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## The Effects of Body Mapping Instruction on Singers' Posture

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### Abstract

Grounded in somatic pedagogy and anatomical awareness, Body Mapping (BMG) emphasizes correcting the internal body map to promote efficient physical alignment and movement. Forty-nine participants were assigned to experimental and control groups and received six weeks of posture instruction targeting the six places of dynamic balance: the atlanto-occipital joint, shoulder joints, lumbar region, hip joints, knee joints, and ankle joints. Pre- and post-instruction assessments were conducted using a high-resolution three-dimensional motion capture system to measure postural alignment during both static standing and singing tasks. Statistical analyses revealed significant improvement in atlanto-occipital alignment during singing and in lumbar alignment during both static and singing tasks for the experimental group. Additionally, the experimental group demonstrated significant composite improvement in overall postural alignment while singing. The control group also exhibited measurable gains, suggesting that even minimal instruction may enhance postural awareness. However, the more substantial changes observed in the experimental group support the pedagogical value of Body Mapping as an effective method for developing postural alignment in singers. These findings provide preliminary quantitative evidence supporting BMG and contribute to the growing body of research on somatic methods in vocal pedagogy.

**Keywords:** *Body Mapping, Alexander Technique, posture, balance, choir, somatic*

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## Introduction

Physical posture constitutes a foundational element of vocal technique. Singers actively seek to optimize sound production by deliberately aligning the feet, knees, arms, and shoulders. Vennard (1967) emphasized that the positioning of various body segments can significantly influence the quality of vocal sound, either enhancing or detracting from it. McCoy (2010) noted that while proper posture does not guarantee effective singing, poor posture almost invariably hinders vocal development. Participation in somatic instruction enables learners to develop awareness that transfers across daily and performance activities, rather than serving singular physical aims (Jain et al., 2004). Approaches such as the Alexander Technique (AT) and Feldenkrais Method exemplify the somatic emphasis on body awareness and coordination, providing structured processes for refining movement efficiency and sensory perception while drawing on proprioception and mental imagery—core pedagogical tools shared across somatic methods currently taught in the United States. Sarlegna and Sainberg (2009) defined proprioception as “the component of somatosensation that provides information about the orientation and motion of body segments and the state of the muscles” (p. 2). They argued that proprioception functions in concert with visual and tactile input, enabling the brain to perceive limb orientation, movement, and spatial relationships.

For musicians, this sensory integration proves critical, as it facilitates both technical execution and expressive nuance. Keller (2012) proposed that musical activity engages mental imagery in conjunction with action simulation—the replication of observed actions—and internal models—the cognitive ability to predict outcomes of movement. For instance, a musician might adjust their posture based on visual observation of a peer or mentally anticipate changes in tone quality resulting from a modified physical stance. These applications of mental imagery depend fundamentally on proprioceptive input, which informs the performers’ physical adjustments. Although much of the existing literature on proprioception focuses on athletic training or rehabilitation (Collins, 2010; Heggernes, 2013; Yoo et al., 2018), emerging evidence supports the efficacy of musical activity as a therapeutic intervention for improving balance in individuals with neurological conditions (Bucci et al., 2016; Ghai & Ghai, 2019).

The primary objective of somatic education is to enhance functional movement by promoting economical, efficient, and anatomically sound body use. While this principle applies to athletic and dramatic performance (Lowndes, 2012), musicians may benefit from a heightened mind-body connection. Yost (2022) found that university flute students who engaged in positive self-talk reported changes in their physical experience while playing the instrument. Pianists can modify their seated posture to reduce back discomfort (Slade et al., 2018; Wong et al., 2023), and string players produced louder sound and reported greater ease after receiving instruction focused on enhancing mind-body awareness (Dora et al., 2019). For singers, vocal function may be influenced not only by knowledge of postural alignment but also by their self-perception and bodily awareness during singing (Cardoso et al., 2017; Gilman & Johns, 2017; Luck & Toiviainen, 2007; Staes et al., 2011).

Posture and breath management are widely recognized as central tenets of vocal pedagogy (Doscher, 1994; McCoy, 2019; Miller, 2004; Vennard, 1967; Ware, 1997). Vocal pedagogues employ a range of strategies to teach postural awareness and physical balance; however, many educators continue to rely on traditional models drawn from pedagogical literature and anecdotal practice rather than empirical research (Conable, 2000b; Malde et al., 2020). Despite methodological diversity, a number of shared recommendations emerge from pedagogical literature and practice. These include: maintaining an erect head position balanced forward and upward; lengthening the posterior neck while softening the anterior; relaxing and gently retracting the shoulders; elevating but not protruding the chest; expanding the rib structure; slightly bending the knees; and positioning the feet approximately six to eight inches apart with weight distributed toward the forefoot. These recommendations are widely supported by research and appear consistently in vocal pedagogical texts (Doscher, 1994; Miller, 2004; Ware, 1997). However, many resources fail to explain the underlying anatomical or physiological rationale, relying instead on traditional, non-empirical models. As noted by Isley-Farmer (2005), singers' understanding of breath management often remains limited to the torso and neck, neglecting the interdependent relationships between upper and lower body joints (p. 293).

Balance, a prerequisite for daily activities, similarly influences vocal behavior, including speaking and singing. Researchers have explored connections between balance and vocal characteristics such as pitch, tone quality, loudness, and breath control. Arboleda and Frederick (2008) argued that expanded therapist knowledge of the muscular systems involved in postural alignment benefits voice therapy patients. This perspective is supported by a meta-analysis conducted by Cardoso, Lumini-Oliveira, and Meneses (2017), who investigated the relationship between posture and vocal function, particularly among individuals with dysphonia. Of the 1,319 studies identified, twelve demonstrated significant correlations between postural configuration and vocal output, particularly concerning alignment between the skull and the neck. According to their findings, forward or backward head positions and neck extension correlated with increased vocal tension, a higher pitch, and decreased vocal quality, as compared to a neutral head position. They further noted that cervical extension and a backward head position were associated with increased loudness (Cardoso et al., 2017, p. 124.e4)

Additional research supports the influence of posture on vocal production. Gilman and Johns (2015) investigated how different postural configurations impact singers' perceived phonatory effort. In their study, 46 adult singers produced sustained /a/ vowels 18 times while assuming various standing and sitting positions. After each repetition, participants rated their perceived effort using the categories "least effort," "habitual effort," and "increased effort." The researchers found significantly higher effort levels when singers stood with locked knees compared to soft knees, and when the head leaned either forward or backward.

Although researchers have examined a range of variables related to posture and vocal performance, most studies have stopped short of recommending shifts in pedagogical practice. Despite the emergence of therapeutic and instructional strategies aimed at enhancing

posture and voice use, much of the vocal pedagogy literature continues to rely on inherited postural traditions rather than empirical research. Body Mapping has earned recognition within the musical community due to its perceived benefits; however, scientific inquiry into its efficacy remains limited.

## Body Mapping

Body Mapping (BMG) is a somatic approach designed to improve movement efficiency for musical performance by identifying and correcting inaccuracies in an individual's internal representation of the body, or "body map" (Buchanan, 2014). Visual and proprioceptive input forms this map and guides motor learning and planning. Neuroscience research demonstrates that interconnected motor and sensory cortical areas maintain adaptable body maps that represent musculoskeletal anatomy and function and incorporate information about external objects, such as musical instruments (Buonomano & Merzenich, 1998). Conscious awareness and sensory feedback continuously update these maps, refining motor coordination and supporting skilled performance (Ostry et al., 2010). Cortical representations respond to long-term motor patterns and sensory experience, demonstrating both stability and adaptability (Schone et al., 2025).

AT instructors William Conable and Barbara Conable developed BMG in the 1970s after observing that a student's difficulty bending her arm reflected a misperception of the elbow joint. In subsequent years, they continued to teach AT principles while emphasizing the role of the body map in coordinated movement. The Alexander Technique functions as a somatic method that trains individuals to maintain postural balance and coordinate movement efficiently, reducing unnecessary tension and enhancing overall bodily function. Barbara Conable formalized BMG instruction in her 2000 publication *What Every Musician Needs to Know About the Body* (WEM), which accompanied a course of the same name. The text presents anatomical diagrams and descriptions of the body's structures, highlighting how musicians can move with greater balance, ease, and injury prevention. Conable aligned many of the book's principles with foundational concepts from AT, including Use of the Self, Primary Control, Inhibition, and Direction. For example, WEM's section on inclusive awareness builds on the Use of the Self by integrating personal, spatial, and environmental awareness. The concept of Primary Control parallels the Laws of the Spine section in WEM, which outlines four key directives:

1. The head must lead spinal movement [from the atlanto-occipital (A-O) joint].
2. The vertebrae must follow [the head] in sequence.
3. The spine must be free to lengthen and gather in spinal movement.
4. Spinal movement should be concentrated across the whole spine. (Conable, 2000b, p. 19)

The principles of Inhibition and Direction correspond to Conable's definition of BMG: "Body Mapping is the conscious correction and refining of one's Body Map to produce efficient, graceful, and coordinated movement" (p. 5).

In her second publication, *The Structures and Movement of Breathing* (2000a), Conable adapted the BMG framework specifically for singers, emphasizing anatomical understanding of the breathing mechanism. She introduced the concept of six places of dynamic balance: the A-O joint, shoulders, lumbar vertebrae, hips, knees, and ankles. She posited that optimal vertical alignment of these six points facilitates more effective singing. While full Body Mapping curricula involve a broader set of principles and pedagogical tools, the current study focused on these six alignment points to isolate their specific impact on singers' postural alignment. Instruction incorporated strategies commonly used in somatic education—including detailed verbal description, palpation, guided movement, anatomical models and images, and posture adjustments during singing—which are integral to Body Mapping but not exclusive to it.

The six points of dynamic balance are described as follows: the A-O joint, consisting of the atlas (C1 vertebra) and the occiput (the base of the skull), serves as the first point of balance; mapping this joint facilitates release and expressive movement (Malde et al., 2020). The second point of balance, the shoulder joint connects the humerus to the scapula, which links to the clavicle and sternum, forming part of the rib structure. The third point of balance, the lumbar region, supports the weight of the head and torso and delivers it into the ground or chair, depending on the performer's position. When aligned properly, this region should sit directly beneath the A-O joint.

The hip joint, the fourth point, lies adjacent to the lumbar region and connects the femur to the pelvis in a lateral ball-and-socket configuration. The fifth point, the knee joint, comprises the femur, tibia, and patella. As the body's largest joint, it functions as a modified hinge, permitting movement in multiple planes. Garretson (1990) noted the pedagogical recommendation for singers to keep the knee loose and unlocked to facilitate circulation during standing. The sixth point, the ankle joint, forms where the bottom portions of the tibia and fibula meet the talus bone in the foot. This joint lies above the heel's front edge, rather than directly at the back of the foot, as is commonly misunderstood.

Survey research has reported positive perceptions of BMG instruction across several domains, including breath control, muscular release, and reduction of performance anxiety. Knaub (1999) analyzed approximately 500 reports and journal entries from music majors enrolled in an AT course taught by William Conable. The findings indicated that students perceived an increased understanding of anatomical structures and joint functions. Buchanan and Hays (2014) investigated undergraduate students' reflections on BMG instruction in a university music program. Twelve undergraduate students received Body Mapping instruction as part of a university elective. Journal entries highlighted themes such as internalization of BMG principles, integration into personal practice, improvements in technical and expressive performance, and enhanced self-awareness. Salonen (2018) conducted a mixed-methods study with 12 university music students enrolled in a course on musicians'

occupational health, which incorporated BMG content, an AT workshop, and practical application through master classes. Using journal entries, interviews, and pre- and post-course surveys, the survey identified four thematic outcomes: general impressions of BMG, enhanced physical awareness, increased psychological awareness, and perceived improvements in musicianship.

## Research Methods

Body Mapping represents one of several somatic approaches that seek to enhance postural awareness and movement efficiency through anatomical understanding and kinesthetic learning. Although participants in previous studies frequently report perceived improvements in comfort, coordination, and expressive ease, empirical evidence verifying these outcomes remains limited. The purpose of this study was to systematically examine the effectiveness of BMG as a method for posture instruction. Specifically, the study examined whether the instruction based on BMG—which utilizes scientific images and anatomical models to teach postural alignment—would lead to a statistically significant improvement in posture. The research addressed the following research question: Does a significant difference exist in postural deviation from six anatomical points of alignment—both during static standing and while singing—between participants who received BMG instruction (experimental group) and those who received verbal instructions only (control group).

This study took place at a large public university in the United States and included 49 undergraduate students, primarily non-music majors, between the ages of 18 and 25. All participants were members of one of two non-auditioned choral ensembles. A cluster sampling method assigned participants to either the control or experimental groups based on vocal section: sopranos ( $n = 15$ ) and tenors ( $n = 10$ ) formed the control group, while altos ( $n = 15$ ) and basses ( $n = 9$ ) comprised the experimental group (see Table 1 on the next page). The researcher did not hold an instructional or supervisory role with the participants. All instructional sessions were delivered by a conducting assistant using researcher-developed scripts to ensure consistency across ensembles and minimize potential researcher influence. This study was approved by the university's Institutional Review Board (Protocol #IRB0003275), and all participants provided informed consent prior to participation.

Prior to the treatment period, participants completed pretest measurements in a laboratory within the university's kinesiology department. This facility is equipped with a Vicon motion capture camera system, which offers high-resolution kinematic analysis at a minimum rate of 120 frames per second (Dobrian & Bevilacqua, 2003). Due to its capacity to capture fine-grained motion data over a wide spatial area (Yang et al., 2012) researchers have widely adopted the Vicon system for biomechanical studies. The Vicon system demonstrates high accuracy in measuring joint movement and researchers therefore use it as a gold standard for validating other motion capture technologies (Carse et al., 2013; Davenport et al., 2009; Guerre et al., 2015; Mjøsund et al., 2017; Pfister et al., 2014).

Each participant was fitted with 35 anatomical markers to allow comprehensive motion

**Table 1**  
Demographics of Sample

Group	n (49)	%
Ensemble		
Treble	30	61.2
Tenor/Bass	19	38.8
Voice Part		
Soprano	15	30.6
Alto	15	30.6
Tenor	10	20.4
Bass	9	18.3
Study Group		
Control	25	51
Experimental	24	48.9

capture by the Vicon system. During the pretest, participants stood still for 20 seconds to establish a postural baseline, after which they sang “Happy Birthday” three times in a comfortable vocal range while the system recorded thousands of frames per trial. The same procedures were repeated after the six-week treatment period to collect posttest data. Postural alignment was defined as the angular deviation, measured in degrees, from a vertical reference line at six anatomical landmarks: the A-O joint, shoulders, lumbar spine, hips, knees, and ankles. Smaller values represented more neutral alignment.

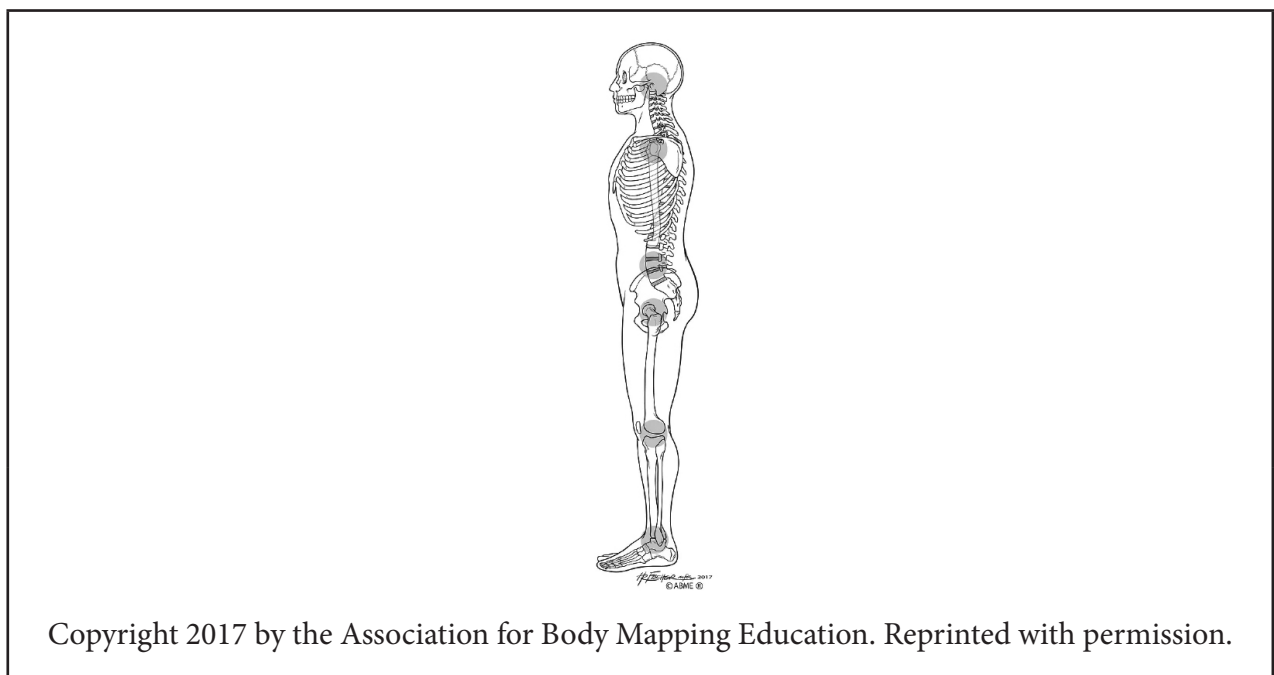
Between-group analyses were conducted using independent samples t-tests and one-way ANOVAs to compare posttest alignment between the experimental and control groups, while within-group changes from pretest to posttest were examined using paired-samples t-tests

and repeated-measures ANOVAs. Slight differences in degrees of freedom across analyses reflected missing data from individual participants due to partial marker loss or motion capture errors, resulting in unequal case counts per test. Composite posture scores were calculated by averaging the absolute deviation values across all six anatomical landmarks to provide an overall indicator of postural alignment. This composite measure allowed for evaluation of overall postural change rather than isolated joint movement. To reduce the risk of Type I error associated with multiple comparisons, an adjusted alpha level of  $p < .01$  was used following Bonferroni correction procedures.

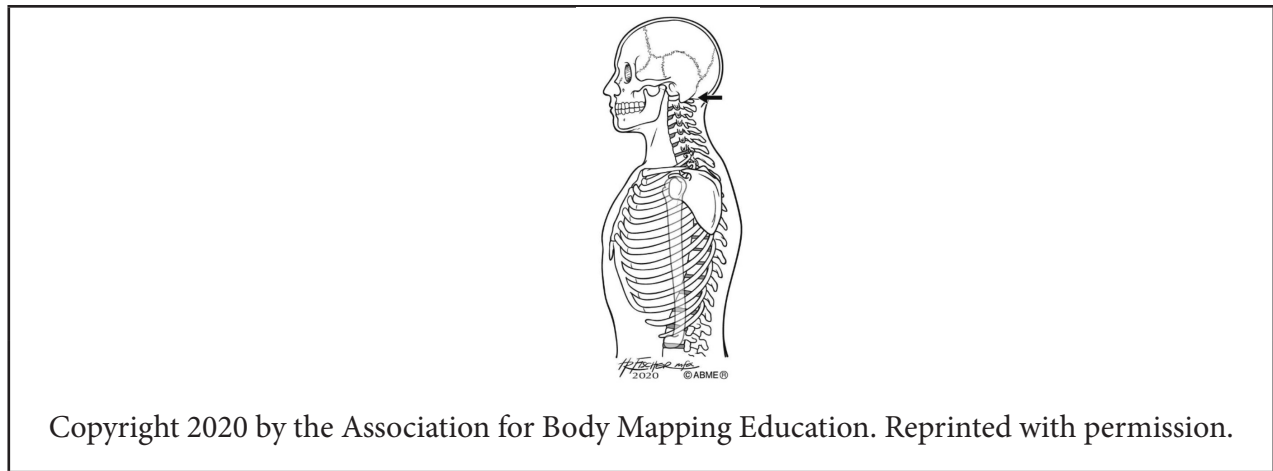
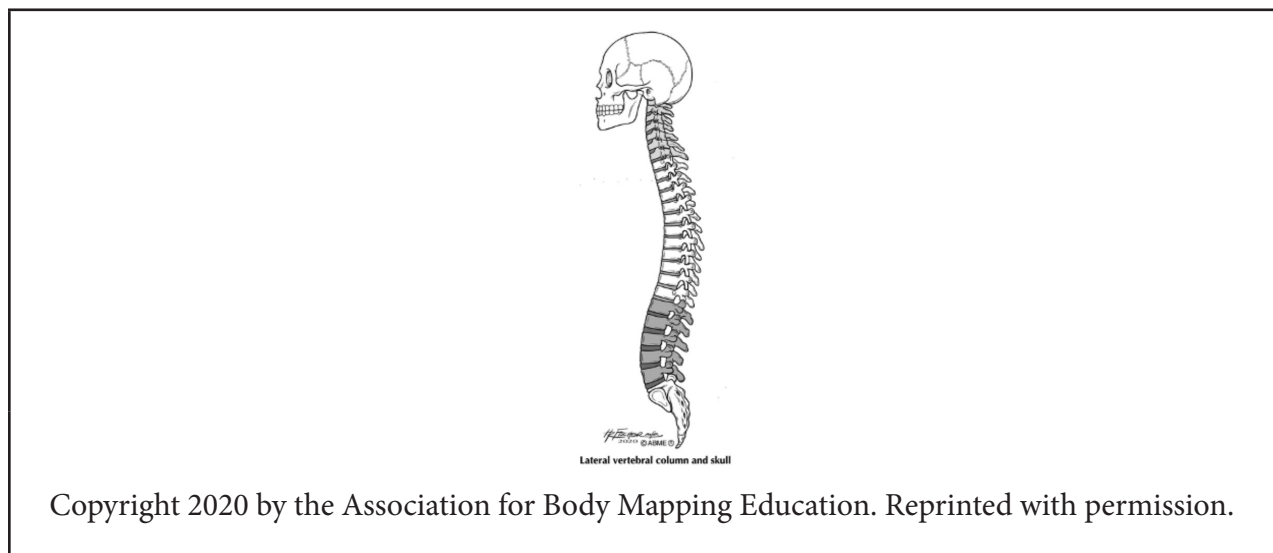
Participants in both the control and experimental groups completed six 15-minute instructional sessions over six weeks totaling 90 minutes. Each session focused on the six postural alignment points corresponding to the BMG concept of the “six places of dynamic balance”: the A–O joint, shoulder joints, lumbar region, hip joints, knee joints, and ankle joints. A conducting assistant, trained by the researcher prior to the study, delivered all instruction. For the experimental group, the assistant provided detailed verbal descriptions, palpation, and guided movement, and used anatomical models and images (see Figure 1 below and Figures 2 and Figure 3 on the next page), to illustrate joint positions and alignment. The assistant also demonstrated posture adjustments during singing, offering participants both visual and kinesthetic guidance. In contrast, the control group received brief verbal explanations and simplified movement demonstrations by the same assistant, without visual aids or anatomical models, emphasizing general body awareness primarily through verbal cues and mindful attention to bodily sensation during vocal exercises. This design isolated a single component of the broader BMG curriculum to evaluate its specific impact on singers’ postural alignment.

### Figure 1

*Balance Mascot with Places of Dynamic Balance*



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**Figure 2***Atlanto-Occipital Joint***Figure 3***The Lumbar Region of the Spine (shaded)***Results**

This study tested the hypothesis that a significant difference in postural alignment would emerge between the experimental and control groups during both status standing and singing tasks. Although 49 participants enrolled in the study, technical complications with the motion capture system resulted in complete data for only 40 participants; all subsequent analyses reflect this reduced sample. Pretest to posttest differences in angular deviation (degrees) were calculated for each anatomical landmark during static standing and singing. Negative values indicate movement toward vertical alignment, whereas positive values indicate movement away from vertical. Standard deviations reflect variability across participants, with some landmarks, such as the knees and ankles, exhibiting high variability due to natural differences in joint movement and minor inconsistencies in marker placement.

**Table 2***Static Posttest Comparison for Each Place of Balance Between Groups*

Postural Angle	Value	F	Hypothesis df	Error df	Sig.
A-O	0.963	1.675	1	43	0.202
Shoulder	0.995	0.212	1	41	0.647
Lumbar	0.748	13.493	1	40	<0.001*
Hip	0.978	0.888	1	40	0.352
Knee	0.990	0.312	1	30	0.581
Ankle	0.997	0.905	1	38	0.347*

\* $p < .05$ 

Note. The lumbar results were significant in favor of the experimental group.

Between-group comparisons showed a statistically significant difference in lumbar alignment during the static task,  $F(1, 40) = 13.493$ ,  $p < .001$ , indicating that participants in the experimental group achieved more optimal lumbar alignment following instruction (Table 2). No significant group differences emerged during the singing task,  $F(1, 39) = 1.799$ ,  $p = .188$ . The analysis showed no significant differences between groups for the remaining alignment points, including the A–O joint, shoulders, hips, knees, and ankles, during either condition. Within-group analyses revealed improvements from pretest to posttest for several joints (Tables 3 and 4 on the next page). The experimental group demonstrated a significant improvement in A–O alignment ( $F[1, 20] = 8.68$ ,  $p = .008$ ). Both groups showed significant improvements in lumbar alignment (Control:  $F[1, 23] = 6.918$ ,  $p = .015$ ; Experimental:  $F[1, 17] = 6.9$ ,  $p = .018$ ). Additional significant changes occurred in the lumbar region for the control group ( $t[20] = -0.518$ ,  $p < .05$ ) and in the shoulder joint for the experimental group ( $t[19] = -2.578$ ,  $p < .05$ ).

Composite posture scores, calculated as the mean absolute deviation across all six landmarks, provide an overall index of postural alignment, with lower values indicating alignment closer to vertical (Table 5 on page 64). Significant improvements appeared for the Control Static condition ( $F[7,10] = 13.73$ ,  $p < .001$ ), the Control Singing condition ( $F[7,6] = 16.65$ ,  $p = .002$ ), and the Experimental Singing condition ( $F[7,6] = 22.60$ ,  $p < .001$ ). The

**Table 3***Mean Difference Between Static Pretest and Posttest for Each Place of Balance*

Postural Angle	Control				Experimental			
	<i>M</i>	<i>SD</i>	<i>F</i>	<i>Sig.</i>	<i>M</i>	<i>SD</i>	<i>F</i>	<i>Sig.</i>
A-O	-2.86	21.92	0.41	0.53	10.38	16.15	8.68	0.008*
Shoulder	.512	5.31	0.21	0.65	0.35	6.88	0.05	0.82
Lumbar	5.22	9.71	6.92	0.02*	5.57	8.99	6.90	0.02*
Hip	0.56	12.84	0.04	0.84	2.93	10.74	1.41	0.25
Knee	-0.18	281.61	0.000	0.99	-50.76	204.2	0.80	0.39
Ankle	-1.87	15.92	0.32	0.58	-3.91	22.54	0.51	0.49

\* $p < .05$ 

Note. Results for the A-O joint were significant for the experimental group. The lumbar results were significant for both groups.

**Table 4***Mean Difference Between Singing Pretest and Posttest for Each Place of Balance*

Postural Angle	Control				Experimental			
	<i>M</i>	<i>SD</i>	<i>F</i>	<i>Sig.</i>	<i>M</i>	<i>SD</i>	<i>F</i>	<i>Sig.</i>
A-O	-5.08	18.75	0.67	0.42	5.09	15.17	4.67	0.04*
Shoulder	-.39	9.05	0.29	0.59	3.52	10.02	1.89	0.18
Lumbar	1.70	10.23	0.22	0.65	3.13	12.76	0.69	0.42
Hip	-2.29	13.62	0.41	0.53	2.83	12.55	0.20	0.66
Knee	-25.05	108.87	0.08	0.79	-6.28	200.5	0.00	0.99
Ankle	-1.85	16.39	0.32	0.58	-2.75	27.52	0.51	0.49

\* $p < .05$ 

Note. Results for the A-O joint were significant for the experimental group.

**Table 5**  
*Comparison of Composite Pretest and Posttest Measurements*

Composite Test	Value	F	Hypothesis df	Error df	Sig.
Control Static	0.91	13.73	7	10	<0.001*
Control Singing	0.95	16.65	7	6	0.002*
Experimental Static	0.94	6.83	7	3	0.071
Experimental Singing	0.96	22.60	7	6	<0.001*

\* $p < .05$

Note. Three significant results were found in the composite analyses. 1) Control Static,  $F(7,10) = 13.73, p = .001$ . 2) Control Singing,  $F(7,6) = 16.65, p = .002$ . 3) Experimental group,  $F(7,6) = 22.60, p = <.001$ .

Experimental Static condition did not reach significance ( $F[7,3] = 6.83, p = .071$ ). These results indicate that minimal verbal instruction yielded measurable improvements in overall postural alignment, whereas BMG-based instruction produced stronger or more integrated improvements, particularly during singing tasks. Overall, the findings indicate that instruction influenced upper cervical alignment, specifically at the A–O joint, and lumbar posture, with composite scores confirming broader trends in postural organization. High variability in other joints indicates that interpretations should focus on general trends rather than individual deviations.

## Discussion

Voice pedagogy literature indicates that misalignments in the body may negatively affect vocal production, underscoring the importance of effective postural instruction for singers. The current study provides preliminary evidence that both the BMG treatment and the control treatment were associated with partial improvements in participants' static standing posture. One notable trend was the limited number of variables showing statistically significant improvement across conditions, which may reflect participants' difficulty maintaining postural alignments while singing, as opposed to standing still, or a partial internalization of subtle distinctions during instruction. The control group, who received only brief verbal cues, demonstrated measurable gains in lumbar alignment during both static and singing conditions, suggesting that even minimal, targeted instruction may enhance postural awareness. These findings indicate that focused attention on posture, even in the absence of comprehensive instruction, may contribute to observable improvements. For choral educators, this finding highlights the potential value of integrating brief, targeted cues into rehearsals,

although effects may vary among individuals and contexts.

The experimental group's outcomes provide preliminary support for the potential benefits of BMG-based instruction. In particular, the A-O joint showed improvements across multiple analyses (see Figure 2). These results are consistent with longstanding claims in BMG literature regarding its foundational role in whole-body balance (Conable, 2000b; Malde et al., 2020). While these results align with pedagogical theory, it is important to note that findings reflect associations rather than causal effects, and additional research is needed to confirm the observed patterns. Furthermore, although the experimental group's singing posture improved across multiple alignment points, changes at individual joints were not uniformly significant, suggesting that integrated postural improvements may emerge gradually and require sustained practice.

Among the six postural landmarks targeted in this study, the lumbar region appeared particularly complex for both instruction and assessment (see Figure 3). Statistically significant improvement during the static posture conditions suggests that BMG instruction may help participants access challenging internal regions, although variability in joint movement and participant experience could influence outcomes. The A-O joint, introduced first in the instructional sequence, also demonstrated consistent improvement, possibly reflecting the perceptual prominence and the sequencing of lessons. These patterns suggest potential strategies for structuring postural instruction but should be interpreted cautiously due to the study's limited scope and size.

Composite data from the experimental group's pretest and posttest singing tasks showed the greatest number of statistically significant outcomes. These improvements appear to correlate with changes at the A-O joint and reflect key principles in BMG pedagogy, including the Laws of the Spine. While the data do not suggest that adjusting the A-O joint alone will automatically realign the rest of the body, they do support the pedagogical assertion that full-body alignment often begins from the top. The proximity of the A-O joint to the larynx—and its relevance to head-neck posture—may have enhanced participants' somatic awareness during phonation tasks. These findings are consistent with Peultier-Celli et al. (2020), who reported greater postural stability among trained singers compared to untrained participants. For vocal instructors, this suggests that beginning postural training with the head-neck relationship may be a practical and impactful entry point into more comprehensive alignment work.

Finally, the improvements observed in the control group's A-O joint and lumbar alignment underscore the influence of focused attention, mental imagery, and awareness on postural change. However, it remains unclear how these improvements translate to broader functional or vocal outcomes, emphasizing the need for further investigation. The control group received brief verbal prompts such as, "Think about this joint while you sing," but did not engage in movement-based activities, anatomical discussions, or visual demonstrations. Nevertheless, they demonstrated measurable improvements in alignment. These results underscore the pedagogical relevance of the body map—a conceptual model of the body

formed through sensory perception and visual feedback. Because the body map is cognitive rather than anatomical, it may be altered through mental focus. For educators, this highlights the potential power of suggestion, visualization, and awareness in postural teaching, even without full somatic curricula. Although this outcome was not predicted by the study's hypotheses, it opens a compelling avenue for future inquiry within BMG-informed pedagogy and beyond.

### Further Study

Researchers should extend both the number and duration of instructional sessions in future studies to examine how increased exposure to BMG principles influences postural comprehension and application. In the present study, participants received one 15-minute session per week for six weeks, totaling 90 minutes, which may have been insufficient to produce measurable postural changes. Additionally, this intervention isolated only the six places of dynamic balance, excluding other core components of the full BMG curriculum, such as whole-body coordination, breathing, and sensory awareness (Buchanan & Hays, 2014; Knaub, 1999; Salonen, 2018). A more comprehensive intervention may yield more substantial or integrated improvements.

This study also employed a group instruction model without individualized sessions. Typical BMG instruction often occurs one-on-one, allowing instructors to address participants' unique postural tendencies. Future research could compare group-based and individualized instruction to determine the relative effectiveness of each approach and to clarify how individual differences in learning style or somatic experience affect outcomes.

Further studies might also investigate BMG instruction across diverse participant demographics, including singers with varying levels of prior training, voice majors versus non-majors, or participants with background in dance or athletics. Such research could help clarify how previous experience influences postural learning and integration.

Finally, future investigations should examine whether changes in postural alignment correspond with measurable effects on vocal quality. While this study focused solely on postural measures, exploring the relationship between alignment and acoustic or perceptual aspects of singing would provide valuable insight for voice educators and choral conductors. Establishing this connection, while remaining mindful of potential confounding factors, would strengthen the pedagogical rationale for integrating Body Mapping into vocal instruction.

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