest, and repeated posttest was recorded on an audio tape recorder.

Results

To study the effect of this teaching technique aimed at improving vocal accuracy in inaccurate singers, Grades 1, 3, and 5 were viewed as independent cohorts. Three judges independently listened to the tapes of all participants’ singing performance and scored each task using the Boardman (1964) scale. The judges’ scores were checked for interjudge agreement, and 80% of the ratings were found to be within 1 point of the other ratings for the same performance. The averages for each task for each test were added together to create a score for vocal accuracy for each test. The highest possible score for each test was 21. The Wilcoxin Matched Pairs Signed-Ranks Test was chosen for the analysis of changes in vocal accuracy from the IPR (Initial Pretest) to the IPO (Initial Posttest), the IPR to the RPO (Repeated Posttest), and the IPO to the RPO (Table 4.2). These analyses revealed the following results:

1. Group I in all grades showed a significant improvement when comparing their vocal accuracy scores of the Initial Pretest (IPR) and the Initial Posttest (IPO).
2. Group II, Grades 3 and 5 showed no significant improvement when comparing their scores of the Initial Pretest (IPR) and the Initial Posttest (IPO).

3. Group II, Grade 1 showed significant improvement in comparing their scores of the Initial Pretest (IPR) and the Initial Posttest (IPO).

4. All groups showed a significant improvement in comparing their scores of the Initial Pretest (IPR) and the Repeated Posttest (RPO).

5. All groups except one (Group II, Grade 5) showed no significant difference when comparing their scores of the Initial Posttest (IPO) and Repeated Posttest (RPO).

6. All children in the study made some improvement in their vocal accuracy from the Initial Pretest (IPR) to the Initial Posttest (IPO) or from the IPR to the Repeated Posttest (RPO).

Following their singing, children were asked to make a self-assessment of their performances. A 3 (IPR, IPO, RPO) by 3 (correct, incorrect, don’t know) matrix was created for each grade within each group. Then, a chi-square analysis was performed to determine independence of test and correctness of self-assessment (Table 4.3). When the chi-square analysis showed no significance in comparing correctness of assessment to each test, the investigator looked at the percentage of correct, incorrect, and don’t know responses for each group in each grade.

The results of the study are:
7. Through a three by three chi-square analysis, all groups showed that the pattern of self-assessment (correct, incorrect, don’t know) was exclusive of the test (IPR, IPO, RPO).

8. All but one group showed a greater percentage of being correct in their self-assessment of their vocal performance when compared to being incorrect or not knowing.

9. All children from Grades 3 and 5 who were in the study were above 63% in the correctness of their self-assessment.

10. All children who were dropped from the study, after receiving a perfect score on the Initial Pretest, showed at least 80% correctness of their self-assessment.

Discussion

Vocal Accuracy

Group I in each grade showed a significant level of improvement in their vocal accuracy from the Initial Pretest (IPR) to the Initial Posttest (IPO). The finding in the current study leads the investigator to conclude that playing all three matching games (card matching game, sound jar matching game, and voice matching game) in the initial meeting did help students understand the aural application of the word “match,” which then led to an improvement in vocal accuracy.

During the matching games, the children were involved in using discrimination and memory as they tried to find the pairs that matched. Tighe and Tighe (1968) produced evidence that suggested that perceptual learning plays a critical role in the
discrimination processes of a young child. Discrimination and memory are two skills that have been found to be necessary in developing vocal accuracy (Bentley, 1968; Goetze et al., 1990; Howle, 1992; Joyner, 1969).

The matching games in this study were designed to involve children in activities that focused on visual and aural learning modalities. This teaching technique supports the thoughts expressed by Goetze et al. (1990) and Price et al. (1994) of using a focused teaching technique for vocal accuracy. The use of multiple learning modalities agrees with studies by Apfelstadt (1983), Pautz (1988), and Persellin (1993), each of which supported the use of various learning modalities in developing vocal accuracy. Beginning with the visual mode agrees with Persellin (1993), who found the visual mode was stronger than the aural and kinesthetic modes, Schevill (1971), who found that visual acuity developed earlier than auditory, and Scott (1977), who found success in using the visual mode first before the aural mode. Grade 1 was the only group in Group II that showed a significant improvement from the IPR to the IPO. Being in Grade 1, students may have been more easily affected by instruction due to age and relative inexperience.

A comparison of the Initial Pretest (IPR) with the Repeated Posttest (RPO) revealed that all grades in both groups showed a significant improvement in test scores. These results mean that all participants in the study improved in their vocal accuracy from the Initial Pretest (IPR) to the Repeated Posttest (RPO). This finding may be the result of individual, as opposed to group, testing. If true, this finding would agree with
Marx (1982) and Goetze and Horii (1989), who found that vocal accuracy was best developed in an individual setting. This finding may also be due to repeated testing.

In comparing the Initial Posttest (IPO) the Repeated Posttest (RPO), all of the groups, except Group II, Grade 5, showed a nonsignificant gain. Because no matching games were played from the IPO to the RPO, the results may indicate retention from the previous week, as well as the usefulness of such games in developing vocal accuracy. The games may heighten a child’s interest in the task, cause a higher level of focus on the task, or aid in a child’s ability to transfer his/her knowledge and learning from one area to another, yielding more immediate vocal accuracy.

**Self-Assessment**

The independence of test (IPR, IPO, RPO) and correctness of student self-assessment was tested through six separate three by three chi-square analyses (Table 4.3). Because the chi-square analysis showed no significance in comparing correctness of assessment to each test, the investigator decided to look at the overall percentage of correctness among all participants (Tables 4.4 & 4.5). The results show that most of the participants were correct in their self-assessment. Only Group I, Grade 1 showed a higher percentage in incorrectness.

While many previous studies of vocal accuracy support the use of feedback in developing vocal accuracy (Goetze et al., 1990; Howle, 1992; Paladino, 1991; Welch et al., 1989), none of them asked the singer to make a self-assessment of his/her own singing performance without the aid of any visual or physical representation of their
singing. When singers assessed their own singing performance without the aid of any other representation of their singing, they had to use the skills of discrimination, memory, and inner hearing as suggested by Goetze et al. (1990). They had to remember what the model did, what they themselves did, and inner hear the two examples to compare them and assess their own performance.

Table 4.4 shows that the percentage of correctness increased with each grade. This finding concurs with Sims (1991), who found that the percentage of correctness increased with the age of preschoolers tested. The increase in the present study could be due to the natural maturation process and previous experience. Group I, Grade 3 was the exception. They had the highest percentage of correctness of all groups in all grades. It is interesting to review the percentages of those who were dropped from the study due to a perfect score on the Initial Pretest (Table 4.5). The data show that most of the students could make a correct self-assessment of their singing.

Conclusions

The following conclusions can be drawn from the results of the study:

1. Children’s vocal accuracy improves when they are led to apply the aural use of the term “match” and after completing a sequential series of matching games (a card game, sound jar game, and a voice-matching game).

2. Vocal accuracy of students in Grades 3 and 5 may show immediate significant improvement when they complete only the voice-matching game.
3. Most children in Grades 1, 3, and 5 can correctly assess their own singing performance. Their correctness was not related to test (pretest, initial posttest, repeated posttest).

4. Most of the children will maintain their improvement after instruction on vocal accuracy one week later.

Implications

The results of the current study imply that a focused teaching technique with self-assessment can aid the development of vocal accuracy in elementary school children. It is recommended that teachers work individually with their inaccurate singers. Teachers should involve these singers in matching games that allow the children to exercise their discrimination and memory skills. These games and repeated testing with feedback have been shown to help inaccurate singers become more accurate in a short timespan. These games may help children’s vocabulary understanding of the word “match” when used in an aural context. Children in the study who played three matching games had immediate significant gains, which were maintained one week later.

Because Grade 1 was 42% correct in self-assessment and Grades 3 and 5 were above 63% in their correctness in their self-assessment, it is recommended that teachers ask their students to evaluate their own attempts at vocal accuracy. This study has shown that the majority of students in Grades 3 and 5 assessed themselves correctly in correspondence to their performance. Children who were dropped from the study because of a perfect score on the IPR had at least an 80% rate of correctness. It appears
that many students know how accurately they repeat a sung phrase; teachers need only to ask them.

It must be remembered that all of these results were derived from the singing of simple melodies within the interval of a perfect fourth using simple rhythm patterns. The results are based on students' improvement while singing these patterns. The results do not mean that the students could sing more difficult pitch patterns. Students would need to gradually add notes to their melodic vocabulary to maintain steady improvement and advancement in their vocal accuracy, or future research would need to be completed that asked students to sing other patterns after completing the RPO.

This study does show that vocal accuracy is a skill that can be taught and that the teaching time of the skill can be enhanced with attention to vocabulary development, which uses visual and aural learning modalities in an individual setting. This study extends the work of Hair (1977) and Flowers (1983), in which a musical vocabulary was developed to describe musical excerpts, to developing vocabulary understanding to aid in the development of vocal accuracy.

**Recommendations**

From the results of the study, the following suggestions and recommendations for future research are made:

1. To replicate the study in an elementary music class over a period of time at regular intervals to determine if the teaching technique is effective in teaching vocal accuracy in a group setting
2. To replicate the study with inaccurate singers from different age levels beyond elementary school to determine if the teaching technique is effective with older students.

3. To replicate the study using group comparisons to try to determine if the teaching technique had any effect on any one group or if improvement in vocal accuracy was due to repeated testing.

4. To replicate the study in different cultural contexts to determine if the teaching technique has universal affect with inaccurate singers.

5. To initiate a study which compares the teaching technique of this study with other pitch-matching teaching techniques over a long period of time.

6. To replicate the study and analyze data gathered on the number of tries in each matching game and compare that number with test scores.

7. To replicate the study and analyze self-assessment responses regarding melodic contour discussion and vocabulary used in self-assessments in Grades 1, 3, and 5.
Appendix A

Introductory Letter & Consent Form
Dear Parent:

One of the skills that your child's music teacher works to develop in each child is that of matching pitch. I am working to contribute another teaching idea to music teachers that will possibly help uncertain singers develop this skill. Dr. Patricia Flowers, my advisor at The Ohio State University, is helping me conduct this research project which is the topic of my doctoral dissertation.

My idea involves working with uncertain singers as identified by their music teachers from singing they have done in music class. The children would work with me individually and play matching games with cards, sound jars, and a video. To ensure confidentiality, names will not be used. Each child's singing will be recorded on an audio tape recorder and labeled by number. These tapes will be copied and used by other music teachers to evaluate each response. When evaluations are completed, tapes and evaluations will be returned to me. All copies of tapes will be destroyed. One original tape will be stored in the home of the co-investigator, Sandra Mathias, for three years.

After playing the matching games, each child will be allowed to select a sticker of his or her choice. This is my way of thanking the children for being part of the project.

I have worked with other children in preparing this project. I found that each one enjoyed the games and learned about his or her singing voice. Thank you for considering this request to work with your child.

Sincerely,
I consent to participating in (or my child’s participation in) research entitled, “A Technique to Aid the Development of Vocal Accuracy.”

Dr. Patricia Flowers or her authorized representative, Sandra Mathias, has explained the purpose of the study, the procedures to be followed, and the expected duration of my child’s participation. Possible benefits of the study have been described, as have alternative procedures, if such procedures are applicable and available.

I acknowledge that I have had the opportunity to obtain additional information regarding the study and that any questions I have raised have been answered to my full satisfaction. Further, I understand that my child is free to withdraw consent at any time and to discontinue participation in the study without prejudice to my child.

Finally, I acknowledge that I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

_________________________  ____________________________
Participant                              Person Authorized to
                                      Consent for Participant
                                      ____________________________
                                      Date
Appendix B

Game Instructions
Activity 1. Card Matching Game

T shows S cards. S names pictures and makes a sound for each one. T asks S if they have ever played the card matching game. If not, explain that T will turn the cards over and mix them up, then they are to turn the cards over, one at a time, to find the ones that match. When a match is found, that pair is set off to the side.

1. Turn the cards over and mix them up. Arrange the cards in 2 lines of 3 each.
2. Have S turn over one card and make the sound. Leave the card picture side up.
3. Have S turn over another card and make the sound. Leave the card picture side up.
4. T asks, “Is it a match?”
5. S answers.
6. If the cards do not match, T turns both cards face down.
7. Continue with the game until all matches are found.

Note: If you are playing the game in a large group, different children can turn the cards over, not always the same person.

Activity 2. Sound Jar Matching Game

T shows S jars. T lets S shake each jar and guess what may be inside. T reinforces S guess or tells student what is inside. T mixes up the jars and sets them in one line.

1. T states, “Now we are going to play a different game. In the card game, you used your eyes to find the matches. How do you think you will find the matches this time?” (Reinforce S answer of ears, or tell them they will use their ears.)
2. Have S shake on jar and set it in front of the line.
3. Have S shake another jar.
4. T asks, “Is it a match?”
5. S answers.
6. If the jars do not match, put them back in line. If the jars match, move them off to the side.
7. Continue with the game until all matches are found.

Activity 3. Voice Game

The teacher will sing phrases and ask the S to match. The teacher will move her hand to follow the phrase contour and ask S to do the same. The teacher will ask S if it was a match. If the S says no, the teacher will ask if the S thinks they were above or below the teacher’s voice.

1. T states, “In this next game, there are no cards to match and there are no jars to shake and match. Can you match my hand and my singing?”
2. T sings and moves hands:
1. so mi mi so so mi
   This is my sing-ing voice.

3. S sings and T asks if it was a match and if not, how was it different.
4. T sings and moves hands:
   so so la la so so mi
   Play-ing ball is lots of fun.

5. S sings and T asks if it was a match and if not, how was it different.
6. T sings and moves hands:
   so mi la so mi
   Who has the thim - ble?

7. S sings and T asks if it was a match and, if not, how was it different.
Appendix C

Response Sheet
RESPONSE SHEET
for a Technique to Aid the Development of Vocal Accuracy

No. _____ □ Group I □ Group II □ Group III □ Group IV □ Group V □ Group VI
No. of Tries Cards _____ Jars _____

Test □ Initial Pretest □ Initial Posttest □ Repeated Posttest
School □ Public □ Private
Grade □ 1 □ 3 □ 5
Age □ 6 □ 7 □ 8 □ 9 □ 10 □ 11 □ 12

Pretest/Posttest
T = Teacher S = Student CSP = Comfortable Starting Pitch (F4)

T: “Can you match my singing” T sings ...
S sings ...
T marks accuracy ...
T: “Was it a match?”
If ‘no,’ T asks, “How was it different?”

T: “Can you match my singing” T sings ...
S sings ...
T marks accuracy ...
T: “Was it a match?”
If ‘no,’ T asks, “How was it different?”

T: “Can you match my singing” T sings ...
S sings ...
T marks accuracy ...
T: “Was it a match?”
If ‘no,’ T asks, “How was it different?”

75
Appendix D

Judge’s Response Sheet
Judge's Response Sheet
for a Technique to Aid the Development of Vocal Accuracy

No. ____  □ Group I  □ Group II  No. of Tries  Cards ____  Jars ____

Grade □ 1  □ 3  □ 5
Age □ 6  □ 7  □ 8  □ 9  □ 10  □ 11  □ 12

Please rate each task on each test and put those numbers to the right of the rating scale:
Initial Pretest  7  6  5  4  3  2  1
Initial Posttest  7  6  5  4  3  2  1
Repeated Posttest  7  6  5  4  3  2  1

Comments:

__________________________________________________________

Judge's Signature  _____________________________  Date  _____________________________
Appendix E

Raw Data
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**Average** 11.24 12.66 14.47
REFERENCES


Dissertation Abstracts International, 42, 3489A. (University Microfilms No. AAI 820-2158)


83


