Title: The Effects of Class Voice and Breath-Management Instruction of Vocal Knowledge, Attitudes, and Vocal Performance Among Elementary Education Majors

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It is with pleasure that we inaugurate the reprint of the entire seven volumes of The Quarterly Journal of Music Teaching and Learning. *The journal began in 1990 as* The Quarterly. *In 1992, with volume 3, the name changed to* The Quarterly Journal of Music Teaching and Learning *and continued until 1997. The journal contained articles on issues that were timely when they appeared and are now important for their historical relevance. For many authors, it was their first major publication.* Visions of Research in Music Education *will publish facsimiles of each issue as it originally appeared. Each article will be a separate pdf file. Jason D. Vodicka has accepted my invitation to serve as guest editor for the reprint project and will compose a new editorial to introduce each volume. Chad Keilman is the production manager. I express deepest thanks to Richard Colwell for granting VRME permission to re-publish* The Quarterly *in online format. He has graciously prepared an introduction to the reprint series.*

The Effects of Class Voice and Breath-Management Instruction on Vocal Knowledge, Attitudes, and Vocal Performance Among Elementary Education Majors

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Teaching children to sing in the elementary school has received renewed interest in recent years (Atterbury, 1984; Goetze, 1985; Phillips, 1983, 1985; Stafford, 1987). Much of this interest has focused on the need for developing the singing voice as a psychomotor skill, a learned behavior. Stafford (1987) reports that 79 percent of college methods instructors and 69 percent of elementary music teachers surveyed in the southern geographical region of the United States "indicated that elementary school children should receive specific instruction in singing" (p. 134). College music instructors listed "vocal development" higher than "music literacy" when asked to rank order the most important outcomes related to singing instruction for the young singer.

Today, the primary responsibility for developing the child singer falls to the elementary music specialist. With music teaching positions being eliminated or limited by many school districts, however, elementary classroom teachers are assuming more responsibility in the teaching of music, as they had earlier in the twentieth century. Coffman (1987), in a survey of vocal music and the classroom teacher between 1885 and 1905, concluded that "contemporary music educators should re-examine the possibility of team-teaching by classroom teachers and music specialists. Such an approach might help to integrate music more fully into the total curriculum and aid in securing music's place in the schools" (p. 102). Such a recommendation is worthy of serious consideration; classroom teachers may once again provide a vital service to music education in those schools cutting back on music specialists.

Elementary education majors are required by most colleges and universities to take some music course work. A survey of the New York State school system by Picerno (1970a) indicated that only 39 percent of the elementary classroom teachers were involved in teaching some music, and that 93 percent of the music supervisors "felt that their elementary classroom teachers were not interested in teaching music" (p. 110). A more recent report (Goodman, 1986) indicates that most elementary music education in Ohio is given by music specialists. Goodman recommends that undergraduate music

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courses for elementary education majors be re-examined for content relevant to musical competencies and that a positive attitude by classroom teachers to teaching music be encouraged in college methods classes.

Music is a complex discipline, one that requires considerable time and effort to master. The amount of time given to classroom teacher training in music (one or two courses at most schools) is small. Realistically, what can be expected from such teachers when it comes to teaching music? Classroom teachers surveyed by Picerno (1970b) "felt that those musical activities requiring special skills, such as conducting groups, teaching theory, or music history should be done by the music specialist" (p. 256). The activity classroom teachers said they engaged in most often, and the one in which they felt most competent, was "to teach a song" (p. 251).

Singing is the traditional core of the elementary general music program. Picerno (1970b) and Pendelton (1975) report that the activities most judged by classroom teachers to be within the range of their teaching abilities focus on singing. Evans (1958) notes that singing problems are among the most common factors affecting the attitude of the elementary classroom teacher toward teaching music: Singing alone in front of the class is reported to create a strong feeling of insecurity among these teachers. Gelineau (1960) concludes that those classroom teachers who like to teach music have a longer history of singing and participation in vocal activities than those who dislike teaching music. Slagle (1967) notes that in an investigation of seven methods of instruction on the musical achievement of elementary education majors, only the group taught by singing evidenced a more positive attitude toward music.

It would seem logical that singing skills should be emphasized in the music instruction of elementary classroom teachers. An examination of the content of methods texts and basal series used for such instruction (Kavanaugh, 1982; Phillips, 1983), however, reveals little information concerning the development of singing as a psychomotor skill, either for the child or the teacher. Stafford (1987) reports that "eighty-eight percent of the college methods instructors . . . expressed a lack of confidence in the adequacy of methods classes to develop the competencies necessary for guiding young singers" (p. 134).

Recognizing the need for a program of vocal pedagogy for the classroom teacher, Barnes (1987) investigated the effects of class voice instruction and differential song material on vocal performance, vocal knowledge, and the attitude of 113 elementary education major enrolled in a one-quarter course of music education at Ohio State University. One intact class served as a no-contact control group, while subjects from two other classes were randomly assigned to three treatment groups: 1) vocal pedagogy instruction and traditional art songs, 2) vocal pedagogy instruction and children's songs, and 3) only singing children's songs. A pretest measure consisted of individual singing and tape recording of the song "America".

The investigator met each group for 40 minutes, twice a week for five weeks. Vocal pedagogy instruction included such techniques as posture, breathing, diction, intonation, vocal quality, and projection. Posttest data consisted of ratings of individual singing, a tape recording of the song "America", and scores on investigator-designed vocal knowledge, attitude toward singing instruction, and self-perception of singing ability measures. Vocal performances were evaluated by judges using an investigator-designed performance rating scale which included visual judgments of both posture and breathing.

Results of multiple *t* tests for pre-posttest evaluations of each treatment group on separate measures of posture, breathing, diction, intonation, projection, and vocal quality showed that vocal pedagogy training along with children's song literature (treatment group 2) was best in improving posture and vocal quality. Posttest analysis (ANOVA) among groups revealed a significant difference only for projection. Breathing approached significance, "suggesting that class voice instruction may have resulted in an improvement in breathing" (Barnes, 1987, p. 81).

A posttest ANCOVA analysis revealed that subjects who received vocal pedagogy along with children's song literature scored significantly higher on the test of vocal knowledge than those who only sang children's songs. The group who received vocal pedagogy along with art song literature did not show significantly higher scores than the control group on vocal knowledge. Yet, only the pedagogy/art-song group scored significantly higher than the control group on subjects' attitudes toward singing instruction and self-perceptions of singing ability.

Discussing the results of the study, Barnes (1987) states that "Vocal pedagogy training using children's songs appears to be the most effective method in improving posture, vocal projection, and vocal quality of elementary education majors" (p. 87). Given that Barnes was able to randomly assign subjects to her treatment conditions, split-plot ANOVAS (with treatment as between-subjects factor and time-pretest and posttest administrations of the same measures as a within-subjects factor), or one-way ANCOVAS (with pretests as covariates and the treatment as a between-subjects factor) would have been more appropriate ways to analyze the data. Perhaps these more rigorous analyses would have yielded different results.

The reliability evidence for measures employed in the Barnes study was limited. For example, no reliability estimates were given for vocal knowledge or attitudinal measures. In addition, judges' ratings of subjects' breathing during singing was determined from videotapes.

Among her recommendations for further research, Barnes includes replication of the study over a longer treatment period and the use of a different song in pre-and posttest evaluations. Both are important recommendations; five weeks of vocal instruction may be insufficient to produce significant vocal results among untrained singers, and Gould (1968) reports that using the same song in both pre- and posttests may result in a carry-over effect, regardless of treatment. Similar but not identical songs should be used for pre- and posttests.

Purpose of the Study

The purpose of the present study was to replicate and extend the investigation by Barnes (1987). Specifically, the present researchers wanted to determine whether vocal knowledge, attitudes, and vocal performance among elementary education majors would improve as a result of an extended time of vocal treatment (ten weeks) with additional emphasis on breath management. In addition, the use of more sophisticated instrumentation for breathing measurement, along with more reliable vocal knowledge and attitudinal measures, and more rigorous data analysis were used as means to further Barnes's (1987) research on the effects of vocal instruction on the cognitive, affective, and psychomotor learning of elementary education majors preparing to become teachers.

Method

The subjects were elementary education majors (male and female) enrolled in a one-semester, undergraduate methods-and-materials course for the classroom teacher at the University of Iowa. These students ($n=43$) elected to take the course to fulfill part of their certification program.

Three intact classes were involved. Treatment conditions were randomly assigned as follows: Vocal Instruction with Breath Emphasis (VWB), Vocal Instruction without Breath Emphasis (VWOB), and a Control Group (CG). There was an equal number of subjects in the VWB group ($n=18$) and the VWOB group. A small control group ($n=7$) was available, and despite the small sample size, it was decided that having a control group was desirable. The use of ANCOVA procedures helped to increase the power of the statistical tests.

Each of the three groups met for two 50-minute periods a week over ten weeks. The classes were taught by two university instructors who followed the same syllabus. One instructor taught both the VWB and VWOB classes, and the other taught the CG class. Both instructors were aware of the nature of the study and did not add additional instruction that would have interfered with the treatment conditions.

Prior to the treatment, subjects completed an inventory assessing knowledge of singing skills and vocal physiology (20 items), self-perception of singing abilities (13 questions) and attitude toward singing instruction (17 items). The "vocal knowledge" measure was constructed by the investigators to assess important knowledge and comprehension level objectives (Bloom, 1956) for the vocal instruction classes. Approximately 40 initial items were screened for objective congruence and potential flaws by the investigators and two assessment professionals. The final 20 items included in the measure were judged to be of the highest technical quality and best suited to the objectives of the study. Measures of "Self-perception of singing ability" and "Attitude toward singing instruction" were adapted from Barnes (1987). The items were rephrased, deleted, or expanded to better reflect the goals of this study.

Upon completion of the self-report inventory, the subjects were scheduled for separate 15-minute "singing assessment" appointments, in which one of the present investigators and a research assistant collected data on the following measures:

1) highest and lowest pitches sung (expressed in whole numbers)
2) vocal range (in numbers of half-steps)
3) vocal duration (in numbers of seconds)
4) vocal performance (taped singing of "America" for the pretest, and "O Music" by L. Mason for the posttest)
5) thoracic breathing (as reflected in millimeters of torso displacement), and
6) abdominal breathing (as reflected in millimeters of torso displacement).

The vocal-range measure reflected the mean score of three assessments of highest and lowest pitches sung on ascending and descending arpeggios. Vocal duration was the mean of three trials measured in relation to a mid-range pitch being sung as long as possible at 80 decibels (using a prescribed marking on a decibel meter). Vocal performance was evaluated by summing the responses based on a five-point rating scale to assess the subjects' pitch accuracy and vocal quality. The pitch-accuracy scale reflected the subjects' ability to accurately sing both phrase direction and individual pitches, while the measure of vocal quality required the judges to rate the extent to which a given subject's voice reflected an acceptable vocal model for elementary school children's vocal instruction.

Breathing was measured using a Respitrace™ Calibrator System linked to a Linear™ chart penwriter. Two Respibands (thin, gauze-like bands with internal wire sensors) were placed around the torso of the subject, one at the upper chest level and one at the abdominal level below the lowest ribs, and were held in place by Velcro tabs. Each Respiband was connected via a transducer to a separate channel of the penwriter, thus permitting simultaneous but separate and independent measures of thoracic and diaphragmatic breathing.

All of the singing and breathing measures were described and demonstrated to the subjects in class prior to the separate appointments. Practice before each vocal measure ensured that subjects understood the objective of the task and what they were to do. The piano and a vocal model were used to establish key/tonality for each vocal performance measure. A female research assistant served as the vocal model for the female subjects, and one of the present male investigators served as the vocal model for the male subjects. A Sony two-channel, reel-to-reel tape recorder (TC-252) and a stereo microphone (Audio-Technica AT9400z) were used to record each subject's performance. Every effort was made to administer all dependent measures under identical conditions for all subjects.

The two weeks of pretest data collection were followed by a treatment period of ten weeks. The first session for the treatment groups was a 50-minute lecture/demonstration in recognizing the appropriate vocal quality and range for children's singing. Following this initial instruction, the investigator met twice weekly at the beginning of class for ten-minute "voice lesson" sessions with students. A bell timer was used to ensure the same treatment time. Four hours of voice instruction were received by each of the treatment groups over the ten-week period. The control group did not see

the investigator and received no instruction in singing. They did sing the songs in the course syllabus.

The instruction in singing for both treatment groups included exercises and vocalises involving the techniques of respiration (posture and breathing), phonation (the speaking voice), resonant tone production, diction, and expressions. These techniques were drawn from a methodology written by Phillips (1989) for use in beginning vocal instruction. Children's songs were included to facilitate transfer of vocal techniques to actual song literature.

Both treatment groups used the same exercises, vocalises, and songs and received the same instruction except for the amount of emphasis placed on posture and breathing. Instruction for the VWB group began with respiration exercises. In the initial week of the treatment period, proper breathing techniques were demonstrated to and practiced with the VWOB group but were not practiced thereafter; infrequent reminders to "breathe deeply" were the only instruction given to this group.

Following ten weeks of treatment, the three groups were posttested to assess vocal knowledge, self-perception of singing ability, and attitude toward vocal instruction. A parallel form of the vocal-knowledge test was administered to determine any contamination of results due to memory. The parallel form of the test was constructed using the same techniques as for the original form. Individual "singing assessment" appointments were scheduled to obtain posttest measures of vocal performance and breathing measures.

Results

The reliabilities of the measures employed in the study are given in Table 1. Internal consistency estimates (coefficient alphas) are based on "items" for the vocal-knowledge and attitudinal measures, "judges" for the pitch-accuracy and vocal-quality measures, and "trials" for the other "vocal-performance measures". As is evident from Table 1, internal consistencies are high (above .95) in most cases. The low internal consistency (.32) for pretest scores on the vocal-knowledge test (Form A) was anticipated; students were not expected to know much about singing prior to the treatment. As a result, the range of pretest scores was narrow, and the reliability coefficient was attenuated. The internal consistency of Form A as a posttest increased to .80, reflecting the broader range of achievement after instruction. An equivalent-forms reliability coefficient of .81, based upon posttest administrations of forms A and B, provided additional evidence of the reliability of the vocal knowledge tests.

Test-retest reliability estimates are lower in comparison to the internal-consistency estimates. These anticipated estimates indicate that scores change to a certain extent over time. As expected, the instability of scores is greatest for attitudinal, vocal-knowledge, and breathing measures, areas in which the treatment was expected to have its strongest impact.

The data were analyzed using both MANCOVA and ANCOVA with the SPSSX mainframe computer package. Alphas of .10 and .05 were set for multivariate and univariate tests respectively. To control the probability of Type I error, measures were analyzed within content-related subtests. That is, the vocal-knowledge tests, self-perception of singing ability items, performance measures for songs (judged pitch quality, accuracy, and breathing measures), and performance measures for vocal parameters (high and low pitch, range, duration, and breathing measures) were each initially analyzed within a MANCOVA design with pretest measures as covariates and corresponding posttest measures as dependent variables. Three out of four designs revealed a statistically significant treatment effect at the .05 level: Vocal knowledge test [Wilks Lambda $(4,84) = .718$, $p < .007$)], self-perception of singing ability items [Wilks Lambda $(26,34) = .161$, $p < .034$)], and performance measures for vocal parameters [Wilks Lambda $(10,62) = .517$, $p < .017$)]. The remaining design, performance measures for song, was significant beyond the .10 level [Wilks Lambda $(8,66) = .665$, $p < .081$)]. These multivariate tests were followed by a series of univariate ANCOVAs to determine the specific dependent measures most responsible for treatment

effects. In addition, an ANCOVA was used to analyze total scores on the "attitude toward singing instruction" measure.

ANCOVA results and adjusted treatment means adjusted for corresponding pretest scores are presented in Table 2. Significant treatment effects favoring both vocal instruction groups over the control group appear for both forms of the vocal knowledge test, the self-perception item "I know how to breathe properly when singing," and the vocal-performance measure "high pitch." Differences ($p < .05$) favoring the VWOB group over the control group appear for the self-perception items "I like the sound of my singing voice" and "I feel comfortable singing a solo in front of others." A difference favoring the VWOB group over both the VWB and control groups appears on the "attitude toward singing instruction" measure. Finally, a difference favoring the VWB group over the VWOB group appears for the vocal-performance measure "judged vocal quality". On nearly all measures, including those not statistically significant, both vocal-instruction groups have higher adjusted means than the control group. In addition, the VWB group has higher adjusted means than the VWOB group on several vocal performance measures, namely, high pitch, range, abdominal breathing for duration, abdominal breathing for singing, judged vocal quality, and judged pitch accuracy.

Table 1

Reliability Estimates for All Measures

	Type of Reliability Estimate		
	Internal Consistency		Test-Retest
Measure	Pretest	Posttest	
Vocal Knowledge Measures			
Form A	.32	.80	.41
Form B		.74	—
Attitudinal Measures			
Singing Instruction	.89	.86	.47
Self-perception of Singing Abilities	.95	.94	.76
Vocal Performance Measures			
High Pitch	.99	.99	.94
Low Pitch	.99	.99	.90
Range	.98	.97	.77
Duration	.96	.97	.80
Judged Pitch Accuracy	.93	.96	.73
Judged Vocal Quality	.86	.83	.64
Thoracic Displacement[a]	.95	.94	.78
Abdominal Displacement[a]	.97	.95	.43
Thoracic Displacement[b]			.51
Abdominal Displacement[b]			.30

[a] Thoracic and abdominal measures taken simultaneously with duration measures.

[b] Thoracic and abdominal measures taken simultaneously with singing of song. Since these measures involved only one trial, internal consistency estimates could not be computed.

Table 2

ANCOVA Results and Adjusted Treatment Means for All Dependent Measures

Dependent Measures	ANCOVA Measures	Adjusted Means		
		VWB	VWOB	CG
Vocal Knowledge Tests				
Form A	$F(2,43) = 7.87, p = .001$*[a]	12.2	13.1	7.6
Form B	$F(2,43) = 6.85, p = .003$*[a]	12.0	13.0	7.9
Attitudinal Measures				
Singing Instruction	$F(2,40) = 7.47, p = .002$*[b]	65.5	70.9	62.9
Self-perception of singing ability items				
Sit & stand properly	$F(2,41) = 2.12, p = .134$	4.2	4.5	4.1
Sing in tune	$F(2,41) = 2.12, p = .133$	3.7	4.0	2.8
Breathe properly	$F(2,41) = 6.60, p = .003$*[a]	4.2	4.3	3.0
Correct vocal model	$F(2,41) = 1.73, p = .191$	3.7	4.2	3.7
Like sound of voice	$F(2,41) = 3.99, p = .026$*[c]	3.6	3.8	3.0
Vary voice volume	$F(2,41) = 0.69, p = .507$	4.8	4.7	4.4
Hear out-of-tune notes	$F(2,41) = 1.54, p = .228$	4.3	4.8	4.5
Project voice	$F(2,41) = 1.04, p = .363$	3.6	4.0	3.5
Sing wide range	$F(2,41) = 0.11, p = .900$	3.6	3.5	3.4
Don't run out of air	$F(2,41) = 2.81, p = .672$	4.2	4.0	3.4
Pronounce words properly	$F(2,41) = 0.06, p = .940$	4.1	4.1	4.2
Comfortable singing solo	$F(2,41) = 3.82, p = .030$*[c]	2.4	2.8	2.0
Comfortable singing in group	$F(2,41) = 1.47, p = .242$	4.6	4.7	4.1
Singing Performance Measures				
Duration	$F(2,39) = 2.47, p = .097$	11.8	13.4	10.9
High pitch	$F(2,39) = 6.76, p = .003$*[a]	42.7	42.1	40.3
Low pitch	$F(2,39) = 0.03, p = .970$	16.0	16.0	15.9
Range	$F(2,39) = 2.17, p = .128$	27.6	27.0	25.6
Judged vocal quality	$F(2,39) = 3.60, p = .037$*[d]	3.0	2.5	2.6
Judged pitch accuracy	$F(2,39) = 0.85, p = .437$	3.7	3.4	3.4
Thoracic displacement[e]	$F(2,39) = 1.25, p = .297$	12.0	13.5	11.7
Abdominal displacement[e]	$F(2,39) = 1.27, p = .292$	7.8	6.1	4.2
Thoracic displacement[f]	$F(2,39) = 1.62, p = .211$	10.6	13.3	10.2
Abdominal displacementf	$F(2,39) = 2.53, p = .093$	10.1	5.9	5.3

* Significant difference among adjusted means at the .05 level.

[a] Based on Bonferroni *post hoc* comparison tests, both VWB and VWOB adjusted means were significantly higher than the NCC adjusted mean ($p < .05$).

[b] Based on Bonferroni *post hoc* comparison tests, the VWOB adjusted mean was significantly higher than both VWOB and NCC adjusted means ($p < .05$).

[c] Based on Bonferroni *post hoc* comparison tests. the VWOB adjusted mean was significantly higher than the NCC adjusted mean ($p < .05$).

[d] Based on Bonferroni *post hoc* comparison tests, the VWB adjusted mean was significantly higher than the VWOB adjusted mean ($p < .05$).

[e] Thoracic and abdominal measures taken simultaneously with duration measures.

[f] Thoracic and abdominal measures taken simultaneously with singing of song.

Discussion

The investigators sought to determine the effects of vocal instruction with and without breath emphasis on the vocal knowledge, attitudes, and vocal performance of university elementary education majors. Multivariate statistical tests revealed significant differences among treatment groups within each of these three areas. Subsequent univariate tests and *post hoc* comparisons indicated that most of the important differences were between the control group and one or both of the vocal-instruction groups.

Results of the analysis of vocal-knowledge tests indicated that both of the vocal-instruction groups scored higher ($p = .05$) than the control group. The conclusion that vocal instruction enhances vocal knowledge seems reasonable, since vocal-instruction groups outperformed the control group on two independent measures of vocal knowledge (test forms A and B). These findings support those reported by Barnes (1987). While these results are not surprising, they suggest that the traditional course content for elementary education majors (as prescribed in the course syllabus) is lacking in vocal knowledge content. It may be beneficial for methods teachers to consider the inclusion of vocal knowledge (vocal physiology, vocal techniques, and characteristics of good singing) into the course outline.

Subjects' attitudes toward singing instruction, although positive for all groups (adjusted means ranged from 3.70 to 4.17 on a five-point Likert scale), were more favorable in the vocal-instruction groups. The VWOB group, with less emphasis on breathing, scored significantly higher in attitude than the VWB group and the control group. It would be unreasonable to conclude, however, that these differences resulted from a lack of emphasis on breathing, since the control group had no breathing instruction. A more reasonable explanation may be the nature of the VWOB group.

The investigator, who taught both vocal instruction groups, and the regular classroom instructor observed that the VWOB group throughout the study demonstrated a better attitude toward all music instruction. This observation was confirmed by higher pretest mean scores on attitudinal measures for the VWOB group when compared to the other groups. Although covariance analyses are designed to compensate for pretest differences, they provide less experimental control than random assignment of subjects to treatment conditions. Interestingly, however, Barnes (1987), who employed random-assignment techniques, also found a difference in attitude between her two vocal instruction groups. Vocal instruction, alone, may not improve attitude towards singing instruction among elementary education majors. Further research should seek to determine more specific procedures that teachers can use to encourage a positive attitude towards teaching music.

As was the case for measures of vocal knowledge and attitude towards singing instruction, vocal-instruction group mean scores were higher than control-group mean scores on most self-perception of singing ability items. Among the 13 items, only three were significantly different between the control group and one or both of the vocal instruction groups. The item "I can breathe properly for singing", was significant for both vocal instruction groups when compared to the control group. Evidently, the breathing instruction had a positive effect on the subjects' perceptions of their breathing for singing. The additional emphasis in breathing received by the VWB group did not produce a significant difference between it and the VWOB group. The initial sessions for the VWOB groups included some instruction in breathing techniques. Perhaps these limited but informative sessions were just as effective as the sessions for the VWB groups, in which breathing was continually emphasized. Although the optimal amount of time that should be devoted to breathing techniques has not been determined, methods teachers should note that at least some amount of breathing instruction may increase students' self-perception of proper breathing mode.

The adjusted means for all treatment groups on the item "I feel comfortable

singing a solo in front of others" were far lower than the adjusted means on any of the other self-perception items. This finding indicates that elementary education majors feel particularly insecure when singing for others, confirming results reported by Evans (1958). While the mean scores on this item were low for all groups, only the VWOB group had significantly higher scores on judged vocal quality and higher means than the other groups on the vocal performance measures, e.g., judged pitch accuracy and abdominal displacement scores.

This finding suggests that the effects of additional emphasis in breathing are manifested most in the actual performance of songs. Although improvements in vocal performance cannot be attributed with certainty to increased breathing emphasis in the vocal instruction, this conclusion is plausible because the VWB group had a far greater adjusted mean than the other groups on the abdominal displacement measure. This difference approached statistical significance ($p < .093$). The difference between the vocal instruction and control groups on judged breathing mode also approached significance in the study by Barnes (1987). Evidently, the duration of both the Barnes study and the present study was not sufficient to produce statistically significant results for breathing measures. If breathing instruction does make a difference, future research should seek to determine the length of time needed to change breathing patterns.

One final point should be made concerning the results of the vocal-performance measures. Both vocal instruction groups showed significantly higher mean scores than the control group on high pitch and approached significance in range. Vocal instruction for the elementary classroom teacher (even without breathing emphasis) may effectively extend vocal range, particularly in the upper register.

Within the limitations of this study, the results suggest that vocal instruction for elementary classroom teachers is beneficial for improving vocal knowledge and some elements of attitude and vocal performance. Emphasis on breath instruction improved vocal quality. The effects of breath instruction on changes in breathing mode, however, while increasing depth of breathing with greater abdominal-diaphragmatic displacement, may take longer than anticipated in producing significant results, especially among untrained singers. The use of instrumentation (Respitrace) for recording breathing patterns was found to be an objective and highly reliable procedure for the study of breathing and its effects on singing performance. ❑

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