


An Overview of Existing Research About Children's Singing and the Implications for Teaching Children to Sing

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Debra Hedden¹

Abstract

The purpose of this investigation was to identify the findings of the studies devoted to the child voice, most of which have occurred in the past 25 years, and to present a synthesis of these findings with respect to the pedagogy, or art and science, of teaching children to sing. The data suggest that a philosophical disparity exists about singing, that is, teachers believe that it is an easy and natural process, whereas voice scientists support the contrary point of view. Data about children indicate that they have large ranges as infants, begin to sing with greater accuracy in pitch contour than to specific pitches, and gradually increase their range and pitch-matching accuracy as they mature. Many studies reported differences in accuracy with respect to sex, although the vocal mechanisms are virtually identical until puberty. While a variety of results exist for using text with pitch matching, for using accompaniment, for specific ranges at age levels, and for using certain vocal models, there are implications for teaching. Based on the majority of findings, it is suggested that teachers use particular activities with initial singers to help them hear their voices and learn to control the mechanism; that children learn to match one note, then short patterns, before progressing to songs; that the ranges of the children should determine the selected literature to create an effective match; and that vocal modeling be carefully done to assist in helping children match pitch and timbre. The most important element is that children can be taught to sing, suggesting that they have the mechanism in place and the teacher must properly develop their skills in singing.

Keywords

child voice, children's singing, pitch matching, accompaniment, vocal modeling, pedagogy

The child voice is a phenomenon that has received attention in a number of settings, including the implementation of singing schools in America in the early 19th century, and more concertedly during the 20th century with the establishment of the American Choral Directors Association's Repertoire and Standards Committee on Children's Chorus and its National Committee on Children's Choirs (see www.acdaonline.org/R&S/children). Although there has been a genuine effort to share information about children's singing through journals and books, the extant literature is not complete and is, thus, inconclusive. More recently, the perspective of voice physiology that music educators tend to embrace about children's singing being a "fundamental and natural" process has been challenged by voice specialists, who suggest that "voice science and research clearly indicate the opposite" (Trollinger, 2005, p. 45). According to Welch and White (1993), children's musical behaviors are influenced by their development and maturation; however, a clear and accepted "definition of normal, healthy singing" has not been established (p. 147).

The purpose of this article is to provide an overview of the research on prepubescent children and to offer implications for teaching children to sing based primarily on studies of the past 25 years, although a foundation from some older, important studies is integrated. The review of the literature focuses on both internal and external variables: Internal variables related to children's singing include vocal range, pitch matching, and sex differences; external factors subsume solo versus group singing accuracy, use of accompaniment, integration of text, and vocal modeling. Each of these variables is discussed in tandem with pedagogical considerations for teaching children to sing and is focused on children from preK to sixth grade.

¹The University of Kansas, Lawrence, KS, USA

Corresponding Author:

Debra Hedden, School of Music, The University of Kansas,
1530 Naismith Drive, Lawrence, KS 66045, USA.
Email: dhedden@ku.edu

Review of the Literature

Internal Factors That Affect Children's Singing

What have we discovered about the vocal range of children? It is important to understand the ranges of very young children in order to comprehend the limitations and the development that occur with age. In an earlier study, Keating and Buhr (1978) investigated infants' registers, reporting that the fry register (30-250 Hz) was typical, although the children were capable of both very high and very low frequencies that spanned the fry, modal (150-700 Hz), and falsetto (850-2500 Hz) registers, which are all common as children acquire language. Although the range of sound appears to be functional for infants, the use of that range requires years to develop into a singing voice that exhibits tuneful singing.

Tuneful singing is related to the range of pitches children are asked to sing, and young singers most often can perform songs within a limited range. A study with preschool children reported that their range was typically larger than what they demonstrated in singing songs, and modulation was noticed in nearly half of the children's singing, usually a result of their perception that the pitch was too low to achieve (Flowers & Dunne-Sousa, 1990). Kim (2000) suggested that the typical range for preschool children was middle C to C an octave above, with extensions in range occurring with maturation; an overview of several studies reported that range varies among elementary children but can be A-A, B-B, C-C, or as large as low G to high E (cited in Goetze, Cooper, & Brown, 1990).

An investigation with first-grade children reported that the range was more than an octave for 67.4% of the singers, with the number gradually increasing to 97.9% for sixth-grade children (Wassum, 1979). Around 4% of the children exhibited a limited range of a fourth or less; among the children in the study, age and range demonstrated significant correlations, that is, range expanded with maturation.

Moore (1991) found that the typical vocal range for children aged 8 to 11 years can be approximately two octaves and occurs between low G and high G#. According to Welch's (1979) review of studies devoted to children's singing ranges, children aged 5 to 7 years sang either in a small range between D to A (above middle C) or a large range between low G and high D; by age 10, the range changed/expanded to that of middle C to high E (an octave above middle C) or low F to high G.

Studies have demonstrated that range develops from infancy through childhood and affects the child's ability to sing because it has its limits. Range appears to be a most important issue, especially when a disparity is noted between children's capabilities and what they choose to produce. Studies have reported a variety of results

pertaining to children's ranges, but it is recognized that there are generally upper and lower limits, and both appear to expand with maturation. An area of concern is that range can be imposed by the literature (Welch, 1979), creating unhealthy situations for children in which they strain and force sounds outside their comfortable range.

What do we know about pitch accuracy in general? Pitch matching is a skill that contributes to singing accuracy and seems to be related to the child's age and range. Jersild and Bienstock (1931) conducted one of the earliest studies with 3-year-olds, noting that the pitches that were most easily matched were middle C, D, and E flat, those in close proximity to their speaking voices; and intervals of seconds and thirds were matched more successfully than larger ones. While investigating speech fundamental frequency and pitch matching among preschool children, Trollinger (2003) found that a higher speaking voice correlated with greater pitch-matching accuracy. She also found that bilingual preschool children who spoke a tonal language (Cantonese) had greater pitch-matching ability than their "monolingual counterparts" (Trollinger, 2004, p. 218).

Geringer (1983) compared 4- and 5-year-olds with fourth-grade singers, noting that there were significant differences favoring older singers in terms of accuracy in pitch matching. The younger children were far less accurate (2.5 semitone deviations) than the older singers (0.5 semitone deviation), suggesting that maturation played a key role in the increased accuracy.

In her work to classify degrees of accuracy in singing among children, Rutkowski (1990) identified five categories: (1) the presinger, or one who tends to chant; (2) the speaking-range singer, or the child who can maintain some pitch but is limited to his or her speaking range for singing; (3) the uncertain singer, the child who uses both speaking- and singing-voice ranges; (4) the initial-range singer, or the child who uses his or her singing range up to the lift; and (5) the singer, one who sings both above and below the register lift. After further development of the classification that included nine levels, a subsequent study noted that the average classification for first-grade children was "limited-range singer"; for third graders at the beginning of the year, "initial-range singer"; for late in third grade, "inconsistent singer"; for early in fifth grade, "initial-range singer"; and late in fifth grade, "inconsistent singer" (Rutkowski & Miller, 2002, p. 8). Similarly, another study found that children in Grades 1 through 6 did not fully develop their singing voices and frequently wavered between singing and speaking (Levinowitz et al., 1998). Other research has concluded that children can more accurately replicate individual pitches than songs, evidence that draws attention to the complexity of singing a song in its entirety (Welch, White, & Sergeant, 1995).

Singing accuracy depends on the singer's ability to produce the sounds, replicating pitch (Apfelstadt, 1988). At the basis of pitch production is the physiological aspect of breathing. Aaron (1990) found that vocal coordination instruction with children in Grades 4, 5, and 6, "[consisting] of general physical coordination, posture, breathing, phonation, resonant tone production, and instruction in flexibility crossing the register break," improved both pitch matching and range development (p. 96). In addition to the physical elements of singing, Miyamoto (2005) found that using the Yuba method to "specifically train the cricothyroid muscle" significantly improved singing accuracy among fourth-, fifth-, and sixth-grade singers (Discussion section, para 1). These studies also suggest that singing accuracy stems from a variety of factors, many of which can be learned.

Other strategies to improve singing were broached through varied sensory modes to determine if singing accuracy would be affected. For example, Persellin (1993) compared the employment of visual, auditory, and kinesthetic modes to teach a song to primary students, finding that the visual model (high–low visual aid) helped them sing with significantly greater accuracy. This might have been because of the fact the singers could see representations of pitch levels while reproducing the vocal lines. Five- and 6-year-old children who used movement gestures to kinesthetically feel the differences in three-note tonal patterns improved in pitch-matching accuracy (Liao, 2008), demonstrating that using additional means of presenting the concept of pitch produced positive results.

In a study with second-grade students, Reifinger (2009) focused on having the children sight read and sing 25 four-note tonal patterns using *do*, *re*, *mi*, *sol*, and *la*. Results suggested that neither the number of different pitches used in the patterns nor the particular pitches in the patterns influenced the difficulty level for the children; furthermore, difficulty was not affected when the pattern was melodic (mostly relegated to movement that occurs in steps) or harmonic (the pitches of *do*, *mi*, or *sol* forming a chord). He suggested that learning sequences be structured so that particular music-learning tasks are designated to allow the child to acquire skills and that specific pitch-reading opportunities be used in a logical progression to fortify skill acquisition.

The length of patterns were found to be a determining factor when teaching 5- and 6-year-old children to sing in that shorter patterns were more accurately matched than longer ones (Sims, Moore, & Kuhn, 1982), suggesting that teaching complete songs may be an issue for the young singers.

Singing melodies requires "perceptual abilities, neuromuscular responses, and tonal and rhythmic memory factors" (Kuhn & Sims, 1983, p. 154). Various studies lend support to this idea. For instance, first-grade students

learned songs in the keys of B flat, C, D, and E, both with and without accompaniment. There were differences that occurred among keys, with greater pitch inaccuracies with higher keys; the children preferred singing in the keys of B flat and C (Kuhn & Sims, 1983). Beyond the preference and fit for children's singing in certain keys is the idea of modulation during singing. Teaching children to sing without modulating among keys appears to be related to maturation according to Chin's meta-analysis (2003).

To assist the singer in improving pitch matching and other skills in singing, Welch (1985) recommended that "knowledge of results . . . [meaning] information about performance provided by the experimenter/teacher or other external source" (p. 6) be offered to the singer. In other words, specific feedback is essential to help the singer to hone and understand the skills of singing.

Thus, pitch matching appears to improve with age, depends on the singer's range, and uses tonal memory for singing. As the child matures, pitch matching can be developed with practice, by beginning with pitches matched near the child's speaking voice, working to expand pitch matching by teaching patterns, and then proceeding to teaching of songs. Integrating visual, aural, and kinesthetic presentation of pitch may assist the singers in improving their pitch matching.

Does gender play a role in pitch accuracy? Teachers who work with both boys and girls will often notice that they behave and approach learning differently, which provides a point of consideration for instruction. Welch and Sergeant (2009) suggested that there is rapid development of the vocal mechanism between birth and infancy, followed by slower development until puberty, with parallel development occurring for both boys and girls. Based on this evidence, we might assume that teaching both sexes to sing might not necessarily require different strategies; however, this assumption may be untenable given the results of the following studies.

Trollinger's (2003) investigation among preschool children reported that a higher speaking voice correlated with greater pitch-matching accuracy, with girls showing greater accuracy than boys. With older children, Franklin and Franklin's study (1988) found that boys between the ages of 7 and 13 years were four times as likely as girls to be monotones. The researchers posited that girls and boys may process information differently and may require different strategies to achieve accurate singing. Greater inaccuracy in boys' singing was corroborated by other studies focusing on children aged 4 to 8 years (Leighton & Lamont, 2006) and 7 to 9 years (Mang, 2006). In contrast, a 3-year longitudinal study found that children aged 5, 6, and 7 years entered school with comparable pitch-matching and singing abilities, remaining fairly constant in the "homogeneity of their vocal pitch accuracy" as

they progressed in age (Welch, Sergeant, & White, 1997, p. 157); that homogeneity disappears as maturation occurs. Therefore, it is important to consider that maturation may be occurring earlier, with many boys in fifth and sixth grades experiencing the onset of pubescent changes (Killian, 1999).

In addition to the issue of accuracy in pitch matching, Mizener (1993) found that students in Grades 3 through 6 generally liked to sing but had definite preferences for doing so in certain media. Moreover, accuracy decreased among sixth-grade students; thus, she hypothesized that both interest and social influence contributed to the lesser accuracy of their singing. Similarly, Phillips and Aitchison (1998) reported that attitudes toward singing declined with age among students in Grades 4 through 6. Hornbach and Taggart's (2005) study with primary children suggested that the social aspect may be influential, noting that students in Grade 3 were less comfortable with singing and that one male participant commented that he had sung in his "girl voice" (p. 328).

To review, although young boys and girls have essentially similar vocal equipment and size of the larynx, some studies have noted that boys tend to sing less accurately as they get older. Welch et al.'s (1997) longitudinal study reported quite different results, however. Given that vocal development appears to be similar for boys and girls, there must be other factors that affect singing.

External Factors Imposed by the Teacher

What have we learned about pitch accuracy in solo and group performance? Music teachers often use both solos (Hanna, 1997) and groups as a means of diversifying instruction and assessment measures. Smale's (1988) study with 4- and 5-year-olds demonstrated that individual singing was significantly more accurate than singing in unison and that a relationship existed between accuracy of melodic contour and accuracy of pitch matching; similarly, Goetze and Horii's (1989) investigation with K children, first graders, and third graders found that singing was more accurate when performed individually than in groups. In children aged 4 to 8 years, pitch accuracy improved over a 2-year period when the children sang alone, but singing quality also improved both in groups and in individual performance settings (Leighton & Lamont, 2006). Rutkowski (1996) found that kindergarteners' singing in both individual and small-group settings produced greater accuracy than whole-group singing. In contrast, Cooper's (1995) investigation with children in Grades 1 through 5 did not find significant differences in accuracy when individual and group singing were compared; and in Green's (1994) study with children in Grades 1, 2, 3, and 5, singing was more accurate in unison than individually.

The majority of the results focused on solo and group singing suggest that there could be differences in levels of accuracy for children's singing (Aaron, 1993), a point well worth considering by teachers. Therefore, teachers might offer singing in both media to better assist singers in gaining greater pitch-matching accuracy. Szabo (2001) underscored this idea by suggesting that "[o]ne cannot assume that merely participating in a singing group can ensure that inaccurate singers will eventually catch on to singing the melody in tune" (p. 7).

The literature selections that teachers make can affect the quality of singing and the motivation to participate. Erman (1981) maintained that the literature must be matched to the children, particularly those who are the weakest singers so that they can be successful before moving to more difficult selections.

As the child matures and begins to sing in harmony, yet another layer of difficulty is experienced; the singer must maintain his or her own pitch, rhythm, and text against other parts. In teaching children aged 8 to 11 years to match low, middle, and high notes of chords, Moore (1994) found that the major third was the easiest interval to match and that the highest notes of the chords were the most successfully matched, and he suggested that the weakest singers should sing soprano parts and descants because these are the easiest.

As the teacher increases the level of difficulty with harmonic singing, maintaining pitch seems to become more complex, for the singer must maintain his or her part among harmonic layers. As a result, the teacher would need to be familiar with the singer's ability to match notes of the songs and chords and to assign the part accordingly to allow the singer to be successful.

Additional factors: What is known about accompanied singing, vocal modeling, and text? The particular circumstances under which children are asked to sing may well present a variety of challenges. For instance, studies have reported that using/not using the piano for accompaniment for K children (Atterbury & Silcox, 1993) and second graders (Hedden & Baker, 2010) did not produce significant differences in the accuracy of their singing. A study with K and first-grade children using root melodic accompaniment also demonstrated that the accompaniment did not affect their ability to sing accurately (Guilbault, 2004). Earlier, Kuhn and Sims's (1983) investigation with first-grade singers demonstrated that no significant differences in singing accuracy occurred between accompaniments that were melodic, harmonic, or a combination of melodic and harmonic, and those without accompaniment. In contrast, Stauffer's (1985) study with primary children reported that a significant interaction occurred between the grade level and harmony; thus, she recommended that accompaniment be used more frequently with older children, rather than the younger ones,

to reduce the infringement on singing accuracy; the pedagogical strategy of not using accompaniment with primary singers was corroborated by Farmer (2005).

Second, it is unknown whether the addition of text may be a deterrent to accurate pitch matching. One study found that the combination of text and pitch may confuse the pitch-matching process for preschool children (Levinowitz, 1989). In contrast, other studies did not support these findings among 4- and 5-year-olds (Smale, 1988) or kindergarteners (Lange, 2000). It is plausible that certain texts may be problematic or may create pitch-matching challenges with certain melodies while others may not.

And third, the vocal model surfaced as an important factor, with singers in Grades K-3 and 7 to 8 being significantly more accurate in matching a female model than a male model (Yarbrough, Green, Benson, & Bowers, 1991). Singers matching pitches to vocal models who were male, male falsetto, and female were more accurate with the higher-pitched models and showed a consistent gain in accuracy between K and fourth grade, a large gain between Grades 4 and 5, another gain from Grades 6 to 7, and losses in other grades, perhaps due to changes in their voices (Yarbrough, Morrison, Karrick, & Dunn, 1995). Inaccurate singers in Grades K through 8 who were presented singing tasks by vocal models using tenor (falsetto), bass, and sine waves were more accurate in pitch when the human models were used, but an additional factor came into play, in that the children also tried to match the timbre of each model (Price, Yarbrough, Jones, & Moore, 1994).

Goetze et al.'s (1990) overview of research on children's singing reported that the most effective models for pitch matching were females, but male models using falsetto and child models can also assist in matching pitch and timbre. More specifically, modeling by a nonvibrato female or a child model was found to be more accurate for both certain and uncertain singers in Grades K through 3 than the vibrato female or the child model; the researchers posited that the different frequencies in the vibrato created problems for the uncertain singers in that they were unsure which part of the pitch to match (Yarbrough, Bowers, & Benson, 1992). Similarly, Green (1990) found that children in Grades 1 through 6 were most accurate when responding to a child model, less accurate to the female model, and least so to the male model, singing more flat pitches when matching the adult models and more sharp notes to the child model.

In addition to modeling for purposes of teaching children to match pitch, timbre is also an important factor. Many children habitually sing in chest voice; however, McGraw (1996) reported that second-grade children successfully learned to sing in head voice through the implementation of vocalises and songs in the range of E2 to G1. She noted that head voice singing was effective in

replacing the children's poorer habits, recommending that children be taught to sing in head voice from an early age.

Another form of vocal modeling exists in the approach to teaching a song. Klinger, Campbell, and Goolsby's (1998) study with second-grade children demonstrated that teaching the song in the immersion method, meaning singing the song several times with different text-related questions posed between repetitions, produced significantly better results in matching pitch, pitch contour, rhythm, and text than teaching a song by the phrase-by-phrase method. They used a sequence in which the teacher sang the entire song three times before asking the students to attempt singing, then proceeded to move to gradually phasing out the teacher and allowing the students to sing along after a series of singing together. Rutkowski and Runfola (1997) posited that children "need numerous opportunities in each music class to explore their voices and learn to sing with more accuracy" (p. 16); therefore, it would seem logical that songs be modeled several times to allow children sufficient time to replicate pitch and text.

Among the factors of accompaniment, text, and vocal models, the results have been varied, implying that singers may be affected by particular conditions. As a result, the teacher has the freedom to test different situations to see what is successful for his or her students, knowing that supportive accompaniment containing melodic and harmonic elements may be necessary, that the children's opportunities to hear a song multiple times as they learn to sing it may be preferable to teaching it by phrases, that the text may compromise pitch accuracy, and that pitch and timbre nearly like the children's voices may be the most effective vocal model.

Implications for Teaching Children to Sing Based on Research Findings

In the classroom, teachers tend to teach as they have been taught, much of which can be attributed to learning both in a studio and in a choir, and thus in individual and group settings. Although much of that learning is effective, there is a fair amount that is yet to be tested. Based on that idea, I will argue that it is important to use existing research as a foundation for planning and delivering instruction in order to effectively and appropriately teach children to sing. The pedagogy, or art and science of teaching, is critical for young voices to avoid damage. The following discussion offers particular suggestions in teaching children to sing related to the research findings; however, the reader is cautioned to consider that some of these ideas would benefit from additional research.

The Vocal Mechanism

First, the child voice—meaning from preschool to the point of puberty—is characterized by an incomplete vocal apparatus (Trollinger, 2006). Because the mechanism is not fully developed, the teacher must understand that the differences between children’s vocal anatomy and that of adults are striking and should treat the children’s voices with respect to that difference. It is essential for the teacher to understand that vocal abuse is possible in the music classroom, thus care of the voice during ongoing development is necessary. Teachers’ approaches to vocal training need to be careful and strategic, meaning that we must consider the capabilities and realities of the child’s voice and not expect it to produce the timbre, range, and quality of those of adults.

Given the vocal mechanism, we must understand what the capabilities are. That infants are able to vocalize in three registers (Keating & Buhr, 1978) is quite remarkable, but that information also suggests that young children already have a fairly wide range that requires careful development in terms of singing accuracy. In other words, a mechanism is in place, but we must teach children how to properly develop and use it. Part of our pedagogy needs to include instructing singers how to take care of their voices by eliminating yelling, continuous talking, speaking when tired, and using drugs and tobacco (Erman, 1981).

Aural Awareness, Physical Engagement, and Vocal Play

Another part of the pedagogy is teaching children to listen to sounds to create an aural repertoire, for singing certainly depends on one’s ability to listen and to replicate sounds (Apfelstadt, 1988). Thus, we need to consider that the sounds that surround children will have an effect on them. They will mimic sounds and reproduce them as they heard them, with most children having the ability to do so with a great deal of accuracy. Vocal play is suggested to be an integral part of teaching children to sing (Farmer, 2005), allowing students time to acquire an awareness of their voices and that each child controls his or her own voice. This can be done with singing games, call and response, and singing individually in a playful way, particularly for young children (Hanna, 1997).

An essential element of good singing is consistently working on the physiological aspect of singing. In doing so, the teacher concertedly instructs the physical side of singing through “gross body coordination, posture, breathing motion, breath management, speech, phonation, and vocal resonance” (Aaron, 1993, p. 12). It is important for the child to *feel* the production of singing to control his or her singing better, making a strong case for its inclusion.

Toward Pitch Matching and Range Extension

Once the child is aware of his or her voice and has produced sounds, the teacher can then move toward teaching discrete pitch. Evidence exists demonstrating that intentional instruction will assist children in increasing their pitch matching and range with training (Aaron, 1990; Jersild & Bienstock, 1931). It would appear logical to begin pitch instruction through general terms, that of pitch contour. Practice with these kinds of learning activities might well help the singer establish points of reference such as same/different, high/low, and loud/soft to aid discrimination and memory as singing skills accrue.

It would be prudent to focus on the idea of scaffolding, in which the teacher begins with the familiar, that of the pitch of children’s speaking voices (Trollinger, 2003); from that point, he or she then works to help them learn to match pitch by delivering instruction that initially focuses on pitch contour *in the child’s range*. Given the many opportunities for the child to sing alone in call-and-response activities, dramatizations, and short echo patterns, the teacher can identify the progress of each child and the group as a whole. It would seem important to plan subsequent activities based on the level of achievement demonstrated in these experiences and facilitate a highly sequenced and well-monitored program throughout the elementary years to help children become accurate singers.

Improving Singing Accuracy

Attention to singing accuracy involves focusing on pitch contour, followed by discrete pitch matching. Of course, the teacher must work with singing, hear the product the children create, and determine the next course of action based on that product. Using the classifications of different degrees of accuracy in singing (Rutkowski, 1990) allows the teacher to identify the status of children’s singing, ranging from the presinger to singer. The teacher is advised to frequently listen to the child to determine his or her level of accuracy in order to correctly plan and implement instruction to improve that singing.

For the teacher, determining the degree of accuracy must precede the planning and delivery of particular singing experiences to improve that accuracy. It is, therefore, recommended that the teacher not move to more difficult tasks than the child is capable of doing in order to (a) meet the child at the point where his or her skills are, (b) maintain interest and motivation in singing (Phillips & Aitchison, 1998), and (c) allow the child to be successful with particular tasks before tackling more challenging and lengthier ones. The teacher can listen carefully to the child, track progress, and give verbal, aural, and kinesthetic responses to help correct the child’s singing. When specific feedback

is used in helping the singers improve (Welch, 1985), the teacher can then precisely model what the child is singing followed by what he or she can do differently, thus coaching the students toward improvement and, ultimately, to accuracy.

The teacher must teach the singer to hear, judge, and control his or her own voice (Apfelstadt, 1988). The sequence of pitch-matching exercises might begin with one note at a time to allow the singer to achieve success (Welch et al., 1995), proceed to matching short patterns (Sims, Moore, & Kuhn, 1982), and finally extend to a song.

Using some instruction with learning songs by rote and by immersion can increase pitch matching, perhaps assisting in establishing a semblance of tonal memory. The multiplicity in hearing a song several times (Klinger et al., 1998) allows for the students to hum, sing occasional words, and reduce tension through familiarity with the song. Repetition in learning by rote may assist the children in remembering the contour, the pitches, the rhythms, and the text, which are all anchored together in the learning process.

The utilization of quality recordings (Rutkowski & Runfola, 1997) is invaluable in contributing additional modeling and multiple listening opportunities of the song in its entirety. As the child hears the song several times, he or she will gain familiarity with the pitch contour—perhaps the first step in accurately matching particular pitches. This process is akin to that of language acquisition, in that the young child hears certain words and phrases repeatedly before attempting to replicate them. As the child sings, it is necessary that the teacher offer immediate and specific feedback (Welch, 1985) to guide the singer in accuracy. Offering specific feedback should be quite definitive so that the singer understands what to do differently and how to do it successfully. Thus, effective modeling, repetitive opportunities to hear the song, and specific feedback appear to be a compelling equation for improving children's singing accuracy.

Singing in different media, using both individual and group singing, can assist singers in acquiring accuracy. Singing individually aids the child in hearing his or her own voice without other voices obscuring it (Rutkowski, 1996; Smale, 1988) and may allow the child to develop greater accuracy (Goetze et al., 1990; Goetze & Horii, 1989). Group singing may also help the singer to mediate pitches better, providing a kind of anchor to help stabilize pitch. It may be difficult for the teacher to correctly determine the child's singing accuracy when singing is performed in a group situation (Leighton & Lamont, 2006), but individual singing gives the teacher the opportunity to hear the child's voice without other distractions. Therefore, solo work may precede group singing to allow the child the opportunity to hear his or her voice and facilitate the teacher's feedback to assist the singer in improvement.

Other factors exist that may affect children's accuracy when singing songs, such as the addition of text (Levinowitz, 1989). It is possible that text presented in tandem with pitch creates separate and different challenges for children and may be particularly difficult for those with linguistic impairments. Thus, there appears to be some merit in introducing singing on neutral syllables to offer one challenge at a time.

The use of accompaniment and the type of accompaniment used (Stauffer, 1985) may also create issues for the child in that he or she may not recognize which pitch of the accompaniment to match when singing. It is advised that some cappella singing be used before thick accompaniments are introduced to allow the singer to gain stability in his or her voice. Using melodic and traditional harmonic accompaniment may assist the singer (Stauffer, 1985) once the singer has that stability. Therefore, it is recommended that the singer firmly establish his or her own voice without constant accompaniment in the early grades. It would seem logical to gradually integrate accompaniment to teach the singers to hold their part against instruments or vocal harmony parts.

The quality and register of the vocal model (Goetze et al., 1990; Green, 1990; Yarbrough et al., 1991; Yarbrough et al., 1992) are influential on the singer as well. The teacher must be attuned to the effect that the octave change has when modeling is presented by an adult male, for it may be problematic not only in terms of pitch but also with the timbre (Green, 1990; Price et al., 1994). Thus, it would be wise to consider the most appropriate modeling for the singers, understanding what will best assist them in successful singing.

If one contemplates all the elements that can affect singing accuracy, the possibilities are large unless the teacher concertedly limits these so that discrete skills can develop. For example, it is possible that children may focus on other aspects of singing, such as the teacher's voice, the accompaniment, or neighboring singers, which may all contribute to inaccurate pitch matching (Goetze & Horii, 1989). Therefore, this author strongly cautions the music teacher against depending on recordings for *teaching* a song because the inaccurate singer will not know which pitch to match, that of the singer, that of some particular instrument, or that of different notes in the chords. As the singer sufficiently learns the song, recordings can judiciously be used to add harmony.

Improving singing accuracy may well occur through teaching children to match one pitch, then short tonal patterns to allow the singers to focus, before progressing to a full song. Rote learning has demonstrated some merit because it provides repetition, as does the immersion method in learning songs, allowing the child opportunities to hear the song presentation several times. Closely related to the presentation is vocal modeling, which

appears to be quite important and seems to be more effective when the pitch and timbre more closely match that of the child's. Other elements such as individual and group singing, learning patterns and songs with and without text, and singing a cappella and with simple accompaniments are variables that can influence vocal accuracy.

Aural, Visual, and Kinesthetic Learning

Using movement gestures to kinesthetically demonstrate pitch differences in tonal patterns can improve pitch-matching accuracy (Liao, 2008). As music teachers, we might integrate visual, aural, and kinesthetic learning to fortify pitch matching and allow the students to see, hear, and feel differences in pitch before symbolic notation is introduced. For example, if visual, auditory, and kinesthetic modes (Persellin, 1993) are integrated into learning experiences, the probability that the child has received information in a way he or she can understand is great. Therefore, the use of "[h]and signs, hand levels, tone ladders, step bells, diagrams of melodic contour, and the use of a body scale are examples of visual and kinesthetic modes that can assist children in accurate singing" (Szabo, 2001, p. 5). An example of visual, aural, and kinesthetic learning is to allow the children to use "invisible ink" to trace a melodic contour in the air; this is a step in teaching them to hear and determine melodic direction before singing. It provides the children with listening opportunities and responsive practice before the singing occurs. As a result, the teacher who understands that children learn in a number of ways will provide a variety of learning experiences to accommodate the learner and engage him or her, and will do so in a learning sequence that benefits the child.

Music Literature

Of critical import is the teacher's ability to gather data about the children's ranges and to tailor the literature to fit their ranges to better facilitate their pitch-matching success. It appears that the literature selected by the teacher may be a critical component of pitch matching, and this must be done quite carefully to match the abilities of the singers, particularly the *weakest* singers, so that success is achievable by all children (Erman, 1981). Presenting this information in the context of other curricular areas, it would be ludicrous to ask a child to compute math problems that are beyond his or her capability or to read books that are not within his or her level of understanding. Therefore, the match between the child and the literature—or any musical task for that matter—would seem to be of utmost importance. The teacher must know the comfortable ranges of his or her students and align the literature to that range. This implies that the children

have had a multitude of individual singing experiences that allow the teacher to identify those ranges. It may be of critical import to consider literature not only in light of the appropriate range but also to tap into and maintain the children's interest in singing. We might assume that if the child is not interested in the literature, he or she probably will not expend much effort in singing and may reduce the progress that is possible because of lack of participation and practice.

Based on the research that has reported that boys may be facing maturation as early as in fifth grade (Killian, 1999), that children may respond to particular tasks rather than all the singing experiences put before them (Phillips & Aitchison, 1998), and that social circumstances may play a part in children's singing (Hornbach & Taggart, 2005), it is recommended that the teacher facilitate greater ownership for children in the singing classroom. Particularly for intermediate children, an idea to consider is to present a few pieces of literature to a particular grade level at once, allowing the children to read and hear the pieces. The teacher will have selected literature that presents the concept that he or she wants to teach, such as ascending leaps or key modulations. As the children read and hear the pieces, they are given the opportunity to decide which one seems the most interesting to them. Allowing them to make decisions and have some ownership in the process may increase interest and motivation; these experiences also serve as opportunities to teach them to critique and substantiate their choices beyond comments such as "I like it" or "It's cool." Additionally, the students' active involvement in classroom decisions can foster greater leadership and ownership in the process of learning (see information about the constructivist's approach to classroom learning).

The choice of literature is important for the child in that he or she is asked to put forth effort to sing it. Thus, interest in the literature is necessary. For the teacher, the choice of literature must match the ranges and capabilities of the children so that vocal strain and damage are avoided. That literature imposes range is a contention for which to argue, suggesting that the literature must be fitted to the child rather than to the teacher. Because literature eventually becomes the basis for most singing instruction in the classroom, careful selection is warranted. Scrutiny of the literature will help the teacher to choose appropriate, worthwhile, and interesting selections that contribute to the child's learning of music and will serve to motivate the learner.

Maturation, Gender, and Attitudes

As the child matures, he or she is likely to make significant gains in matching pitch (Geringer, 1983; Welch, 1979) and will probably extend his or her range for both

lower and higher notes. Although the size and composition of the vocal mechanism is virtually identical for prepubescent boys and girls, boys have been found to be less accurate in matching pitch (Franklin & Franklin, 1988; Mang, 2006), a finding that may be attributable to the manner in which they process information (Franklin & Franklin, 1988) or to boys' attitudes about singing. Although most children like to sing, they can be selective about the particular situations in which to sing (Mizener, 1993). Boys, in particular, can respond with different levels of accuracy to particular tasks, suggesting that they have preferences and respond accordingly (Welch et al., 1997). There may also be social reasons that contribute to the child's reticence to sing, with older children demonstrating more self-consciousness (Hornbach & Taggart, 2005).

Children's level of singing skills does not necessarily correlate with attitudes about singing (Mizener, 1993), drawing attention to the idea that teachers may have to expend more effort in capturing and maintaining attention and forging positive attitudes about singing. The teacher who carefully plans instruction with "both age- and grade-appropriateness" can more readily help establish positive attitudes (Mizener, 1993, p. 241). Thus, the teacher must be acutely aware that differences might exist among singers and must intentionally design a variety of activities and model enthusiasm for singing that will facilitate participation and learning.

In the upper elementary grades, a decrease in positive attitudes toward singing can occur in each consecutive year; that decrease might be offset by offering vocal instruction beyond only learning through songs in the general music classroom (Phillips & Aitchison, 1998). In considering boys' attitudes toward singing in particular, it would seem prudent for the teacher to incorporate some vocal experiences that are directly targeted at the boys; this might attract their interest, help them maintain that interest, and facilitate easier participation in singing. Using existing vocal exercises that use words related to sports, leisure, and age-appropriate activities may assist in motivating boys to sing. It would seem that greater motivation to participate may contribute to more frequent practice, thus enhancing singing accuracy.

Conclusions

To help the profession better understand how to avoid vocal abuse among children, we must know the parameters of the child voice and instruct our children with pedagogically sound strategies. This implies that the ownership of singing accuracy belongs to the teacher and he or she must carefully weigh the many factors that can and do affect singing. In essence, we need to remember that one size does not fit all when teaching children to

sing. Additionally, we will need to gather more empirical data about the specificity of instructional effectiveness, the sequence of instruction, pedagogical strategies, and particular methods to continue to improve the teaching of singing to children and enhance preservice teacher training. There is a wealth of research yet to be completed to help us better understand how children learn to sing and how we can best teach them.

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