Comparison of Starting Pitch Preferences among Fourth Graders, Undergraduate Music Majors and Elementary Education Majors

Janice N. Killian
Texas Tech University, U.S.A.

Jeremy J. Buckner
Carson-Newman College, U.S.A.

Abstract
The study compared the operant starting pitch of three known songs among 4th graders (n=30), undergraduate music majors (n=30), and non-music majors (n=30) to corroborate that singers distinguished among songs when choosing a starting pitch, and to investigate possible relationships between pitch choice and pitch accuracy. Subjects individually sang "Twinkle, Twinkle Little Star," "Jingle Bells," and "Happy Birthday." Songs were selected based on familiarity and the fact that each started on a different scale degree. Results indicated that all subjects started relatively low in their singing range with chosen pitches clustering about B flat to middle C. Non-music majors selected significantly lower pitches than music majors or children on particular songs, significantly affecting results. Both children and adults appeared to discriminate among songs when choosing a starting pitch. Accurate singers selected significantly higher starting pitches than did less accurate singers. Results are discussed in terms of implications for both practitioners and researchers.

Music educators make use of a wide variety of musical activities in the music instruction of children. One activity, singing, has been reported by Moore (1991) to account for at least 25% of music classroom instruction and is included in virtually every text regarding the teaching of music to children (Anderson & Lawrence, 2004; Campbell & Wade, 2004a, 2004b; Choksy et al., 2000; Hoffer, 2004). Given the agreement regarding the value of singing in the music education of children, it is not surprising that appropriate starting pitches for elementary children is frequently addressed in textbooks (Anderson & Lawrence, 2004; Campbell & Wade, 2004a, 2004b; Choksy et al., 2000; Hoffer, 2004). Teachers following these recommendations might be assumed to frequently initiate songs in what common practice says are appropriate keys. If the teacher regularly begins songs on appropriate pitches, will the student learn to imitate those starting pitches? Or is selection of starting pitches perhaps somehow related to natural tendencies? The answer to these questions would seem to be of interest to researchers in search of data regarding human musical responses as well as to teachers in search of the best data-based classroom practices.

Comparisons between adult and child vocal ranges indicated that adults tended to exhibit larger vocal ranges than children. Specifically, Geringer, Nelson, and Kotska (1980) found that adult vocal ranges were consistently lower than the vocal ranges of children, and that non-music majors exhibited vocal ranges of slightly less than two octaves (Kuhn, Wachhaus,

Moore & Pantle, 1979), while children's ranges were generally believed to be narrower (Forrai, 1995; Hoffer, 2004). Educators were encouraged to begin songs on a comfortable pitch for children (Anderson & Lawrence, 2004; Campbell & Wade, 2004a, 2004b; Eisen & Robertson, 1996), and some texts (Forrai, 1995; Hoffer, 2004) identified a child's appropriate range as D above middle C to an octave higher. Differing adult and children ranges may affect starting pitch selections. In studies particularly related to this one, Killian (1993, 1996) reported that when singing familiar songs, college women's (non-music major) mean starting pitch across 27 songs was about A below middle C (with extremes that ranged G# two octaves below to F# above middle C). In comparison, elementary students (third graders) exhibited a mean starting pitch of middle C (with extremes from C# below middle C to A# above middle C) on the same task. Thus adults chose significantly lower starting pitches than did children, and although starting pitches were highly individual, both groups discriminated among songs when choosing the starting pitch. The fact that children selected higher starting pitches than adults suggested that discrepancies in vocal range might be the result of development and/or experience and training (Moore, 1991; Wassum, 1980), although these studies did not discriminate between age or training among participants who were all untrained singers.

These data regarding pitch choices were consistent with recommendations by music pedagogues. Choksy (1988) advised teachers to pitch rote songs near the key of D, because her experience indicated that young children most often pitch the lower note of a minor third around F#. Consistent with these ideas, Moore (1991) reported that children centered their tonality near middle C# when performing "America."

Adding additional impetus to the importance of starting pitch issues to practicing music educators were the data indicating that children most frequently mismatched pitch when singing at the extremes of their range (Rutkowski, 1986; Smith, 1963). In an early study, Smith (1963) reported that young children who received training to sing tunefully were most improved when singing was restricted to a lower register of middle C to the A above. This advice was consistent with Rutkowski (1986) who argued that children should be led to sing in a restricted range in their early years to maximize pitch matching. Did children who were relatively inaccurate singers *selected* starting pitches that were less appropriate (i.e., at the extremes of their ranges) than those of their more accurate peers? Extant research does not appear to address this question.

Research indicated that both singing accuracy and singing range might be developmental in nature (Cooper, 1995; Phillips, 1989; Miller & Rutkowski, 2003; Rutkowski, 1990; Trollinger, 2003; Welch, Sergeant & White, 1997), although the relationship between the two was yet to be fully explored. Geringer (1983) reported that pitch matching accuracy was significantly better for 4th graders as compared to pre-school age students. Again, did inaccurate singers tend to select pitches outside their ability to produce those pitches, i.e., outside their singing range? It might also be asked whether age or training affects operant pitch selection. In other words, did adult singers differ from children in operant pitch selection, and did experienced musicians differ from inexperienced musicians on this task?

In addition, examination of extant research regarding pitch centers revealed some interesting anomalies and possibilities. Music theorists have speculated that humans may perceive greater pitch clarity around

specific pitches and thus perhaps select those pitch centers. Huron (2001) identified "toneness" as one of 10 perceptual principles, and suggested that sounds may be perceived as auditory images, speculating that "pitch perception is a learned phenomenon arising primarily from complex tones produced typically by the human voice" (2001, p. 7). In a related study, Huron and Parncutt (1992) calculated the average notated pitch from a large sample of diverse music including Western and non-Western instrumental works. The average pitch from the sample was found to lie near D# above middle C. In addition, Huron (2001) speculated that clarity of pitch perception might be linked to vocal production, suggesting a link between perception and performance with the human ear and voice. Huron suggested that greater clarity of pitch perception of complex tones occurred around middle C and musical practice and human hearing appear to be co-adapted. Although data did not appear to exist regarding whether Huron's ideas were in fact viable, Huron's ideas would appear to support Choksy's claim (1988) that children centered tonicity around D above middle C, and raised the question of whether humans, children or adults, have an ideal tonal center.

Given the research indicating the differences in ranges and starting pitches between adults and children, the unknown relationship between training and pitch choice, possible effects of pitch choice on singing accuracy, the speculation that humans might perceive some sort of "natural" pitch center, and the possible influence these questions might have on teaching singing, the purpose of this study was: (a) to compare the operant starting pitch of three known songs among 4th graders, undergraduate music majors, and non-music majors, allowing an examination of possible differences due to both age and musical experience; (b) to corroborate existing evidence that singers discriminated among songs when choosing a starting pitch by comparing operant starting pitch selections on familiar songs beginning on *do*, *mi*, and *sol*; and (c) to identify and investigate possible relationships between pitch choice and pitch accuracy, i.e., did less accurate singers choose different starting pitches than accurate singers?

Method

Subjects ($N = 90$) consisted of 4th grade students ($n = 30$), undergraduate music majors ($n = 30$), and undergraduate non-music majors ($n = 30$). Music majors (male = 16 and female = 14) were enrolled in freshman and sophomore music theory classes at a large southwestern university in the United States. Non-music majors (male = 1 and female = 29) were enrolled in music for elementary education major courses at the same university. Fourth graders (male = 16 and female = 14) from two intact classes at a local elementary school that had a consistent twice-weekly music class served as participants. All participants, volunteers drawn from intact classes, were tested individually.

Singers were asked to sing "Twinkle, Twinkle Little Star," "Jingle Bells," and "Happy Birthday" chosen as three very familiar children's songs (Prickett & Bridges, 1998) requiring both melodic steps and leaps and each starting on a different scale degree ("Twinkle, Twinkle" = *do* beginning pitch; "Jingle Bells" = *mi*; "Happy Birthday" = *sol*). All subjects individually were provided with the words to the three songs and were instructed to sing the songs *a cappella*. No reference to pitch or tempo was given. Song order was counter-balanced to distribute possible order effects.

Subjects' responses were recorded via a Sony Portable Mini-Disc Recorder model MZ-B100. Raw data consisted of the

recorded performance of the subjects that were transferred to an HP Pavilion series dv4000 laptop and were converted to .MP3 format using *Audacity 1.2.3,* audio editing software. Starting pitches were determined independently by two experienced music educators using standard equal-tempered pianos verified for accurate tuning with an A-440 tuning fork. Reliability on 100% of the starting pitches = .93 using the agreements / agreements + disagreements formula (Madsen & Madsen, 1998). Because the purpose of the study was to determine general starting pitches, no attempt was made to identify the frequency in Hertz (Killian, 1996). These data allowed examination of subjects' consistency of starting pitch choice among the three songs to determine if individuals tended to select the same pitch or discriminate among songs. Additionally these data allowed examination of consistency among other singers within the same group, and among the three groups to examine any possible age/maturity or musical training factors.

Results

The resulting data consisted of the audio recording of subjects' responses. Absolute pitch names were converted to sequential integers indicating semitone differences. Modifying procedure established in similar studies (Killian, 1996; Geringer, Nelson, & Kotska, 1980; Kuhn, Wachhaus, Moore, & Pantle, 1979), middle C was set to = 0, Db = +1, D = +2, Eb = +3, and so forth. Pitches below middle C were indicated using negative integers. Thus B below middle C = -1, Bb = -2, and so forth. With regards to starting pitch for the adult male subjects, the absolute pitch name was converted ignoring the octave displacement consistent with adult male vocal range. For example if an adult male began on B an octave below middle C, the integer assigned was -1. Table 1 displays the mean starting pitch for each song across the three different groups.

Statistical comparisons were performed using a 3 (songs) x 3 (groups) x 6 (counterbalanced orders) ANOVA with

Table 1
Mean Starting Pitches: A Comparison of Song by Group

Song Title	Group	Mean	Std. Deviation	*N*
"Jingle Bells"				
	4th Grade	1.67	3.01	30
	College - Music	0.13	3.50	30
	College - Non-Music	0.07	2.30	30
	Overall Song Mean	0.62	3.04	90
"Happy Birthday"				
	4th Grade	-1.63	1.61	30
	College - Music	-1.63	2.44	30
	College - Non-Music	-3.27	1.57	30
	Overall Song Mean	-2.18	2.05	90
"Twinkle, Twinkle"				
	4th Grade	-1.1	2.59	30
	College - Music	-1.67	2.20	30
	College - Non-Music	-3.37	2.59	30
	Overall Song Mean	-2.04	2.63	90

repeated measures on the starting pitch for each individual as the dependent measure. Analysis indicated no significant differences among the counterbalanced orders; thus that factor was not examined further in this study. There were, however, significant differences in starting pitches by majors ($F[2, 87] = 7.05$, $p < 0.001$) as well as in different songs by majors ($F[1, 87] = 67.61$, $p < .001$). There were no significant interactions across any factor. Multiple comparisons of significant results were computed using the Tukey HSD. Examination of Table 2 revealed significant differences between 4th graders and non-music majors and between music and non-majors on the starting pitches selected on both "Happy Birthday" and "Twinkle, Twinkle." There were, however, no significant differences among groups on "Jingle Bells," and there were no significant differences on any song between 4th graders and music majors.

More detailed examination of the frequency of pitch choice by song in Table 3 revealed variability across all pitches within all groups, indicating that singers did seem to discriminate among songs (i.e. subjects started specific songs on specific pitches rather than a tendency to begin each song on the same pitch). However, pitch choice among songs seems to reveal certain trends.

Table 2
Tukey HSD Multiple Comparisons across Songs by Groups

Songs	Groups		Mean Difference	Standard Error
"Jingle Bells"				
	Grade 4	Music	1.53	0.77
		Non-music	1.60	0.77
	Music	Grade 4	-1.53	0.77
		Non-music	0.07	0.77
	Non-music	Grade 4	-1.60	0.77
		Music	-0.07	0.77
"Happy Birthday"				
	Grade 4	Music	0.00	0.50
		Non-music	**1.63	0.50
	Music	Grade 4	0.00	0.50
		Non-music	**1.63	0.50
	Non-music	Grade 4	**-1.63	0.50
		Music	**-1.63	0.50
"Twinkle, Twinkle"				
	Grade 4	Music	0.57	0.64
		Non-music	**2.27	0.64
	Music	Grade 4	-0.57	0.64
		Non-music	*1.70	0.64
	Non-music	Grade 4	**-2.27	0.64
		Music	*-1.70	0.64

* $p < .05$, ** $p < .01$.

For example, the range (pitch range not vocal range) with the most frequently chosen pitches to begin "Jingle Bells" was between B and Eb. Also, subjects frequently chose pitches within the range of Ab to B for "Happy Birthday," and G to Bb for "Twinkle, Twinkle."

Additionally, audio recordings were evaluated for general pitch accuracy. An overall score was given each singer ranging from 1 (little or no pitch center, spoken rather than sung), 2 (mostly pitched, but some modulation or missed intervals), and 3 (accurate pitches). Reliability across 25% of the recordings regarding pitch accuracy scoring = .91 using the agreements / agreements + disagreements formula (Madsen & Madsen, 1998). Mean accuracy scores for group by songs appear in Table 4.

Statistical analyses revealed a significant difference among songs ($F[2,87] = 53.41$, $p < .001$) as well as among accuracy groups ($F[2, 87] = 38.33$, $p < .001$). There were no significant interactions. Tukey HSD multiple comparisons revealed a significant difference in accuracy between those scored as highly accurate (3) and those scored as inaccurate (1). No other differences were significant. Further examination of Table 4 indicated that among both 4th graders and non-music majors, the accurate singers selected higher starting pitches than did less accurate singers on every song. Note that each integer represented a pitch of a half step. The tendency for accurate singers to select higher starting pitches than inaccurate singers was especially noticeable among the 4th graders.

Table 3
Frequency of Pitch Choice: Comparison of Song and Group

	Starting Pitch												
	C	Db	D	Eb	E	F	Gb	G	Ab	A	Bb	B	Total
"Jingle Bells"													
4th Grade	5	3	1	6	2	2	3	1	0	3	1	3	30
Music	2	5	5	5	1	5	1	0	1	2	0	3	30
Non-music	5	4	4	0	4	0	0	0	3	0	4	6	30
Total	12	12	10	11	7	7	4	1	4	5	5	12	90
"Happy Birthday"													
4th Grade	3	1	2	0	0	0	0	0	4	4	10	6	30
Music	1	2	0	0	3	0	0	2	4	7	5	6	30
Non-music	1	0	0	0	0	1	0	7	4	9	5	3	30
Total	5	3	2	0	3	1	0	9	12	20	20	15	90
"Twinkle, Twinkle"													
4th Grade	3	3	1	1	1	0	2	1	2	3	10	3	30
Music	3	3	1	0	1	0	1	2	3	3	9	4	30
Non-music	1	0	0	0	0	2	1	9	5	6	4	2	30
Total	7	6	2	1	2	2	4	12	10	12	23	9	90

Table 4
Pitch Choices of Accurate Singers (scores of 2 & 3) versus Inaccurate Singers (score of 1)

	"Jingle Bells"	"Happy Birthday"	"Twinkle, Twinkle"	Mean Pitch	Approximate Pitch Names
Music Majors					
All $n = 30$	0.13	-1.63	-1.67	-1.06	B below middle C
Non-Music Majors					
Accurate $n = 20$	0.85	-3.05	-3.65	-1.95	Bb below middle C
Inaccurate $n = 10$	-1.60	-3.50	-4.40	-3.17	A below middle C
Mean	0.07	-3.12	-3.80	-2.28	Bb below middle C
4th Graders					
Accurate $n = 18$	2.60	-1.28	-0.06	0.42	middle C to C#
Inaccurate $n = 12$	0.17	-2.17	-1.83	-1.28	B below middle C
Mean	1.67	-1.63	-1.10	-0.35	B below middle C

Results can be summarized as follows:

1. There was a significant difference between 4th graders and non-music majors and between music and non-music majors in the choice of starting pitch of familiar songs on "Happy Birthday" and "Twinkle, Twinkle." There were no significant differences between 4th graders and music majors. All singers started relatively low in their singing ranges with chosen pitches clustering about Bb to middle C. Non-music majors selected the lowest starting pitches (mean starting pitch = -2.28 = Bb below middle C), 4th graders selected the highest starting pitches (mean starting pitch = -0.35 = middle C), and music majors in between (mean starting pitch = -1.06 = B below middle C).
2. Both children and adult subjects appeared to discriminate between songs when choosing a starting pitch. Review of the data revealed only 2 participants who started on the same pitch for all three songs (a music major who started all on B below middle C and a non-music major who began all songs on middle C).
3. Much variability was noted among groups and among songs within groups. Starting pitches for "Jingle Bells" ranged from -7 to +7 (Gb below to Gb above middle C). "Happy Birthday" starting pitches ranged from -7 to +4 and those for "Twinkle, Twinkle" ranged from -7 to +6. Note that all the -7 starting pitches were from non-music majors.
4. Accurate singers selected significantly higher starting pitches than did inaccurate singers.

Discussion

Initial examination of the selected starting pitches revealed that most participants selected pitches in the lower part of their singing ranges. Such a finding was consistent with descriptive research comparing ranges and speaking pitch of changing voice boys (Killian, 1999) as well as among children (Moore, 1991). While no significant difference was found between children and music majors, children and non-music majors' pitch choices and music and non-music majors pitch choices differed significantly. It seemed reasonable that non-music majors had little or no training in singing; therefore, they chose pitches lower in their range and closer to their natural speaking voice. Research into the relationship between operant starting

pitches, vocal training, and speaking voice pitch might explain the significant difference in starting pitches between non-music majors and children, and such research might prove fruitful in identifying the most comfortable place to begin new singers (either adults or children) and thus be of great interest to practicing educators.

Singers did discriminate on starting pitches; only two singers started each song on the same pitch, leading us to speculate when and how children learned on what pitches a song begins. Further developmental studies on the acquisition of this skill appeared in order. In this study the highest starting pitches were chosen for "Jingle Bells" (beginning on *mi*; overall mean starting pitch = Db above middle C) by all three subject groups; very little differences were noted on starting pitch selection for "Happy Birthday" (starting on *sol;* mean starting pitch = Bb below middle C) and "Twinkle, Twinkle" (starting pitch on *do;* mean starting pitch = Bb below middle C). Despite beginning on different scale degrees, the melodies of "Happy Birthday" and "Twinkle, Twinkle, Little Star" began lower and moved upward in the scale. This similarity in melodic movement might explain the general agreement among subjects for choosing a lower starting pitch for "Happy Birthday" and "Twinkle, Twinkle Little Star." Although this tendency was evident in all groups, there were significant differences between music and non-music majors and between children and non-music majors. Clearly both children and adults have some sense of "where a song should start." Researchers and theorists might want to further explore the reasons for this knowledge. It should be remembered, however, that these subjects were from a single geographical area and were asked to sing only three familiar songs. Thus any generalizations to other populations should be made with caution. Future studies may be designed to explore this relationship further.

Perhaps the result of most interest to practicing music teachers was the fact that accurate singers (those scoring 2 or 3 on the accuracy rating) began all songs on a higher pitch than did inaccurate singers (those scoring 1). There appeared to be a tendency for these inaccurate singers to select pitches very near the bottom of their range thus confirming Rutkowski's (1989, 1990) and Miller & Rutkowski's (2003) research. This finding might lend credence to common practice advice to teach children to find their head voices (Anderson & Lawrence, 2004; Campbell & Wade, 2004a, 2004b; Choksy et al., 2000; Hoffer, 2004). Much investigation remains to determine whether low starting pitches contribute to inaccurate singing or if inaccurate performance or perception contributes to selecting pitches from the lowest part of an individual's range.

For the purposes of this study, the three songs were presented in all possible counterbalanced orders to equally distribute any potential order effect. Further detailed analysis regarding the effect of song order may reveal the influence of beginning on various scale degrees. No effort was made to analyze anything other than the starting pitch. Did participants tend to stay in the same key? Is there a tendency toward a universal key center in Western children's songs (Choksy, 1988; Huron & Parncutt, 1992) similar to evidence of a tendency to perceive and perform within specific tempo parameters (Buckner, 2005)? Did those who modulated within a song then start the next song in the key to which they had modulated? Why did some participants sing "Jingle Bells" and "Happy Birthday" in reasonable tonality, but then simply speak "Twinkle, Twinkle" regardless of where it appeared in the counterbalanced order? Is there something about the melody of that particular song or have people learned it as a

spoken rhyme rather than a melody? Clearly further, more detailed analyses of these data and additional studies regarding this issue are warranted.

Further research like this study is encouraged. One may explore in a research data-base those procedures and assumptions that are considered common practice among music educators in classroom settings. Whether results confirm or conflict with common practice can only be of benefit to researchers and classroom music educators alike.

REFERENCES

Anderson, W., & Lawrence, J. (2004). *Integrating music into the elementary classroom*. 6th ed. Belmont, CA: Schirmer.

Buckner, J. (2005) *The effect of rhythmic notation on undergraduate music majors' choice of tempo.* Unpublished Master's Thesis. Texas Tech University.

Campbell, P. S., & Wade, B. C. (2004a). *Teaching music globally: Experiencing music, expressing culture*. New York: Oxford University Press.

Campbell, P. S., & Wade, B. C. (2004b). *Thinking musically: Experiencing music, expressing culture*. New York: Oxford University Press.

Choksy, L. (1988). *The Kodály method.* 2nd ed. Englewood Cliffs, NJ: Prentice Hall.

Choksy, L., Abramson, R., Gillespie, A., & Woods, A. (2000). *Teaching music in the twenty-first century*. Englewood Cliffs, NJ: Prentice Hall.

Cooper, N. A. (1995). Children's singing accuracy as a function of grade level, gender, and individual versus unison singing. *Journal of Research in Music Education, 42,* 222-231.

Eisen, A. & Robertson, L. (1996). *An American methodology.* Lake Charles, LA: Sneaky Snake Publications.

Flowers, P. J., & Dunne-Sousa, D. (1990). Pitch-pattern accuracy, tonality, and vocal range in preschool children's singing. *Journal of Research in Music Education*, *38*, 102-114.

Forrai, K. (1995). *Music in preschool.* 3rd ed. Budapest, Hungary: Kultúra Foreign Trading Co.

Geringer, J. M. (1983). The relationship of pitch-matching and pitch-discrimination abilities of preschool and fourth-grade students. *Journal of Research in Music Education, 31*, 93-99.

Geringer, J. M., Nelson, J. K., & Kostka, M. J. (1980). Differential assessment of child and adult singing ranges. *Contributions to Music Education, 8,* 39-45.

Hoffer, C. (2004). *Music for elementary classroom teachers.* Prospect Heights, IL: Waveland Press.

Huron, D. (2001). Tone and voice: A derivation of the rules of voice-leading from perceptual principles. *Music Perception, 19*, 1– 64.

Huron, D., & Parncutt, R. (1992). How 'middle' is middle C? Terhardt's virtual pitch weight and the distribution of pitches in music. Unpublished manuscript.

Killian, J. (1993). Comparison of children's and adult's preferred starting pitches when singing familiar children's songs. *Texas Music Education Research*, *1993,* 31-35.

Killian, J. (1996). Definitions of "knowing:" Comparison of verbal report versus performance of children's songs. *Journal of Research in Music Education, 44*(3), 215-228.

Killian, J. (1999). A description of vocal maturation among fifth and sixth grade boys. *Journal of Research in Music Education, 47*(4), 357-369.

Kuhn, T. L., Wachhaus, G., Moore, R. S., & Pantle, J. E. (1979). A comparative survey of undergraduate nonmusic major vocal ranges with textbook song ranges and elementary school students' vocal ranges. *Journal of Research in Music Education, 27,* 68-75.

Madsen, C. K., & Madsen, C. H. Jr. (1998). *Teaching/Discipline: A positive approach for educational development.* 4th ed. Raleigh, NC: Contemporary Publishing Co.

Miller, M. S., & Rutkowski, J. (2003). A longitudinal study of elementary children's acquisition of their singing voices. *UPDATE: Applications of Research in Music Education, 22*, 5-14.

Moore, R. S. (1991). Comparison of children's and adult's vocal ranges and preferred tessituras in singing familiar songs. *Bulletin of the Council for Research in Music Education, 107*, 13-22.

Phillips, K. H. (1989). Mary Goetze: Factors affecting accuracy in children's singing. *Bulletin of the Council for Research in Music Education*, *102*, 82-85.

Prickett, C. A., & Bridges, M. S. (1998). Familiarity with basic song repertoire: Music education/therapy majors versus elementary education majors. *Journal of Research in Music Education*, *46*, 461-468.

Rutkowski, J. (1989). The effect of restricted song range on kindergarten children's use of singing voice and development attitude. *Council for Research in Music Education Bulletin*, *100,* 44-53.

Rutkowski, J. (1990). The measurement and evaluation of children's singing voice development. *Quarterly Journal of Music Teaching and Learning, 1*(1 & 2), 81-95.

Smith, R. B. (1963). The effect of group vocal training on the singing abilities of nursery school children. *Journal of Research in Music Education, 11*, 137-141.

Trollinger, V. L. (2003). Relationships between pitch-matching accuracy, speech fundamental frequency, speech range, age, and gender in American English-speaking preschool children. *Journal of Research in Music Education, 51*, 78-94.

Wassum, S. (1980). Elementary school children's concept of tonality. *Journal of Research in Music Education, 28*, 18-33.

Welch, G. F., Sergeant, D. C., & White, P. J. (1997). Age, sex, and vocal task as factors in singing "in tune" during the first years of schooling. *Bulletin of the Council for Research in Music Education, 133*, 153-160.