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The Relationship of Vocal Accuracy, Gender, and Music Aptitude among Elementary Students

by

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The purpose of the study was to gain insight into how children in the fourth and fifth grade acquire singing ability. The question to be pursued in the course of this study is as follows: What differences are found in children's singing accuracy relative to tonal music aptitude and gender?

The students in the sample comprised the entire fourth and fifth grades in a suburban middle-class school. There were 174 students with gender almost evenly distributed; specifically 86 males and 88 females.

Students were audio taped singing three separate tasks: 1) patterns from the Singing Voice Development Measure (SVDM), 2) a long-familiar song of 12 measures (America, in the key of F), and 3) a newly-learned song (Path to the Moon, in the key of G) also consisting of 12 measures. Finally, students were administered the Intermediate Measures of Music Audiation (IMMA).

Results of a two-factor ANOVA investigating differences in children's singing accuracy relative to tonal music aptitude and gender found that the singing of high-aptitude children and moderate-aptitude children was significantly more accurate than the singing of low-aptitude children ($p < .0001$) and the singing of female children was significantly more accurate than the singing of male children ($p = .0008$).

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Students in elementary school, generally grouped in grades kindergarten through fifth grade, are almost universally acknowledged to have treble singing voices (Cooksey 1992, Phillips 1992). While some children of the age of nine or ten may be entering puberty, most are not and even those who are exhibiting beginning maturational changes will often retain their treble voices for their time in elementary school. Phillips (1992), and Campbell and Scott-Kasner, (2001), agree that when children begin elementary school their ranges are often limited to about five or six notes. As they progress through school and mature, there is also agreement that students' ranges expand downward and upward so that by the time students are ten years old their range has expanded to more than an octave, beginning at approximately "a" below "middle c" and extending to "e or f" above "high c."

This is the only time in a child's education where there will be this widespread agreement in range, regardless of gender or age. Middle school and high school students will deal with a variety of changing voices, octaves and qualities among both male and female students (Cooksey, 1992).

Despite this uniformity in range among elementary students, there is ample literature to demonstrate that this consistency does not extend to accuracy. Many researchers have found it necessary to assess the accuracy of the developing voice, among them Agnus, Garner, and Howard (1998), Cooper (1995), Davies and Roberts (1975), Howard and Welch (1989), Levinowitz, Barnes, Guerrini, Clement, D'April, and Morey (1998), Rutkowski, (1990), Welch, (1979 and 1994), and Welch, Sergeant, and White (1996) and agreed there is a wide disparity in the accuracy of the elementary singing voice.

There have been still other researchers who did not concentrate on those factors stated above, but instead sought answers from intrinsic factors that each elementary child possess, that is, gender and music aptitude. The following studies have been chosen for inclusion in this article for their particular emphasis on examining gender and music aptitude as it relates to the vocal accuracy of elementary students.

Jones (1993) designed a study to determine how audiation skills of accurate singers compare with those of inaccurate singers. In her study, the developmental aptitude test, *Primary Measures of Music Audiation (PMMA)* was administered to an equal number of accurate and inaccurate singers in the first, second, and third grades.

Through a series of *t*-tests, she compared the Tonal, Rhythm, and Composite mean scores of accurate singers with the Tonal, Rhythm, and Composite mean scores of inaccurate singers and found that pitch discrimination and vocal accuracy appear to be related.

Gordon (1986) believes that children progress through a developmental stage of music aptitude until they reach the age of about nine years, when their music aptitude stabilizes. He devised the *Primary Measures of Music Audiation (PMMA)* to test the developmental music aptitude of students in grades kindergarten through three. The *Intermediate Measures of Music Audiation (IMMA)*, also created by Gordon (1986) are often used to measure the music aptitude of children in grades four and five. Previous researchers, such as Jones (1993) and Rutkowski (1990) have used the *PMMA* to measure music aptitude, but have not found it necessary to use the *IMMA* in their investigations.

Apfelstadt (1984) designed an investigation of sixty-one kindergarten children where one

of her aims was to determine whether there was a relationship between gender and performance when given pitch discrimination and vocal pitch-matching tests. Pitch discrimination was determined by a score achieved on the *Primary Measures of Music Audiation, PMMA*. She also wished to determine if there is a "relationship between pitch discrimination and pitch-matching accuracy." Apfelstadt found no relationship between gender and performance on pitch discrimination and vocal pitch-matching tests. Similarly, she also found no relationship between pitch discrimination and vocal pitch-matching accuracy.

Goetze and Horii (1989) discovered that among one hundred kindergarten and first grade students, the children were more accurate when they sang individually than when they were singing with a group. They also reported that girls sang more accurately than boys, especially in group singing.

Jarjisian (1983) investigated singing achievement of young children among six first grade classes. She administered the *Primary Measures of Music Audiation* and reported that children with high tonal aptitude test scores achieved significantly higher vocal achievement ratings than those children with low tonal aptitude scores.

Atterbury and Silcox (1993) examined the effect of piano accompaniment on vocal accuracy among 205 kindergarten children. They found no significant differences in vocal accuracy between the two groups, those singing with piano accompaniment and those singing without it. However, the authors did find that "children with high musical aptitudes as measured by the *Primary Measures of Music Audiation* had significantly higher posttest song

scores."

Gender was examined by Rutkowski (1986) as one of her purposes as she sought to "determine whether differences exist between boys and girls in the use of singing voice and developmental music aptitude." She found no significant differences between genders in the use of their singing voice and music aptitude.

Welch, Sergeant, and White (1996) examined the singing competencies of five-year-old students and gave their subjects four separate tasks, which they measured for vocal accuracy. The tasks included singing glissandi, patterns, single pitches, and two songs composed especially for the study. The authors concluded that a five-year-old child progresses through a distinct hierarchy of vocal tasks as they acquire vocal accuracy. No significant differences were found between the singing competencies of boys and girls.

Phillips and Aitchinson (1997), investigated third grade students to see if inaccurate and accurate singers exhibited differing abilities in pitch discrimination and tonal aptitude. They found that when students took the *PMMA* tonal aptitude test there was a significant difference between the music aptitude of accurate and inaccurate singers.

It is important to note that most of the researchers mentioned here have investigated vocal inaccuracies among children in the primary grades of elementary school. Few have included students in fourth and fifth grade, even though many researchers have acknowledged that children acquire greater vocal accuracy as they mature, and none have focused on nine-and-ten year-old children exclusively. These children appear to be prime

candidates for an investigation of singing accuracy.

Purpose and Question

The purpose of the study is to gain insight into how children in the fourth and fifth grade acquire singing ability. The question to be pursued in the course of this study is as follows: What differences are found in children's singing accuracy relative to tonal music aptitude and gender?

Sample, Design and Procedures

The students in the sample comprised the entire fourth and fifth grades in a suburban middle-class community in southern New Jersey. There were 174 students; specifically, 76 fourth grade students and 98 fifth grade students. Gender was almost evenly distributed, with 38 males and 38 females in grade 4 and 48 males and 50 females in grade 5.

All students were audio taped at individual, private sessions during which they were given three tasks to sing; 1) melodic patterns from the *Singing Voice Development Measure*, 2) a long-familiar song, *America*, in the key of F, and 3) a newly-learned song, *A Path to the Moon*, in the key of G. The order of songs and patterns was randomized using a modified Latin Square so that there was no order effect. Three judges, using the *Singing Voice Development Measure (SVDM)* as the assessment tool, evaluated the performances. Within a group setting, the same students were also administered the Tonal portion of the *Intermediate Measures of Music Audiation (IMMA)*.

Vocal accuracy in echo-patterns and rote-songs was compared with tonal music aptitude. Vocal accuracy was also examined to find possible relationships with tonal music

aptitude or gender.

Descriptive Statistics

The vocal accuracy means, standard deviations, and standard error of measurement for grades four and five are shown in Table 1. The same statistics for the Tonal subtest of *IMMA* are shown in Table 2. Table 3 shows descriptive statistics for gender.

Table 1. Means, Standard Deviations, and Standard Error of Measurement of Vocal Accuracy - Grades 4 and 5

Task (n = 174)	Mean	<i>SD</i>	<i>SEM</i>
<i>SVDM</i> Patterns	4.37	0.96	.07
<i>America</i> – Familiar Song	3.52	1.29	.10
<i>Path to the Moon</i> – Unfamiliar Song	3.49	1.32	.10
Composite Scores	3.79	1.09	.08

Table 2. Means, Standard Deviations, and Standard Error of Measurement of the Tonal portion of *IMMA* - Grades 4 and 5

Tonal <i>IMMA</i> (n = 165)	Mean	<i>SD</i>	<i>SEM</i>
Grades 4 and 5	34.97	2.73	.21

Table 3. Means, Standard Deviations, and Standard Error of Measurement of Vocal Accuracy by Gender - Grades 4 and 5

n = 88 females, 86 males	Mean	<i>SD</i>	<i>SEM</i>
Female Students	4.08	.93	.10
Male Students	3.51	1.17	.12

Results

Results of a 2 x 3 two-factor Analysis of Variance (*ANOVA*) in children's singing accuracy relative to tonal music aptitude and gender indicate a significant difference was found between Singing Accuracy and Gender ($p = .0008$) and Singing Accuracy and Aptitude Category ($p < .0001$).

The dependent variable was the grand mean of each student's vocal accuracy scores, combining the data of all three tasks. The independent variables were the students' gender and their tonal aptitude category. Tonal aptitude category was established by dividing the *IMMA* tonal aptitude raw scores into the three categories of high, medium and low, with the top twenty percent labeled as high, the bottom twenty percent labeled as low, and the middle sixty percent labeled as medium. There were no interactions found among factors. Results of the *ANOVA* are shown in Table 4.

Table 4. ANOVA for Grand Mean of Singing Accuracy, Gender, and Tonal Aptitude

	DF	Sum of Squares	Mean Square	F-Value	p-Value
Tonal Aptitude Cat.	2	23.266	11.633	11.829	< .0001
Gender	1	11.534	11.534	11.728	.0008
Ton. Apt. Cat*Gender	2	2.481	1.241	1.262	.2860
Residual	159	156.369	.983		

Finally, the Scheffé Post-hoc test, summarized in Table 5, reveals that students with high music aptitude and moderate music aptitude were more accurate singers, than were students with low music aptitude.

Table 5. Scheffé Post-hoc test for Vocal Accuracy Effect: Aptitude Category

	Mean Diff.	Crit. Diff.	p-Value
High, Low	1.076	.501	< .0001
High, Moderate	.361	.455	.1496
Low, Moderate	-.715	.466	.0010

An Analysis of the Results

Upon examining the results of the two-factor *ANOVA*, this researcher was surprised to see that gender was a significant factor in vocal accuracy. The research in the field has been mixed, and it was thought that because there was such a strong singing program in the general music classes observed that no significant gender differences would be found. That assumption however, was mistaken. Female students were found to score significantly higher in singing accuracy than male students ($p = .0008$). Before too much is made of these data, it is wise to remember what Nancy Cooper noted in her analysis of the data acquired in her study. Although she did not find significant gender differences, she made the following observation:

Differences teachers may observe in their classrooms between boys' and girls' singing accuracy should probably not be attributed to gender alone. Other factors, such as motivation, peer pressure, or control of the vocal mechanism may be contributing to these perceived differences (Cooper, 1995).

This researcher agrees that motivation and peer pressure play an important role in vocal development of both genders. It has been observed that girls generally want to please the teacher and want to be selected for an elite group of singers, so they treat the assignment as an honor and a privilege. Conversely, it has been observed that generally boys do not appear to care about the outcome of their vocal assessment and are frequently oblivious to the "honor" bestowed on them by being chosen to sing in a select group, based on their vocal accuracy.

Many students have been taught, from kindergarten through fifth grade, that it is normal for all children of both genders to have treble voices before the onset of puberty. Teachers frequently discuss changing voices and the ranges of students' voices at various times in their lives, and the stereotypes that persist about boys sounding like girls. Teachers have students listen to children's recordings, attempting to identify the singer(s) by gender, only to conclude that children's gender cannot be identified through the timbre of their voices. But despite their best efforts, teachers still hear an occasional stereotypical comment from a child saying, "He sings like a girl."

It was less surprising to find the second significant difference found in the *ANOVA*, that tonal aptitude influences singing accuracy. It makes sense that tonal memory plays a significant role in the development of singing accuracy. As expected, the post hoc test indicated that the higher the tonal aptitude the more accurate the singer. This follows along the lines of logic, but also confirms that tonal aptitude is an important component within a child's vocal development.

It is curious however, why some students with high tonal music aptitude take so long to develop vocal accuracy. It would seem that with this extra gift in aptitude students would be able to achieve accuracy early in their singing career, but it has been this researcher's observation that this is often not the case. One can speculate that perhaps it is the lack of the physical coordination required to sing accurately that impedes the child's progress. If researchers knew the answer to that question they would be able to help remediate students in a more efficient manner.

It is important for more research to be done in the area of vocal accuracy, gender and music aptitude. Most of all it is recommended that further research be done by those who are passionate about their work and wish to apply what they learn to the general music classroom. Classroom music teachers need realistic studies done by dedicated researchers so that they can apply the results to the situations that practitioners in the general music classroom encounter every day.

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