

FEMALE ADOLESCENT VOCAL PEDAGOGY:
MASTERY SKILLS FOR THE INDIVIDUAL IN THE CHORAL ENSEMBLE

by

Erin Bailey

A professional improvement project submitted to the faculty of

Brigham Young University

in partial fulfillment of the requirements for the degree of

Master of Music

School of Music

Brigham Young University

July 2011

BRIGHAM YOUNG UNIVERSITY

GRADUATE COMMITTEE APPROVAL

of a professional improvement project submitted by

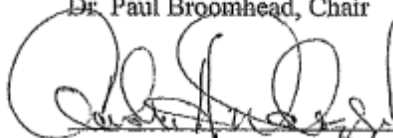
Erin Bailey

This project has been read by each member of the following graduate committee and by majority vote has been found to be satisfactory.


7/27/2011
Date


Dr. Paul Broomhead, Chair

27 July 2011
Date


Dr. Andrew Dabczynski

26 July 2011
Date


Dr. Allen Hopkin


BRIGHAM YOUNG UNIVERSITY

As chair of the candidate's graduate committee, I have read the professional improvement project of Erin Bailey in its final form and have found that (1) its format, citations, and bibliographical style are consistent and acceptable and fulfill university and department style requirements; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the graduate committee and is ready for submission to the university library.


7/15/2011
Date


Dr. Paul Broomhead
Chair, Graduate Committee

Accepted for the
Graduate Studies Council


Dr. Thomas Durham
Graduate Coordinator

Accepted for the
School of Music


Dr. Kory Katseanas
Director

**Music Education Graduate Program:
Professional Improvement Project**

The culminating project for the MM Degree in Music Education is the Professional Improvement Project (PIP). The PIP provides students an opportunity to demonstrate their ability to engage in a project of sufficient depth and scope to have meaningful implications for their own practice. It may also have implications for the wider music education profession.

The PIP document requires the following elements:

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SECTION I – BRIEF INTRODUCTION (1-2 pages)

SECTION II – PAPER ON RELEVANT TOPIC (10-16 pages, not including sources)

SECTION III – DESCRIPTION OF THE PROJECT (2-5 pages)

SECTION IV – THE PROJECT

SECTION V – REFLECTION (8-15 pages)

APPENDIXES

ACKNOWLEDGEMENTS

I would be extremely ungrateful if I did not thank a few people that have gone above and beyond their expected duties to help me in my path to completing my masters. I thank my committee for their patience and guidance, especially Dr. Broomhead for his tireless commitment to my success and growth. I thank Dr. Hopkin, Michele Scott, Debra Cook, and Debra Bonner for their extra time spent discussing and teaching vocal concepts to me. I especially want to thank my husband for his countless hours helping me in every capacity—as editor, baby-sitter, and friend—no matter what the job was, he was there with a smile on his face willing to do whatever was needed.

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Section I: Introduction

As I observe other teachers and go to workshops and conferences, I am often surprised by the diversity of approaches employed in teaching young singers to sing. Many teachers describe the singing of their female students as having a lot of “fuzz,” or escaping air in their sound. I have spoken to many teachers about this issue and have encountered a variety of positions regarding it. Some say that this fuzzy sound is simply caused by students’ stage of development—that it is something that must be there because of the changes occurring in the physiology. These teachers advocate doing nothing about this sound. The problem will go away in time. Other teachers say that this sound happens because students are not using a speech-like quality, incorporating exercises that sometimes result in a belt-like sound in their singers. Finally, some teachers believe that the fuzziness occurs because students are not getting sufficient air-flow. They focus on the diaphragm and breathing to address the problem. No matter the explanation of the problem or the approaches to addressing it, a systematic method grounded in research seems to be lacking. Robinson and Winold (1976) state:

The key to a satisfying choral experience for the individual singer is a conductor who can create a performing environment in which each singer can realize his or her inherent vocal potential. . . This is possible only when the conductor fully understands vocal production and is able to apply this knowledge through the literature in a pedagogically sound manner. (p.54)

I believe that too often our students’ choir experience is not as rewarding as it could be because our instruction lacks attention to building the individual voice and is not well-planned or purposefully sequenced to that end. Instead, our instruction too often focuses on learning the

songs for our next concert or performance. The adolescent singer needs the utmost care as she grows and her voice begins to mature.

As I contemplated this concern I began to look at the different vocal pedagogies of great vocal teachers, past and present, to find the best ideas to use with my students. I was disappointed to find very little written specifically for adolescent female voices. I found no well-developed instructional approach in any ready-for-classroom-use format. Authors have written about the physiological development of the voice and much is known about the physical changes that take place. However, some authors have disagreed about what the adolescent voice is capable of and what instruction should be given. I determined to devote my time and energy to find all the research I could to help me construct my own sequenced method of vocal instruction and submit it as part of my Professional Improvement Project.

As I began collecting data for the various physical factors affecting the adolescent voice, it became clear that there were more than physiological forces at work on the adolescent singer. Along with the changes in the physical structure of the voice and body of each singer, it became clear that psychological shifts also occur that affect the singing process. Thus, I broadened my search to include information regarding these changes as well. This project includes a description of that research in Section II. Sections III and IV provide an outline and specific description (respectively) of the resulting instructional approach. Section V includes my reflection on the process and results.

Note: Robinson, R., & Winold, A. (1976). *The choral experience*. New York: Harper's College Press.

Section II: Adolescent Vocal Pedagogy in the Choral Ensemble

There seems to be a consensus among vocal experts that choral directors are responsible for the vocal development of their students. Lee (1977) says, “Choral directors should know as much as possible about the human voice. They have a responsibility to give young singers sound vocal advice to prevent damage to the vocal instrument. There are directors who are hurting voices” (p. 5). According to Weiss (1978), “The most important goal of the choral director in the schools is to help the student to discover and develop his or her vocal instrument” (p. 32). Siple (1993) adds that the choral director must be able to function as a group voice teacher, and must “understand vocal development as well as the limitations of the voices in his or her choir” (p. 28). Gackle (1987) surmises that it is “obvious that the responsibility of encouraging healthy vocal development increasingly rests with the vocal music teacher within the school program” (p. 9). Since many adolescents do not have access to private vocal instruction the choral conductor is often the only vocal instructor with whom these singers will ever interact. Therefore, it is necessary that teachers possess the ability to instruct students in the proper use of the vocal mechanism both to prevent vocal abuse and to help singers produce the most beautiful sound of which they are capable.

Gackle (1991) notes that music educators and choral conductors are often under-prepared for working effectively with the special needs of the adolescent voice. Historically, it has been debated whether or not adolescents should sing through the voice change at all. Vocal abuse, misuse, and overuse have been given as reasons to avoid singing at this age. However, there are also researchers who advocate singing through the mutational period (time in which the vocal structure is changing or “mutating” as it matures) using vocal exercises (Andrews, 1986; Finn, 1935; Gembizkaja, 1962; Hammar, 1984; Ingham and Keaton, 1983; Phillips, 1985). Finn (1935)

states that the symptoms of vocal misuse can be corrected through proper vocal training.

Gembizkaja (1962) proposes that the use of careful, systematic vocal instruction during the time of puberty actually facilitates voice mutation (or voice change.)

The majority of vocal development research available to educators pertains to voice mutation in male singers. Only recently have researchers recognized the female voice change as a topic in need of study. And, a great deal of literature indicates a need for more research on this topic. Daniels (1982) states that there is a “fertile field” for research concerning all aspects of the pubertal changes of girls (p. 52). Gackle (1987) concurs that “minimal information exists concerning this phenomenon [the changing voice] in the female voice” (p. 2). In this paper, I first present an overview of literature on the changing adolescent vocal physiology and adolescent psychology. Then, I provide five recommendations based on the synthesis of information from the research.

Review of Literature

Adolescent vocal physiology.

“If choral conductors wish to be a part of the voice building process, then they have an obligation to study the factual scientific material about the vocal mechanism” (Doscher, 1987, p. 17). Hammar (1984) also states:

The conductor should be knowledgeable about the anatomical components of the vocal mechanism—its limitations as well as its potential. It is one matter to envisage what sounds are desirable for performance of a given musical selection and quite another to lead the singers to better vocal production. (p. 120)

According to Wilson (1978), the three periods of most rapid change in the fundamental frequency of the human voice are: the first four months of life, one to three years of age, and

thirteen to seventeen years of age. A common misconception is that the female voice does not change significantly during adolescence. Apparently trying to change this perception, some researchers have recognized that the female voice goes through substantial pubertal changes. Luchsinger and Arnold (1965) note that the vocal bands of female adolescents increase in size approximately three to four millimeters while male vocal bands increase up to one centimeter. Kahane (1975) observes that the female larynx increases more in height than in width, becoming distinctly different from that of the male, which grows front to back leading to the protrusion of the thyroid cartilage or Adam's Apple. Hirano (1981) observes:

In a newborn, no vocal ligament is observed. In a four year old child, a thin and immature vocal ligament is observed. The vocal ligament is still immature at the ages of twelve and sixteen. It is only after puberty that a mature layer structure forms. (p. 39)

It has not yet been established whether or not the vocal ligament matures as a result of physical growth alone or if the maturation of the vocal ligament is dependent upon voice use.

Seth and Guthrie (1935) observe that the first indication of voice change is a slight huskiness or breathiness of the voice due to the incomplete closure of the posterior part of the glottis. Vennard (1967) calls this gap in the vocal folds the mutational chink and observed that the mutational chink or gap represents weaknesses in the interarytenoid muscles. Incomplete closure occurs when the front part of the glottis vibrates cleanly while the back part, bound by arytenoid cartilage, does not close at all, creating a little gap or triangle, characteristic of all young voices and is particularly noticeable in young female voices. While Ingham and Keaton (1983) also observe the breathiness in female adolescents, they attribute it not only to the mutational chink caused by the incomplete closure of the posterior end of the glottis, but to a poor approximation of the vocal folds resulting from the lack of breath management. They

suggest that skills for proper breath management could be developed to close the glottis more adequately.

Thurman and Klitzke (1994) list as indicators of female voice change: lowering of the mean speaking fundamental frequency by three to four semitones, increased breathiness, huskiness, hoarseness, voice cracking during speech, noticeable register breaks during singing, decreased and inconsistent pitch range capabilities, singing feels more effortful, with a delay in phonation onset, breathy, heavier, rougher voice quality or breathy, thin, colorless voice quality. Cooksey and Welch (1998) observed that register shifts occur in transition areas which can be very unstable, vocal fold coordination becomes more difficult, and decreased comfort zones in the singing voice can appear in diverse pitch regions.

Other factors are important in order to understand the female changing voice. Weiss (1950) observes that the lengthening and increased circumference of the chest provides greater breathing capacity. The descent of the larynx allows for an increased size in the pharyngeal tube and further enlarging of the respiratory systems. The development of sinus cavities and facial structures further increase the young singer's resonating capacity. Phillips (1992) observes that, by the age of eight, the lungs have fully developed so the child is more likely to be able to sustain the upper voice.

An awareness of the physiological changes discussed above can have a transformative effect on vocal instruction in choirs involving female adolescents. These facts may lead choral teachers to more efficient and sound practices as they design vocal pedagogy for their students.

Adolescent psychology.

Changes affecting the vocal mechanism are not the only challenges faced by adolescents learning to sing. In addition to physiological changes, there are indications that adolescent

psychology must also be considered for its impact on singing during the vocal change. May and Williams (1989) observe:

How students feel about their voices during the mutation process has not been adequately addressed by the research community. . . If the music teacher focuses exclusively on this student's physical problems associated with her singing without attending to her psychological difficulties, then that teacher risks alienating or discouraging the student. (p. 22)

Adolescence is often a turbulent and unpredictable period of human development. Adolescence is also a vitally important period during which time individuals are making decisions about themselves and about the world that have the potential to change the course of their lives and society. While the potential for meaningful change is present throughout humans' lives, the period of adolescence, with new freedoms and new choices, represents a particularly rich opportunity for these kinds of changes. Many researchers and theorists have identified the adolescent years as a time in which people acquire mental skills that make humans capable of shaping the future of their civilizations.

As adolescents develop greater conceptual complexity and participate in more varied social relationships, they begin to assume an adult perspective in problem solving and decision making (Newman, 1975). Piaget outlines stages of development from infancy to adulthood. From about the age of 11 or 12 to adulthood, concrete operations give way to formal operations when individuals learn to do abstract thinking and can imagine many possibilities within a given situation (Piaget & Inhelder, 1969). Piaget documents six specific new conceptual skills that occur during adolescence that did not occur in childhood, ranging from the ability to manipulate more than two categories at once to anticipating the consequences of actions taken. More recent

research, including behavioral and fMRI studies, demonstrates that during adolescence executive functions are developed, meaning that adolescents develop cognitive skills that enable the control and coordination of thoughts and behavior (Choudhury, 2006). Such cognitive aspects of psychological change during adolescence affect both how students learn about the world and their place in it, and how they learn about themselves.

Another important type of psychological change relates to adolescents' ability to formulate identity. During adolescence, young people's cognitive skills in the abstract enable them to think more about possibilities rather than feeling bound to think only of their concrete reality. Using these skills, adolescents begin the process of self-identification—one of the most important processes of adolescence. Young people going through the process of self-identification may hypothetically adopt certain ideas, opinions, styles, fashion, and outlook on the world. They may place themselves in different hypothetical places within social groups. This experimentation with different self-conceptions allows adolescents to temporarily “try out” different social roles and then remove them when desired. It is like a versioning system for the concept of ‘self’ where adolescents attempt to act out different “versions” of themselves to choose who they want to be. Harter (1996) observes that adolescents who experiment with these “false selves” report higher levels of self-esteem and self-knowledge than those who do not engage in this experimentation, and are more ready to begin the quest for fuller identity. Erikson (1977) calls this the process of identity formation. Identity formation plays a pivotal role and is a time for experimentation and introspection from which a personal identity will evolve. Berger (1998) reminds the teacher that as adolescents become more self-critical and aware of how they might be viewed by others, they can become very sensitive to actual or anticipated criticism.

This combination of openness and sensitivity puts them in an emotional bind, eager for lively intellectual interactions yet highly vulnerable to self-doubt.

Closely related to self-identification, self-esteem is influenced by perceived success in athletics, academics, friendship, or other areas, such as vocal performance. Drucker (1969) observes that few things are as badly needed in growing up as the sense of achievement, which can be found through performance. Adolescent students in large ensembles need the sense of achievement that comes from personal performance on their instrument. Pajares (2005) makes several recommendations to increase self-efficacy in adolescents including: (1) emphasize skill development rather than self-enhancement, (2) make failures normative and resilience becomes second nature, praise effort and persistence—not ability, (3) identify self-handicapping strategies, and (4) emphasize mastery goals rather than performance goals.

Some researchers have begun to make connections between psychology research and vocal instruction. Weiss (1955) exposes an interesting complication of the changing voice by pointing out that many people consider the voice to be an extension of the personality. Therefore while coping with the voice's physical changes, an adolescent also struggles psychologically with how the voice may affect his/her personality—all during the search for a unique identity. Gunter (1992) states that the singing voice reflects all of the problems and emotions a person has in his/her private life. In the turbulent world of adolescence, singing can be emotionally overwhelming. It is important to help students develop coping skills to deal with the tensions of facing peers with this vocal extension of a changing personality and the extreme emotional swings that are common in this developmental stage. As researchers discuss the developmental changes of adolescence, they may offer applications or suggestions from the information they gather. Often these suggestions do not relate directly to teaching female adolescent singers in a

group class or choral setting. In addition, most researchers admit that more research is needed in this area. The following section lists five applications specifically for the choral instructor that are research-based and have been tried in a choral classroom and found effective by the writer.

Recommendations

While the body of research regarding vocal development of female adolescents provides many important insights (above), several topics seemed to be lacking in information or solutions. In some of these cases, leading voice teachers were able to provide additional information. Several practical insights have emerged both from the literature review and from interviews with several vocal experts. I have put these ideas into direct practice both with my private voice students and in my choral classes. They are presented here by topic in the following areas: the mutational chink, mastery skills as a guide to instruction, make the abstract concrete, individualized instruction and assessment, and direct applications for the choral classroom.

Mutational chink: fact or fiction.

The mutational chink, a phrase first coined by Vennard describing the gap created in the vocal folds in younger voices, has been accepted for many years as the root of the breathiness found in young female voices. However, there have been recent studies that suggest that increased breathiness or huskiness may not be “purely a function of age or physical maturity of girls, but may be influenced by non-physical factors, including instruction in vocal technique and vocal modeling in which young girls are exposed” (Toole, 2003, p.105). Miller also suggests that breathiness is not as much a physical development issue, but a lack of proper vocal technique (Miller, 2004). Many teachers are unsure how to proceed when they hear breathiness in the singing voice – hesitant to ask for a clearer sound if the voice is merely exhibiting symptoms of the mutational chink.

A very simple way to assess the source of breathiness is to invite the student to speak a phrase before she sings. The mutational chink will normally affect both the spoken voice and singing voice with a somewhat equal amount of breathiness. If there is breathiness in the spoken voice, it can be dealt with even before any singing instruction is given. If the spoken voice is clear and healthy however, and the student's singing is breathy, teachers can be confident in expecting the same clarity in the singing voice as they teach correct vocal technique. Often, it seems that what teachers are writing off as a mutational chink problem may in fact be a lack of energy and air-flow or other vocal production skills. These skills can be taught by a teacher who is listening, aware, vigilant, and who has a solid basis of knowledge regarding healthy vocal technique. Debra Cook (2009) states:

Most students go far too long accepting the chink as normal because they do not really know how to sing on the breath or support the tone. The ability to use subglottic pressures along with the proper onset of the tone are the two most important elements in mitigating the breathiness through vocal training. (Personal communication, July 2009)

Through many discussions with colleagues, professors, personal experimentation and implementation with my own students, the following exercises are recommended in working with breathy singing voices.

1. Speaking to Singing. Have students speak in a comfortable range "1-2-3-4-5." Then, instruct them to do it again, elongating the length of the vowel only slightly. Find a pitch in the range they are speaking and have them sing "1-2-3-4-5" steady and slow. Invite the student to keep this speech-like quality as they then try other pitches, gradually expanding the range, continuing to elongate the vowel for increased durations. This can be done in all ranges. In the higher ranges, make sure the student is not raising the larynx excessively. Students need to be

taught that they may use the same muscles and actions for singing that they use for speaking. The elongation of a speech-like sound into a longer-held singing note often leads to the need for more air and energy as students hold out long notes.

2. Air flow Exercises. Many teachers use the “lip buzz” or “zz” sound on vocalises. This works well in training the body to use more breath support. Any exercise that can increase air-flow in a continuous stream and help students feel the support lower in the abdominals is helpful. The following is an example of such an exercise. Instruct students to lip buzz or make a zz sound on an upwards octave arpeggio do-mi-so-do and hold out the top note, inviting them to crescendo in energy or air speed. Guide students in doing this a few times, then instruct students to open into any vowel after the lip buzz and hold it, listening to the clarity, and then descend back the same way (do-so-mi-do) on the vowel. Emulating the lip buzz, Ingo Titze (2000) has recommended singing through a straw as useful for training the voice. This exercise creates a higher placement of the voice and enhances singers’ awareness of the need for increased air flow and abdominal support, especially on higher pitches. I have guided students to perform this same exercise singing through a straw replacing the lip buzz and found it very effective.

3. Onset Exercises. Onset simply can be defined as how a singer begins to sing or phonate. There are three types of onsets that singers can employ. The first is the soft or breathy onset where the throat is open but air-flow is slow, creating a fuzzy or breathy sound. The second is the hard or pressed onset, where the throat is being muscularly squeezed and is characterized by a very tense, pushed sound. Both of these onsets are not preferred in singing. The balanced or clear onset is the most healthy, efficient, beautiful way to sing and is created when the throat is open, air-flow is sufficient, and the vocal folds are prepared to sing. After teaching students the three different types of onsets and assessing that they are capable of performing each, employ

this onset exercise from Richard Miller (1996). Instruct students to sing four quarter notes on any vowel, starting breathy and progressing to clear, pausing between each note sung. Invite them to increase the air speed on each quarter note. Ask them to feel and describe what they are doing in their bodies to make the change. Guide them to notice specific things by asking questions, such as, “What do your lower abdominals feel like on the final quarter note?” or “Does your throat feel tense or hurt?” Remember, pain is never correct and careful monitoring will give students the most success. This exercise can also be done using the other extreme—starting with a pressed sound and moving to clear—but I have found this helpful only for students who make no change using the first exercise, signifying that their air flow is less of a problem than the approximation of their vocal folds.

An excellent exercise from Michelle Scott (personal communication, 2010) that combines the ideas in the two air-flow exercises is to invite the students to say, “mmm, mmm, mmuffins!” with each “mmm” louder and rounder than the one before. With each “mmm” guide the students to speed up the air flow and open the throat before opening into the vowel. Students should notice the clarity of tone on the “uh” vowel with the “mmm” preparation. Invite the singer to now sing the Muffin exercise, by putting the “mmm” on a pitch and following the same steps, except instead of finishing the word, instruct students to hold out “muh” on the pitch. Discuss the fact that the vocal folds are already engaged in sound making before the singing of a vowel begins, producing a clear sound. The preparation that is occurring during the “mmm” is necessary even if students start on a vowel. Now invite the singer to sing “mmm, mmmuh, uh” holding out the last uh. I have found these exercises to be extremely helpful in creating a clear, healthy tone in some of the breathier singers.

Mastery skills as a guide to instruction.

Gackle (1987) recognizes that most of the physical techniques in the singing process are best achieved through specific psychomotor training. She suggests that the careful sequencing of vocalises enables the singer to be aware of the “feeling” of the new skill. Too often, choral instructors teach repertoire rather than technique. This may be compared to a basketball coach who has his students play games for the entire duration of their practices rather than using drills that focus on skills and fundamentals such as passing, guarding, and shooting. Corbin (1983) observed that vocalises are often neglected in the choral rehearsal and that when they are included in the rehearsal, they are often not sequenced to enhance the building of the singing instrument or process. From her study, she concludes that techniques for vocal development should be included as an integral part of all choral rehearsals. However, choral instructors often apply vocal warm-ups and technical drills in haphazard ways with no structure or guiding objectives. All vocal teachers should identify what basic, fundamental skills are necessary for students and then sequence activities that address these skills in a step-by-step process that builds the instrument of the singer.

A well-sequenced list of mastery skills will be of great use to teachers and students who are focusing their energy and effort on singing technique. Below is an example of a mastery skills list for vocal students. Notice that this list of skills does not begin with singing. It begins with a task or skill with which most students are already comfortable and with which they may feel safe experimenting—the task of speaking. This offers the instructor an opportunity to easily diagnose vocal health issues early on.

1. Speak a given phrase with energized air-flow and no compression (hereafter called “efficient tone”) in their natural speaking range.

2. Speak a given phrase with efficient tone in the higher range or head voice.
3. Sing a given phrase with efficient tone in the lower, middle, and upper range of the voice.
4. Demonstrate noble, lifted posture and know the four points of alignment (ankles, hips, shoulders, and ears should all form a line when singers are aligned correctly.)
5. Take a low, expansive, relaxed breath maintaining an inactive upper chest.
6. Sing with a balanced onset, as opposed to a soft (breathy) or hard (glottal) onset.
7. Sing on the five pure Latin vowels (Ah, Eh, Ee, Oh, Oo) with a relaxed jaw swinging open like a hinge and a lifted soft palate.
8. Find the target vowel of any diphthong and perform it appropriately.
9. Perform a given phrase in a legato, sustained way with consonants present but not interrupting the line.
10. Exhale steadily without collapsing during singing (“suspension”).
11. Find and sing a given melodic line in chest voice/heavy register and head voice/light register.
12. Transition smoothly through the primo passaggio of the voice, sometimes referred to as the “break,” where the chest voice/heavy register transitions to the head voice/light register, using mixed voice.

This list may be given to the students at the beginning of the year and each day vocalises and exercises are implemented to help students develop these skills. Some benefits that occur for students and teachers when such a skill mastery list is utilized are: (1) warm-ups are no longer haphazard and without purpose, that is, students and teachers both have clear skill-based objectives that are sequenced to produce the greatest success, (2) referring to their list, students

take ownership of their progress and development and can be guided to connect the tools and analogies teachers use during class to the skills they are working on, (3) learning will be meaningful, and therefore deep and lasting for the students, (4) it removes the idea of “good” and “bad” singers as each singer is simply working on a list of skills, (5) teachers can offer feedback that seems unbiased and impersonal and yet more specific and helpful than merely evaluating a singer, and (6) specific skill mastery points can be identified as weaknesses, which allows for a renewed correctional focus on the specific problem.

Make the abstract concrete.

The voice can be a mysterious system to children as it is not seen and is therefore somewhat in the realm of the abstract. Bruner (1960) proposed that any subject could be taught effectively in some intellectually honest way to any learner at any stage of development. The adolescent singer is in a developmentally opportune phase of life in terms of attaining a greater understanding of the vocal mechanism, which, of course, will aid in the development of better singing. According to Piaget (Piaget & Inhelder, 1969), adolescents are leaving the concrete operations stage and progressing to the formal operations stage where they are able to comprehend things they cannot touch or see, like the voice. However, these cognitive abilities happen over a period of time. Instructors can gradually help make abstract ideas more concrete. Harrison (1978) suggests that young people be educated about the physical development of their larynxes, laryngeal functions, and the ways that the changes of the vocal folds during puberty can affect their singing and speaking. Pictures and diagrams will be extremely helpful in this instruction. Body mapping is an excellent way of “helping people discover and correct misconceptions about the way their bodies are built and the way they function” (Malde, 2000, p.521). Malde states that this process of discovery must not end with simple recognition of the

truth, but that “singers must embody the truth until misconceptions are replaced with true kinesthetic understanding of the individual structures in relation to the whole body” (p.521). The use of diagrams and models of physiology may be helpful in making the abstract more concrete, but having students place their fingers on gently on their cheeks (for example) to gently nudge them to a relaxed forward position will lead to greater understanding and success. Anything teachers can do to help their students connect something concrete to the abstract concepts of the invisible, untouchable voice will be of great value. The following is a list of possible activities intended to make the abstract more concrete:

1. Show diagrams or models of the laryngeal structure and its separate parts. Invite students to feel or touch on themselves the different parts of the vocal structure as they are discussed.
2. Instruct students to gently rest their fingers on their laryngae and swallow to feel it move. Then, guide students to feel the larynx as it lowers and rises as they imitate specific sounds. Instruct them to monitor its position as they begin to sing.
3. Conduct a Bernoulli principle demonstration. Instruct students to blow air through two papers to create vibrations. Guide students to experiment with weak air-flow and strong air-flow and notice the effect on the papers to show the energy level needed for efficient singing. Suggest students envision a pinwheel directly in front of them while they sing. As they increase their air-flow, the pinwheel spins quickly.
4. When students are first learning to project the sound, invite them to point to the place they want their voice to go and stare at that point as they speak or sing.

5. Help students feel an open throat by getting a yawn feeling compared to a tight throat that might occur if you tried to lift a grand piano. Invite them feel and describe the difference and then speak through each of them.
6. Instruct students to lie on the floor to feel aligned posture and to feel relaxed low breathing. Invite them to stand and maintain the feeling of lift and relaxation.
7. Guide students feel the release of the jaw by lightly resting a finger in front of the ear to monitor the hinge of the jaw. Invite them to clench and unclench their teeth to experience the feeling of a tight jaw compared to a loose, relaxed jaw.
8. Guide students to plug their noses and purposely speak with a nasal sound followed by a non-nasal, clear, open sound while still plugging their nose and feel the required lifting or raising of their own soft palate to achieve this open sound. Explain that as we lift the soft palate and create more space in the mouth the sound becomes clear and loses the nasal quality. Repeat this activity while singing to help train the soft palate.
9. Use a hand activity to imitate a glottis, for each type of voice onset (feel free to show a diagram of the glottis). Press the hands together tight for a hard/glottal onset, while singing a hard glottal onset, and have students repeat the sound holding their own hands tightly together. Next display hands open and relaxed, wide apart for a soft/breathy onset, and demonstrate vocally, allowing students to repeat the hand action and sound. Finally, bring hands in a ready position about one centimeter apart for balanced onset while demonstrating this technique and have students imitate.
10. Instruct students to sing through a straw while placing one hand in front of the straw to monitor the speed and consistency of the air-flow in their singing.

These are just a few activities that can help students gain a theoretical and practical understanding of the vocal process. The activities can also affect students' ability to be self-regulated learners in that they engage in the process by which learners personally activate and sustain ideas, affects, and behaviors that are systematically oriented toward the attainment of learning goals (Zimmerman, 2008). This self-regulation can help students achieve autonomy—a central goal of education. These activities can be used in subsequent rehearsals as a means to help students self-monitor. Students cannot recognize, adjust, or change what they are doing if they are not first aware of their actions (Schunk, 1991). If teachers help students develop the skills or tools to self-monitor during rehearsal and at home in personal practice, progress will be substantial.

Ali (2010) states that habituation of technique is a goal of practicing for singing, and that the formation of habits must come through daily practice by the student. She points out that practice can also perpetuate poor habits through mindlessness. Choral rehearsals can be either a successful way of habituating excellent vocal technique, or can be forums for practicing and making permanent poor vocal habits. Deliberate and mindful practice will not eliminate the need for feedback by the instructor, but will empower the students to self-correct through vigilant self-monitoring. One way of enhancing student awareness and engagement is to ask students to produce some visual representation (with their hands as described above, for example) of the skill they are envisioning while singing. Utilizing the above concrete signals and demonstrations are designed to help students focus on technique and improve their sound as individual singers.

Individualized instruction and assessment.

As the teacher must instruct a group of choral singers while at the same time making sure that instruction is individualized and personal, it is important that each individual in the

ensemble become a self-regulated learner and self-monitoring singer. Gackle (1991) observes that choral training has been oriented toward creating a group sound rather than building the individual voice, and that directors tend to use an adult sound model rather than helping young individuals find their own age-appropriate voice. Even choral instructors who make vocal training an integral part of every rehearsal may, while succeeding at developing a better combined choral tone, be unsuccessful in helping individual singers gain more ability and confidence in their personal singing instruments. This must be a priority for the instructor. Weiss (1978) shared that the most important goal of the choral director in the schools should be to help the student to discover and develop his or her vocal instrument.

Because of the nature of the vocal instrument, the adolescent must navigate mostly by feel and learn to trust less what he/she hears. Though an adolescent's new ability to think in the abstract alone will be helpful in learning the vocal process, technology makes it very easy to videotape students and have them watch themselves sing. This turns something intangible like the vocal mechanism into something visible, audible, and adjustable as they attempt different techniques suggested by the teacher. And, they can see and hear the results. Playing examples of good vocal models alongside a student's recording can save hours of less-effective instruction.

Alderson (1979) states that students must learn to trust their teachers' ability to hear and evaluate their voices correctly and successfully. During the adolescent phase where authority is often questioned, this immediate, unbiased, technology-based feedback is invaluable and should be used often. Allowing the student to record his/her voice and answer questions about it, even without a teacher present, can be an excellent formative assessment that takes away little or no instruction time. However, taking the time to listen to the recording together, instructing and

making adjustments, re-recording the passage and listening again, is even better and can be a very meaningful and successful learning experience for the student. Reimer (2009) states:

Frequent individual assessment motivates students to practice, encourages a positive and professional demeanor, improves rehearsal and performance, and most importantly, strengthens the desire to strive for perfection. Students become better aware of their musical progress, the conductor evaluates the effectiveness of his or her own teaching, and administrators possess tangible data of assessment. (stthomas.edu/rimeonline)

Especially in a choral setting, where often teachers are evaluating the choir as a whole, individual assessment should be regularly used to help monitor students' vocal development and health. Individual assessment not only gives the instructor a clearer picture of students' individual progress than does group assessment, it serves as a tool to facilitate that process as well. I made a goal to meet with each of my 300 students one-on-one every term. While it was time-consuming to meet with students individually to instruct and assess, students involved in this process reported on their end-of-year survey that, out of all instructional activities throughout the year, it was the most helpful in terms of their vocal development. They also attributed most of their vocal improvement that year to these brief 5-7 minute meetings.

Direct applications for the choral classroom.

Most of the above suggestions may be equally applied in any instructional setting for vocal training, whether private vocal coaching or choral teaching. This final section offers suggestions specifically to choral instructors—especially teachers of adolescent singers. A very helpful guiding perspective is to treat the choir class as a vocal skill-building class that also sings choral music. Students and parents must be informed that this is the nature of the class.

Often teachers immediately try to achieve a unified blended choral sound. However, if some basic individual vocal skills are not yet habituated, students may not be singing efficiently or with adequate breath support and energy and could develop poor habits that lead to vocal strain or abuse. A teacher may want to purchase some unison pieces or even simple classical and Broadway solo repertoire and teach these to the group. Instruct and rehearse these pieces in class as if each student were learning the solo to sing on their own. *Panis Angelicus* by Cesar Franck is an excellent example of a simple piece that can be printed directly from CPDL (<http://www2.cpdll.org/wiki/>) and used as a vocal skill builder.

Students should be spread out so they can hear themselves or they can turn and sing to the wall to focus directly on their own individual vocal production. This activity cannot be emphasized enough, as it plays such an important role in a chorister's self-perception. One of the great challenges of choral singing is being able to hear your own vocal production in the midst of other singers. An important skill for our singers to acquire is that of being able to focus in on and monitor their own voices, and then move that awareness out to others. Later, invite students to sing to a trusted partner and engage in peer assessment based on the skills learned. Once vocal habits are in place, students' attention should be turned to vowel unification, blend, and other choral skills. The result will be much more rewarding and beautiful as students are singing with a full-bodied, supported sound because of the time spent on individual vocal skills.

Along the path of vocal skill building, involve students in frequent activities that help with the process of self-identification. Invite students to "try on" different roles and different vocal sounds to help them discover their own voices. Guide them to experiment with the capacities of their voices by making all kinds of noises. Invite them to copy you in making animal sounds or siren sounds. Instruct them to imitate your singing in different styles- opera,

country, belt, etc. Inviting students to try different tone qualities, ages, vowels, or even facial expressions can make experimentation in the classroom safe and open, without forcing students to sound like something they are not convinced they want to sound like at that time. Recognizing the unique pitch ranges in an adolescent vocal ensemble and the students' desire to be creative and make their own decisions, Freer (2009) recommends developing vocalises that are not pitch specific. He also recommends constructing improvisatory activities that teach vocal skills yet leave pitch choice to the students. For example, inviting students to sing in the middle of their ranges and then higher in their ranges until they have hit their highest note that they can hit with freedom in their throats—without playing predetermined pitches that they must sing—helps students expand their ranges at their own pace while maintaining a feeling of success as they experiment.

Teachers are also advised to play recordings often and guide students in listening critically and then attempting to reproduce what they hear. Remind students that each of them was born with her own unique voice, and that the goal of the instruction will be to bring out the best sound she can produce by learning how best to use her instrument. As students learn more techniques and skills, they will recognize differences between healthy singing and less-healthy singing. Avoid the words “right” and “wrong” when it comes to vocal sound. Adolescents know that there are a lot of famous singers (who are paid a lot more than their choir teacher) whose sound would not be acceptable in her ensemble. Many of these popular singers become vocal models for young singers, affecting them in positive or negative ways. Teachers can and should play a role in guiding adolescents to appropriate and healthy vocal models. Any vocal instruction program must include opportunities to listen to or view recordings of singers demonstrating healthy, age-appropriate sounds.

In conclusion, a prepared choral conductor should possess a solid knowledge of the vocal instrument and the physiological changes that occur during adolescence. The conductor should also address the equally important psychological changes faced by young singers. Using a well-sequenced vocal pedagogy that attends to these special areas of focus can help bring out the best sound of which individual singers are capable and provide a foundation of healthy vocal production that will benefit each student for the rest of her life.

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Section III: Description of the Project

As a teacher of young vocalists, I have found substantial disagreement among my colleagues and even researchers regarding what should be expected of the young voice and regarding the best way to instruct students and help them improve. As the voice begins to change in adolescence, young singers may get frustrated or even quit singing merely because they are not receiving informed, correct instruction. I echo Kenneth Phillips (1996) who states:

Singing is a learned behavior; it is not some type of gift bestowed only upon a talented few. Children and adolescents can be taught to sing, and each person has the right to learn to sing in order that he or she may experience the joy of music as an active participant. (p. 106)

Vocal training must be a core element in any adolescent choral classroom and teachers should equip their students with tools and skills that noticeably improve their ability to produce a healthy singing tone. This project is a structured approach to teaching vocal techniques and skills specifically designed and sequenced for the female adolescent voice in the choral setting.

This project has improved my teaching practice in several ways. As I combined research available in the fields of vocal pedagogy, physiology, and technique with adolescent physiology and psychology, I formulated a unique, well-sequenced vocal pedagogy that addresses the specific concerns of this phase of the singer's life. Focusing on the individual singers in my ensemble and their growth, rather than just the ensemble itself, I have learned to be creative in the ways I teach and assess understanding and achievement of our objectives, while being very methodical in the sequencing of vocal techniques and skills. Completion of this project has given me the knowledge and strategies needed to improve the sound of my choirs, but more

importantly, the ability to train my students in vocal technique and give them something valuable for the rest of their music-making in their lives.

In order to complete this project, I conducted a review of literature regarding vocal physiology and pedagogy, focusing on research that investigates the adolescent female voice where available. I also reviewed literature regarding adolescent psychology and individual assessment in large ensembles. Synthesizing this information, I created a sequence of vocal pedagogy consisting of specific skill masteries and structured lessons to accomplish these skills. I then implemented the instruction with my students over a fourteen week period of time, monitoring and assessing along the way, and making adjustments as needed to the original instruction plan. Section IV contains the specific details of the instruction and sequence. A panel of judges will view and analyze pre- and post- recordings of the students, giving scores for different observable criteria. From these data, I will draw conclusions and make suggestions for revisions in the vocal instruction.

Section IV: The Project

For this project, I created a sequenced approach to vocal pedagogy that combines expert knowledge about adolescent vocal physiology and adolescent psychology. Section IV begins with lists of the objectives, skills, and sequences of the vocal pedagogy treatment used with my students for this project. Following this section is the evaluation criteria used by a panel of judges as they assessed pre- and post-treatment recordings to measure its effectiveness. The data received from these evaluations are then reported and discussed. A student survey was administered to invite feedback from those taking part in the study; results of this student survey are also discussed.

Treatment

There are multiple student-centered objectives focused on vocal technique at the heart of the planned instruction. In my studies in preparation for this project, I compiled 13 vocal skill mastery objectives that, to the extent achieved, may define a solid foundation in vocal pedagogy for an adolescent female. These objectives are listed below. Following this list is the fourteen week treatment plan used with my classes. If the treatment is successful, by the end of the fourteen week instruction it is hoped that each student can:

1. Speak a phrase with energized air flow and no compression (hereafter called efficient tone) in their natural speaking range,
2. Speak a phrase with efficient tone in the higher range or head voice,
3. Sing a phrase with efficient tone in the lower, middle, and upper range of the voice,
4. Demonstrate noble posture and know the four points of alignment,
5. Take a low, expansive, relaxed breath maintaining an inactive upper chest,
6. Sing with a balanced onset, as opposed to a soft (breathy) or hard (glottal) onset,

7. Sing on the five pure Latin vowels with a relaxed jaw swinging open like a hinge and a lifted soft palate,
8. Find the target vowel of any diphthong and perform it appropriately,
9. Perform phrases in a legato, sustained way with consonants present but not interrupting the line,
10. Exhale steadily without collapsing during singing (“suspension”),
11. Perform different melodies in the appropriate register of the voice,
12. Transition smoothly through the primo passaggio, or first transition of the voice,
13. Demonstrate appropriate facial expression and movement.

In order to achieve the mastery skills listed above, my choir students participated in fourteen weeks of instruction, which took place during their regularly scheduled choral class time. Instruction was organized by week and day with only four days of instruction given per week. This allowed me to be flexible, taking into account school activities and the need to stop and review as necessary. I organized the instruction itself so that it would only constitute 5-10 minutes of class time per day; however, it was expected that the techniques or skills taught would be reinforced during the rehearsal of each day’s choral literature. I have included a description of the treatment in the form of short lesson plans. I need to acknowledge here that many of the vocal exercises that follow were formulated from observations, conversations, and suggestions from Dr. Hopkin, Michele Scott, Debra Cook, Ruth Christensen, and Debra Bonner.

Week 1: Speak/sing with efficient tone in different ranges of the voice. (Goals 1-3)

Before treatment begins, spend one day reviewing the words and melody to the Star - Spangled Banner so all have the same preparation. Then pre-record all students.

Day 1: Have each person in the group say a phrase or respond to a question, noting where they speak naturally and if any have any vocal health issues such as excessive raspiness or other signs of vocal damage. Explain that singing is not something that only the talented few are lucky enough to do. It is a learned skill involving mind and muscle coordination that all can learn, just like any other physical activity. Open discussion with the class regarding what the main differences between singing and speaking are. Promise at the end of this discussion that if you can speak, you can sing. Singers usually have to “speak” to someone not immediately close to them and therefore need to project. Invite students to repeat a phrase to varying distances from themselves. Have students repeat different phrases (I used quotes about courage) projecting to different places (me, the wall, the orchestra room down the hall, their house down the street).

Day 2: Introduce efficient tone comparing it to an equation. The voice works most efficiently when two things are working together—velocity of the air going through the vocal folds and no unnecessary tension in the throat. Help them grasp what is happening in the vocal folds by using two papers and blowing through them to get them to vibrate more or less efficiently depending on the speed of the air. Have students experiment blowing between two pieces of paper. Demonstrate a sound that is produced with low velocity of air flow, a sound that is projected with unnecessary tension, and a sound that is projected with no tension and appropriate air velocity. Discuss the differences in sound. Compare each of these to the papers again. Have students experiment with the three different types of production and label how they feel in their bodies. Remember to not use terminology such as “right” or “wrong,” instead use words such as “efficient” or “less efficient.” Another version of this exercise can be done by having students blow through their barely-parted lips. When they reach the right velocity, their lips will start vibrating into what we call a lip-buzz.

Day 3: Review the three different ways of producing sound and have students demonstrate all three, speaking in different ranges. Have students read aloud a phrase so that you can assess the extent to which they are able to project an efficient tone. Discuss how our natural tendency as we get higher is to do the opposite of what is most efficient—we tend to decrease air velocity and increase tension. We need to maintain consistent air velocity (which may feel like increasing it at first since we are used to slowing it down as we ascend) and keep an open throat. Use images such as sneeze breath or cold breath to help keep the necessary openness in the throat to produce a healthy tone.

Day 4: Begin singing in lower and middle ranges with efficient tone, reviewing the two factors involved.

Week 2: Speak/sing with efficient tone in different ranges of the voice. (Goals 1-3)

Day 1: Begin singing in higher ranges with efficient tone. Review the two factors involved. Have a few volunteers come up and sing or speak with efficient tone and receive feedback.

Day 2: Show diagrams of the vocal structure and discuss how unique the voice is as an instrument in that it is all contained inside of us and cannot be manipulated with our hands. Instruct that what we hear is not an accurate assessment of how our voice actually sounds so we often need to go by how it feels. Have students label verbally to a peer or to the teacher the feeling and sound of each of the following: singing with tension, singing with an open throat but without sufficient air flow, and when they have combined an open throat with sufficient air flow to achieve efficient tone. Have volunteers come up and model these different ways of singing and share with the class how each feels. Have the class experiment with them.

Day 3: Find the larynx and discuss how it should remain relaxed as you sing through the range of your voice. Have students first find their larynx by lightly placing their fingers on their Adam's apple and swallowing and feel the action it takes. Then have students monitor their larynxes by lightly placing their fingers to feel if it remains relaxed as we vocalize through different ranges of the voice. Help students notice that if we are trying to sing really high it can go up and if we are singing low or guttural it can go down. Explain that we want it to be in a mostly relaxed state. Have them try and keep it relaxed by taking breaths that open the throat and relax that part of the singing structure.

Day 4: Continue singing through different ranges of the voice, monitoring ability to maintain efficient tone. Ask for some more volunteers today to receive feedback.

Week 3: Relaxation, Alignment, and Diaphragmatic Breathing. (Goals 4-5)

Day 1: Review all the principles we learned last week. Explain that the objectives for this week are things we can do to make our voice production more efficient. Discuss relaxation and rebuilding the body with appropriate alignment. Invite students to take off their day like a backpack and enjoy the light feeling of a weightless body in a free, safe room. Have students roll shoulders or scrunch down into a little ball, something that brings their body out of alignment. Invite them then to build up their bodies to find noble, confident posture. First plant the feet shoulder width apart, maybe one foot is slightly in front of the other. Then wiggle the knees to make sure they're not locked. Place the hips on top of the legs in line with the ankles. Roll shoulders up and down so they are in line with the hips and then place your head on top of your spine. This posture should not be stiff or lazy. This posture will be lifted and open. Have students check the four points of alignment. The ankles, hips, shoulders, and ears are our four points of

alignment and should be in a straight line and the direction of energy should be lifted, rather than downwards or backwards.

Day 2: Review relaxation and alignment.

Day 3: Teach low diaphragmatic breathing by first having students feel their diaphragms. Find the second or third to last rib and put hand on it. Make the diaphragm work harder by plugging one nostril and breathe in slow and long through the nose. Another way to do this is by helping students imagine sucking a milkshake through a straw. Students should be able to feel their diaphragms pushing out against their hands. (This sometimes takes a few tries and sometimes one side is easier to find than the other, so invite them to switch if they are not having success.) Explain the action of the diaphragm and that the abdominal muscles need to relax in order for the diaphragm to fall and the breath to be low. We sometimes can see the stomach stick out in a low breath. Remind students that their bellies are not filling with air (that would create a much different result!) but that the abdominal muscles are relaxing and making room for the descent of the diaphragm. Practice taking relaxed low breaths.

Day 4: Review diaphragmatic breathing. Further instruct on the diaphragm using pictures or diagrams. We can compare it to a trampoline and that the most energy we find is when it is lowered. Have students monitor themselves throughout the rehearsal by putting a hand on their lower abdominal muscles. Invite them to watch a neighboring student and give him/her feedback on the success of the low breathing skill.

Week 4: Balanced Onsets. (Goal 5)

Day 1: Review low diaphragmatic breathing with students. Discuss how this affects their ability to sing with an efficient tone. Compare high breaths to low breaths and have them feel and label the difference.

Day 2: Instruct that when we start singing, we need the breath immediately engaged and freely flowing. We call this the onset. There are three types of onset—the hard glottal onset, the soft breathy onset, and the balanced, engaged onset. Model and have them try each type of onset and explain that the balanced onset is the most efficient. Practice this onset on different vocal exercises.

Day 3: Review onsets and practice them in different ranges of the voice. Have students model what is happening in the vocal mechanism with their hands. Press hands tightly together and make a hard glottal onset with the voice. Let hands rest limply apart and make a soft breathy onset. Bring hands an inch apart and make a balanced, engaged onset. I also like comparing these different preparations to sing to a batter in baseball. Imagine a hard onset is like a young batter gripping the bat so tightly that the pitch hits the bat rather than having him swing. The soft onset is like a batter with the bat limply in his hands almost resting on the ground. When the pitch comes, he is not ready. Now everyone get in ready position, bat swinging slightly in the air ready for the pitch.

Day 4: Practice onsets in different ranges of the voice. Go through and have some volunteers sing and get feedback. Point out that each of us has a natural tendency because of habits we've built over time or because of the music we like to listen to or what we've grown up with. This is not bad. But to get our most efficient tone, we want to have a balanced onset. I have found that if someone is struggling getting to this balanced sound, have them go to the opposite extreme and come back slowly to healthy vocal production. For example, I invite my breathy singers to sing an ugly pressed onset. They usually can do this amidst nervous giggles. Then I merely ask them to do the same sound with an open throat. Strangely, this “reverse psychology” has been very successful.

Week 5: Pure Latin vowels. (Goal 8)

Day 1: As we try to make our singing more efficient, along with how the voice is produced, we also need to focus on other places that affect the sound—our mouth shape. The five pure Latin vowels are A, E, I, O, and U. These need a released jaw that swings freely and corners of the mouth in. Have students put their fingers lightly in front of their ear on the jaw hinge and feel when the jaw is released enough that they feel a space form. I also will invite singers to hold the corners of their mouths in with their fingers for a while. Then I invite them to take their fingers but keep the same feel in their mouth.

Day 2: Review the pure Latin vowels. Breathe in with the shape of the vowel and feel the soft palate lift during inhalation and stay lifted during exhalation. There are several images that help with lifting the soft palate, such as surprise breath, sneeze breath, breath in the nose and mouth, hot mashed potatoes breath, cool air inhalation, etc. Invite singers to plug their noses to monitor what happens to the sound when the soft palate is lifted or not lifted.

Day 3: Do vowel matching activities where one student models the vowel and slowly each student in the room adds, matching the vowel.

Day 4: Practice vowel equalization exercises singing back and forth between two vowels, feeling what changes in the lips, tongue, and inside of mouth. Vowel equalization is a technique that can be used by singers to achieve a more balanced vocal resonance by balancing corresponding front and back vowels and high and low vowels. At this point in our singers' development, however, we mostly are focusing on them being aware of what is changing between these vowels.

Week 6: English Vowels and Diphthongs. (Goal 8)

Day 1: Obviously we don't only use Latin vowels; our language is full of many different vowel sounds. Explain that vowels still need to be formed the same way as in Latin, with jaw relaxed, lifted soft palate, and corners in. Do different vocalises on these different English vowels.

Day 2: Explain that some words, especially in English, have two vowel sounds in one vowel letter or syllable. These are called diphthongs. Give some examples and have students think of some. Some examples are: my, I, how, now, say, pay, joy, etc. Speak them in slow motion and let them feel how the mouth changes to make these sounds. In singing, we will hold out the target vowel. Show them what the target vowel would be and have them sing them holding out the target vowel. (A simple example is "my." We can write this as MAH+i. Have them speak this slowly and then sing it on a pitch.) John Halliday (1970) suggests that the target vowel should be held 90% of the duration of the held pitch, and the off-glide should be the last 10% of the duration.

Day 3: Give them a list of words with diphthongs. (Some examples are time, sublime, enjoy, deploy, take, awake, etc.) Have them circle the syllable on which the diphthong occurs and write the target vowel above. Practice singing these words holding out the target vowel.

Day 4: Invite students to read through the repertoire and find diphthongs and write the target vowel above. Practice these spots in the repertoire. Record some sections and listen as a class to see how successful we are with these vowels together.

Week 7: Legato, Sustained Singing. (Goal 9)

Day 1: Now that we have these lovely vowels to sing on, we really are ready to be most efficient with our voice. Explain that singing is a long line of vowel sounds with consonants

placed on top. Review the vocal folds again and discuss how they will be most efficient if the air is allowed to flow freely and not interrupt the vibrations. Demonstrate a phrase of music with just the vowel sounds and have them repeat. Then demonstrate the same phrase with the legato connection compared to the phrase with interruptive consonants. Have students experiment with these two ways of singing. Discuss which is easier, which feels best, which sounds best, etc.

Day 2: Using warm-ups and literature, have students lip buzz phrases to help them understand the continuous vocal fold vibrations sought for in legato singing. Then have them sing phrases only on the vowels, never breaking in between words. Have them add back in the consonants, using imagery such as place the consonants on top of the beam of sound, let the consonants be like a rock skipping on water, etc. Consonants should not be lazy, but energized as the air flow is not being interrupted.

Day 3: Bring straws in today. Boxes of coffee-stir straws are readily available in bulk of 500 from office supply stores. According to Titze (2000), the smaller diameter of these straws matches more closely the opening of the glottis in the open phase of the vocal cycle than does the diameter of a regular drinking straw. Have each student sing the phrase into the straw, sending a constant stream of air flow through the straw. Students can even put their hands in front and feel the air hitting their hand. Ask them to feel the difference between puffing air through on different words and a consistent steady stream of air. Take the straw out and sing connected, legato phrases.

Day 4: Review the processes from days two and three on other phrases of the literature. Invite volunteers up to get feedback.

Week 8: Suspension. (Goal 10)

Day 1: Now that we are getting our air flow constant and energized, some of us may feel that we are running out or that it's not always a steady, consistent flow. Suspension is yet another way we can use our voices more efficiently. Invite students to find their diaphragm again and take a low breath. This time do not exhale the air but resist the urge to tighten; merely suspend the air for a moment. If the singer suspends her breath for more than 5 seconds, a subconscious anxiety will grow demanding a new breath. The reason for this is that the singer is over-riding the autonomic nervous system's regular breathing cadence. To gain breath control, a singer must learn to disregard that inner voice. Invite students to notice how the ribcage stays expanded and there is no tension. Try to now maintain that feeling while singing—the ribcage will stay expanded and air will not be forced out, but merely allowed to flow out at the rate that it is needed. It is as if the diaphragm were measuring out the right amount for you.

Day 2: Review suspension and practice singing using this new technique.

Day 3: Explain what is happening physiologically during suspension. Really, we are just trying to keep the diaphragm lowered as long as possible without tension rather than bringing it up too quickly. Review the image of the trampoline and we get most energy at the bottom. Introduce breath circles as a way of helping students get the right feeling. While inhaling, bring the arms down and away from the body starting from around the hips and going out in a circle. At the top of the circle we begin vocalizing. As we vocalize the arms come down in a measured way for the phrase and away from us. This also aids in helping the larynx remain relaxed.

Day 4: Review breath circles and use them throughout the rehearsal.

Week 9: Voice Registration and the Primo Passaggio/First Transition. (Goals 11-12)

Day 1: In voice, we commonly hear the terms chest voice and head voice. People call them this because of where they feel the vibrations when they sing. Experiment with this and let them feel these vibrations. However, often times because of how we sing, these two voices feel very different and don't connect very well. Demonstrate a voice that does this. Point out that often times pop or rock singers do things with their voices that achieve a certain emotion or sound they desire but that might not be a healthy way to produce the sound. Often times we think of the voice as only having two rooms—one is chest voice and one is head voice. We don't like the work we have to do to change rooms, so we stay there until the last possible second. Identify this as “anchoring.” Demonstrate and have students experiment with trying to stay in chest voice too long on the way up a scale or trying to stay in head voice too long as they descend the scale. The change will seem clunky and abrupt. Some people call this the “break.” The voice does not only have two settings, but is like two rubber bands that can change length for every note of the scale. If we do not anchor to one room, but allow the voice to stay relaxed and able to move freely around, we eliminate breaks and sing in a more pleasing mixed voice. The first transition, around B for women, is called the passaggio or passage. By using mixed voice before we get to this transition we can eliminate breaks or abrupt changes in tone quality. Explain the physiology briefly, with the main point that when we set the vocal folds or tighten them and change pitch moving the larynx it is inefficient and harder to transition, but when we keep the larynx and vocal folds relaxed and allow the cricothyroid cartilages to do the pitch change, it is efficient and easier to transition. Demonstrate this and invite them to just notice when they feel like their voice transitions to a new place for that rehearsal. This is a very difficult skill for this age group, so for

these first few days really just focus on having them share if they felt something. Get them relying on feelings rather than sound.

Day 2: Often the head voice is the weaker voice because we do not sing in it every day. Begin exercises to strengthen head voice that help with forward placement (ee glides, meow-meow, nya-nya.)

Day 3: Continue exercises to strengthen the head voice. Invite students to monitor the larynx activity with their fingers, attempting to keep it relaxed rather than having it shoot up on high passages.

Day 4: Continue exercises to strengthen head voice. Find places in the literature that are a little higher and use the exercises to strengthen these sections.

Week 10: Portamento Pitch Change. (Goal 12)

Day 1: Begin portamento pitch change, beginning simply with two note slides (C-D-C, D-E-D, etc.). Remind students to not anchor the note by tensing the vocal folds and bringing the larynx up, but to instead let the larynx remain relaxed and the vocal folds free. Demonstrate and have them imitate both of these approaches, and then practicing on the second approach. Point out when they've passed through the primo passaggio or the place where we commonly "break" between chest voice and head voice and celebrate successes. There may be cracking and breaking in this exercise. Praise those people that were willing to take a risk and have this occur, inviting all to keep trying to make a smooth transition without crack or break. It is very important that students are singing with efficient tone by this point. Do not begin these exercises if the two parts of efficient tone (projected tone and open throat) are not working well consistently.

Day 2: Two note slides continue. Remind students that this helps their voices be efficient and natural. Bringing the head voice too low as young singers sometimes do makes the voice feel

fake, less strong, and breathier. Bringing the chest voice too high as young singers sometimes do makes the voice tense, a little strident, and forced. Have singers experiment with these two less-efficient ways of phonating.

Day 3: Begin three note slides (C-E-C, D-F-D, etc.) Make sure students are singing all the tones in between these two notes to achieve the objective of these vocalises. Invite students to do the breath circles or an outward motion with the hands low to help keep the larynx in a relaxed and resting position.

Day 4: Continue three note slides today and review past techniques.

Week 11: Clean Transition through Primo Passaggio. (Goal 12)

Day 1: Begin four note slides. Show how you can apply this technique to difficult passages by first sliding through the interval required on any vowel, then sliding on the vowels of the words, and finally adding consonants.

Day 2: Continue four note slides. Apply slides to passages in the literature.

Day 3: Begin five note slides.

Day 4: Continue five note slides.

Week 12: Clean transition through the primo passaggio. (Goal 12)

Day 1: Review all the techniques and skills worked on up to this point, ending with five note slides.

Day 2: Have students do octave slides in two steps—five note slide followed by four note slide, letting them stop and restart and take their time through the slurs. Then attempt octave slides.

Day 3: Find tricky leaps in the literature and work them doing slides first. Remind them that the sound will be more efficient if the vocal folds can continue vibrating through the pitch change.

Day 4: Review portamento pitch change and invite students to come up individually or in pairs to receive feedback.

Week 13: Embodiment of the Sound and Facial Expression. (Goal 13)

The ideas and techniques in these last sections would obviously have been discussed and practiced before now, but this is the week specifically dedicated to helping each individual student master them, as they will be assessed this week.

Day 1: Our job as performers is to share the message of the piece we are singing. We should do everything we can do to be in character and to feel something ourselves so our audience can feel something. Invite them to make a character sketch of one of their favorite pieces, including the past, present, and future of the character singing, the setting, who they are singing to, and anything else that would help us get into character.

Day 2: Write the emotion above each phrase that you feel like needs to be expressed. Then watch a mirror and see if you really are expressing what you want.

Day 3: Practice embodying the sound by moving to different types of music along with expressing with the face.

Day 4: Have little ensembles sing and get feedback on their expression.

Week 14: Performance Preparation

This week is devoted to review of all the skills learned above in preparation for their post-treatment recording. Post-treatment recordings should be conducted at the end of week 14.

This treatment is progressive, meaning many of the skills build upon the previous skill. I wanted to make sure I did not move on to new skills until the majority of my students showed that they had achieved a mastery of the current skill being developed. For this reason, my treatment did not occur in fourteen weeks. It took sixteen weeks. I also chose not to teach Week 8 Suspension. I felt I had not adequately solidified a way to monitor in all students that they were doing it healthily. The final weeks of portamento pitch change were extremely truncated and only some ideas were used in warm-ups, but not explained in great detail. However, I would not change the order of these steps for a private student or small group. In fact, I hope to use this exact sequence of skills next year, just building my abilities as an instructor to monitor and assess and extending the timeline to be over the whole year.

Evaluation

In order to determine the extent to which students achieved the thirteen goals above, I employed the following steps: Each participant sang The Star-Spangled Banner at the beginning of treatment and again at the end of treatment. Each of the pre- and post-recordings were given an individual number and randomized completely and then given to a panel of judges for evaluation. Therefore, judges would not grade differently for pre- and post-recordings as they were unaware which of the recordings they were watching. Judges were asked to rate seven criteria using a seven point Likert scale (1 = Strongly disagree, 2 = Disagree, 3 = Partially disagree, 4 = Neutral, 5 = Partially agree, 6 = Agree, 7 = Strongly agree.) The criteria were:

1. Alignment: Student exhibits tall, lifted body alignment, with the ankle, hip, shoulder, and ear in alignment and chest open.
2. Breathing: Student uses low, expansive diaphragmatic breathing and does not take high, clavicular breaths.

3. Tone Quality- Breathiness: Student has a clear tone quality with no audible evidence of air escaping (fuzziness or breathiness in the tone.)
4. Tone Quality- Tension: Student has an open, healthy tone quality with no audible evidence of pressing of the vocal valve (drive or tension in the tone.)
5. Space: Student sings with a released jaw and there is audible evidence of a lifted soft palate.
6. Legato Phrasing: Student sings connected, legato phrases with breath support.
7. Transition through Registers: Student transitions easily through her different registers (chest voice/heavy mechanism vs. head voice/light mechanism.)

The results of these evaluations are the main source of data to test the effectiveness of the vocal instruction used in the treatment. Other data used in this study include results of surveys completed by the students themselves.

Data and Discussion

Pre- and post-treatment recordings.

After receiving each judge's scores, the average score for each question was found to check the effectiveness of different aspects of the treatment. The total score of all questions for each student was also found to test the overall improvement of each student after treatment. The Null hypothesis (H_0) states that there is no significant difference between the pre-treatment recordings and post-treatment recordings. With an average difference between the total scores of 7.25 (positive), I reject the H_0 that there is no difference between the pre-recordings and the post-recordings based on an alpha level of .05. Our 95% confidence interval is 6.36 to 8.14 for this experiment and these 67 students. The average of the 4 judges' scores on a given question was used as the student's score for that question. For example if a student received individual scores

of 3, 4, 2, and 3 from the judges for question 1, her score would be 3. Table 1 includes the data averaging all students' scores together for each question.

Table 1

Average change for each question across all students

Judges Report	Pre-Instruction Average	Post-Instruction Average	Average improvement	Standard Deviation	P-value
Question 1	4.26	5.29	1.031*	0.872	<0.001
Question 2	2.79	4.5	1.709*	1.223	<0.001
Question 3	3.2	3.91	0.715*	0.988	<0.001
Question 4	3.51	4.01	0.499*	0.686	<0.001
Question 5	2.92	4.3	1.377*	0.766	<0.001
Question 6	2.97	3.97	1.000*	0.76	<0.001
Question 7	3.24	4.16	0.919*	0.94	<0.001

Note. * Indicates significance.

The lowest total score given for a pre-video was 13, the lowest for a post-video 14. The highest score given for a pre-video was 42, and the highest post-video scored a 49. The biggest drop in score was -15, and the biggest increase was 29. And it should be pointed out that *no* student received a lower average total score from the blind judging after the instructional period. Each judge had an average of less than 1 point of difference between their evaluation and the average of the other judges.

The smallest amount of 'average' improvement was found for question 4 regarding open healthy tone. The initial evaluation averaged 3.5, and ended at 4. The greatest improvement was seen in results for question 2 for low breathing. This value moved from a 2.8 to a 4.5 average,

meaning that the judges on average initially disagreed that students were exhibiting the skill, and afterwards agreed somewhat.

A non-clinical experiment designed around a working classroom environment is subject to certain limitations. The experiment itself was definitely not rigorous in terms of controls and isolation of variables. For the purposes of this project, I elected not to have a control group. Having begun a preliminary form of this treatment with some private voice students over the summer, I felt certain that it was effective and that, in my role as teacher, I needed to offer it to all of my students. Obviously, a control group would have added weight to the data and shown if the results were actually caused by the treatment or if it was improvement occurring merely as a result of being in a choir class and singing every day. Secondly, the treatment was delayed and interrupted often for various reasons, such as performance constraints and the extra variable of a student teacher. Third, this experiment was performed towards the beginning of the year. One would expect most improvement at the beginning of the year, as some of what was taught the previous year is remembered and months of no practice are replaced with daily practice. An exception to this might be for students with a private vocal coach or other choral experiences during the summer months.

Aware of these compromises, I did take certain measures to make the testing of the pedagogy as rigorous as possible within reasonable parameters given my most important role as teacher. First, in sample selection, students who had already been in choir one year with me were chosen. When a student first encounters a particular teacher, we would expect the biggest leap of improvement to occur immediately as the teacher focuses on the easiest and most obvious problems to correct. We might consider this the 'low hanging fruit' effect, with a student gaining the most obvious improvement in the shortest period of time. In the case of this experiment,

almost all these girls had me as their instructor the previous year, thus controlling for this potentially confounding variable in some measure.

Second, since the videos were recorded and evaluated later, the judges did not influence the performance with facial responses to make the student nervous etc. The student was performing for a camera, so in some ways this could be considered an evaluation of 'performance' with its accompanying anxieties. There was not an audience listening (only the camera operator) so this isn't an evaluation of stage fright or the performance anxiety associated with performing before a student's peers or strangers.

Third, videos were completely randomized. All pre- and post- recordings were randomly given a number between 1 and 134. This eliminates any tendencies by the judges to grade post-recordings differently than pre-recordings because of a bias. In addition, any student that did not complete treatment or who had so many absences as to not adequately receive treatment was removed from the sample group.

Fourth, no student received individual help from the teacher on the song used for the recording, the Star - Spangled Banner. Individual help of course was offered on other pieces and techniques as that is part of the pedagogy, but I wanted to test what was being applied from the instruction to their singing. I wanted to test what habits were being developed from the daily activities and instruction occurring in the classroom. The results from the judges then expose how a student performs on a song prepared only by the student, with no direct assistance from the instructor.

Student surveys.

Surveys were given to the same 67 students who were recorded and evaluated after the instructional period. For the first question on the survey, students were asked to write all of the

teaching techniques used during the semester that they remembered. Different techniques were taught for varying durations and frequencies; it is noticeable which techniques were focused on more than once, based on their prominence in the number of responses. Table 2 below shows the technique discussed in class, followed by the number of students who remembered the technique on their survey.

Table 2

Number of students identifying each technique.

Low Breath	42	British Accent	15	Tension	6
Vowels	39	Fat Breathing	14	Skier dude	6
Airspeed/flow	34	Kah Breath	14	Embody the sound	5
Use Support/ Tight Abs	30	Lift soft palette	14	Clear Tone	5
Posture	24	Finger in jaw	13	Larynx down	5
Pinwheel	24	Alignment	11	Laser	5
Eyebrows	23	Open throat	11	String	5
Open Mouth	22	Spin air	9	Diction	4
Cheeks	19	Project	8	Confidence	4
Facial expression	15	Emotion	8	Show teeth	3
Corners of mouth 'in'	15	Hook	7		

Students sometimes used different words to identify the ideas discussed during class. I used the responses to note which techniques each student responded to. For example, some students responded with 'spin the air' as their response, which was more of an explanation for what the air was doing while singing; while others used responses such as 'pinwheel,' which was more of a kinesthetic activity we did to help spin the air while singing. So, as I taught the techniques, different words became the mental flags for different students, depending on their learning style or what they had experience with. Students could respond with as many techniques as they remembered. Responses that were only mentioned once or twice included peach, thinking

low, long jaw, hands by sides, surfer girl, make a story, flat feet, surprise breath, mature sound, long jaw, alive, sight reading, breathiness, prepare, standout, efficient tone, intonation.

It is interesting to note that several of the students who responded with a physical object lesson such as skier dude, responded with several concrete object or easily visualized lessons, while others mentioned mostly kinesthetic activities done during class to help solidify concepts. Others mentioned the principle itself or the more factual or theoretical explanation, indicating students tend to learn best in one way or another. This idea is not new and has been much researched; however, many teachers tend to teach using the same explanations or images that they were taught. It is important to remember that our learners are all different and have different learning styles. Effective teachers will plan into their rehearsal and lessons activities that touch all types of learner in their class.

Many students, if pressed (or examined), might have recalled even more techniques than those they wrote. There seemed to be a perceived or intrinsic 'adequate' number of responses, with certain responses which students perceived the instructor to be expecting. That number seemed to be four or five. This might have been remedied by leaving a large blank space after the question, or numbered lines to create an expectation.

For the next question, students were asked to select from among the techniques they remembered which technique they personally felt had been the most helpful in improving their voices. Most students focused on one single technique. The following table reports this data.

Table 3

Technique a student reported most improved their singing

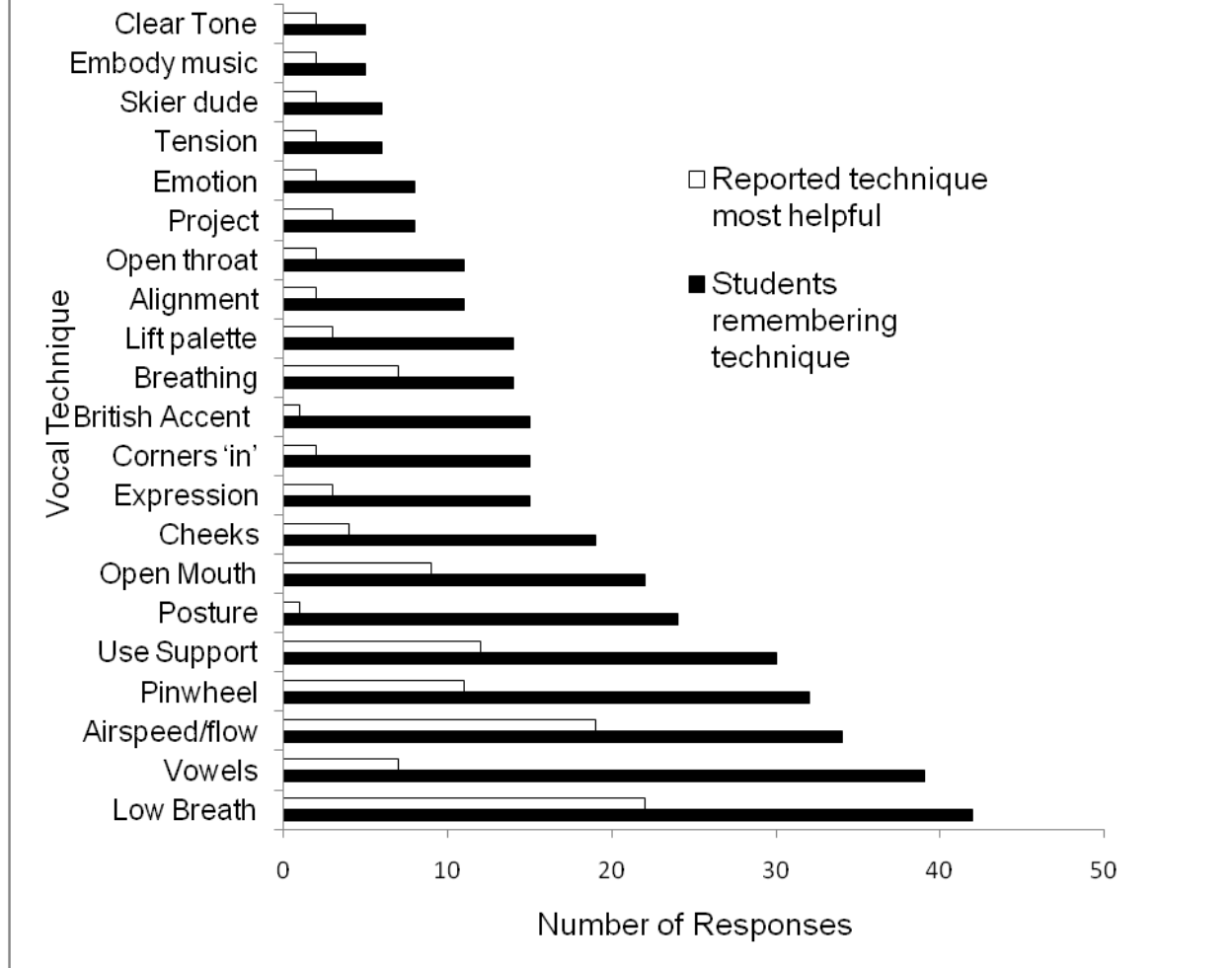
Low breath	22	Project sound	3	Being more comfortable	1
Air flow	19	All	3	Kite	1
Ab engagement	12	Sing open	2	Diction	1
Spin/pinwheel	11	Clearer	2	Relax larynx	1
Tall/narrow vowels	7	Corners in	2	Posture	1
Fat breath	7	Pressing	2	Nasal singing	1
Open/jaw	7	No tension	2	Fish hook	1
Ka breath	4	Ski dude	2	Sparkle eyes	1
Lift soft palette	3	Embody sound	2	Open throat	1
Facial expression	3	Lip buzzes	1		

Comparing Table 3 and Table 4, it is very interesting to note a correlation between the answers most commonly cited for each answer. It seems, based on the responses, that the students believed that the techniques that most improved their vocal production were also the techniques most focused on or most memorable. They may also have felt that their response was expected, but since there was no grade on the survey they could express their own thoughts.

Figure 1 below shows this correlation.

Figure 1.

From student surveys, comparison of techniques students remembered, and the technique which created the most improvement.



For the third question, students were asked to evaluate how their tone had changed. The scores from the pre- and post-recording show how the voice has changed based on specific criteria. But I was interested in how students perceived their voice as changing. Students' perception of their progress is almost more important than the real progress as observed by the teacher. Table 4 below shows these responses.

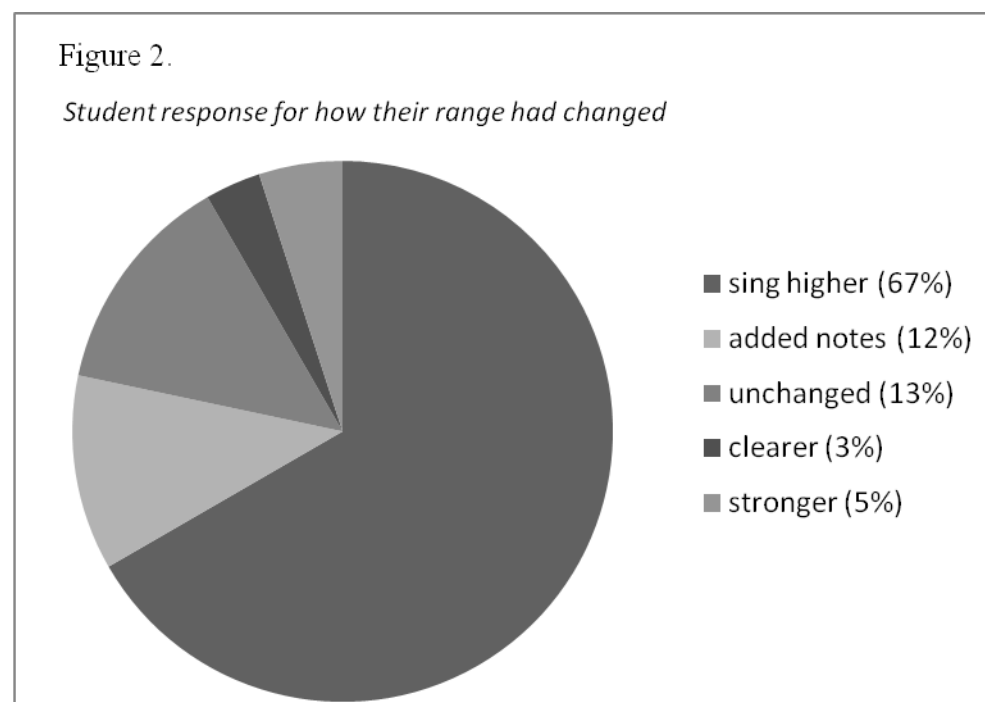
Table 4

Students report how their vocal tone had changed

Clearer	24	Not fuzzy	9	Clear and open	3
Stronger	14	Less breathy	6	Confidence	2
Mature	9	Bright	4	Less tense	2

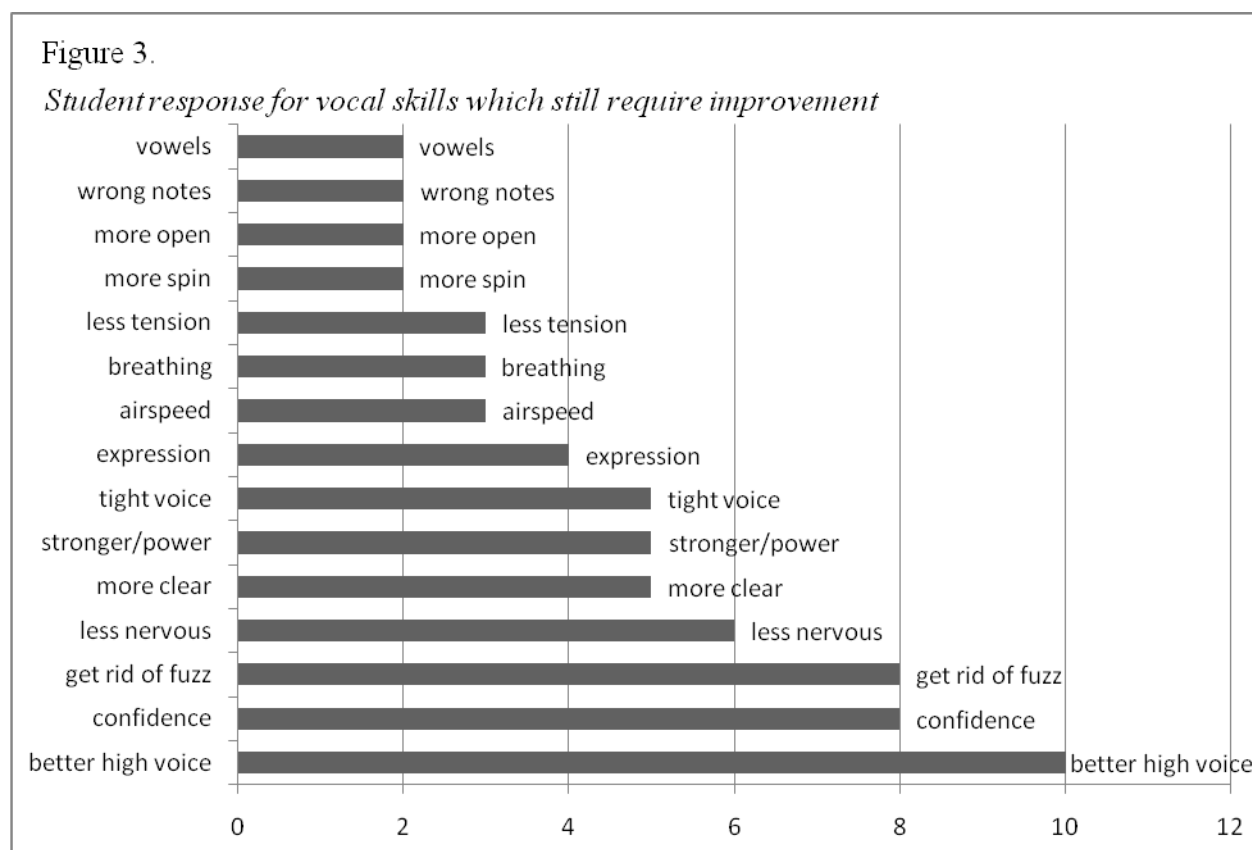
Other single responses were don't know, control, focused, blending better, longer notes, softer, focused, good, better, more efficient, very much, prettier, feeling.

For question 4, students were asked how their ranges may have changed. Almost all of the students responded that they could sing higher. Figure 2 below reflects their responses.



The next question with quantifiable results asked students to evaluate what they still felt they need improvement on. I wanted to see what students felt was lacking in the treatment or what still needed further time and practice so I could make appropriate changes to my

instruction. Figure 3 reports their responses.



Other single responses included breathy, more efficient, feeling a story, everything, abs, diction, low breathing, lift soft palette, better solo, more mature, singing out, and voice crack. Doubtless, if students had selected from among pre-arranged answers they would have sorted themselves more consistently, however this would have destroyed the objectivity and authenticity of the students' responses as they remembered which techniques had been used.

A final question asked students whether they felt they had the tools necessary to make the improvements they wanted. Most answered that they had the tools. A few said they had the tools but needed to apply, focus, remember etc. Several responded that they were nervous. Other answers were work harder, too much to think about at once, and need practice. These survey

results, while more difficult to put in a chart, show me as an instructor, valuable information about my teaching and follow-through.

From the surveys it appears that students remembered the techniques most focused on. There was also a strong relationship between what they remembered and which techniques they felt had most improved their vocal performance. This makes intuitive sense, as they focused on the activities in class, the things they remembered would be what they worked on and saw improvement in for their voice. Having students report what they still felt like they had not mastered was useful. Taking a measurement of this aspect of the students' learning process from time to time will help me customize teaching to what the students feel is still lacking.

In conclusion, here is a brief review of what this experiment reveals to me as an educator. According to the panel of judges, it is apparent that student performance improved measurably in specific criteria. It is clear that the students were remembering some of what was taught and attempting to internalize and apply the information and activities. Some students seemed to benefit more from the visual or object oriented lessons, while others remembered most of the learning techniques. I can see that the breathing, support, air flow exercises, etc. had a large effect on the students' learning. Other lessons which were emphasized less seemed to get jumbled in student reflections. I was, nevertheless, impressed that the blind survey of judges was clear in indicating that the students had improved in the areas of interest. I think students marked improvement shows the validity of the activities.

Section V: Reflection

Reflection on the Project

Through the process of completing this project, I have learned a great deal. Studying the literature and synthesizing the information found were both things I wasn't expecting to love as much as I did. I also enjoyed learning from some very intelligent vocal instructors along the path. Interviewing and questioning great teachers were probably the most valuable parts of this project, for me personally. I got very excited about the possibilities for my choirs as I tried some of the vocal techniques on myself and other private students. The most frustrating part of this project was the implementation. A music classroom is not a sterile, science lab environment. The pressures of scheduling, performances, and other school priorities along with the addition of student teachers, made it very difficult to keep strictly to the treatment plan. It was frustrating to be aware of the imperfections in the study, and sometimes be the cause of the imperfections, and want to continue forward with the process. However, I learned much more than I expected to learn and gained valuable experience that will help me in my future endeavors into research and teaching.

Of the things I learned, a few key ideas stand out. First, I knew from the beginning that I needed a control group but couldn't bring myself to do it. As I look at these results now, I realize why a control group is so important. With all these great numbers, none of them really "prove" anything. One cannot profess to have a method that makes a real difference unless she can *show* that difference. The significance of my results is weakened because of the lack of comparison to a control. However, I made a moral decision to involve all of my students in the pedagogy, as I felt they would get the most improvement and success through this process. I believe I made the correct decision for my students.

Second, I was trying to test too much. For my personal use, I wanted to create a vocal pedagogy that brought my students greater success in their individual voice. However, it is quite difficult to know which parts of the pedagogy really resulted in growth when the treatment contained so many different ideas and techniques over such a long period of time. It would be best to break down the pieces of this pedagogy and test them individually over short periods of time against a control group to really determine the effectiveness of each part.

Not all things I learned were about my mistakes. I learned that my actions and efforts affect positive change- change in myself, in my classroom, and in my students. This year I made a specific point to tell my students that we were going to have great choirs of course, but the main goal was the personal progress and success of each individual singer in the class. This influenced every pedagogical decision I made, each rehearsal and activity. Never before have I seen the results in the voices but also in the attitudes of my singers. For our spring concert solo auditions, in one of my classes there were only six girls out of forty that did not try out for a solo. I have never had that happen before and I attribute this behavior to an increased sense of power and confidence brought about by personal striving for excellence. They had the tools and were shown how to use them and began to take personal responsibility for their individual sound and they began to be pleased with the results. At least in that aspect, I am a successful teacher.

Reflection on Current and Future Teaching Practice

It has been very rewarding to examine my practice as it relates to individual student growth in my classroom. I have received evaluations of my choirs at festivals and know that I am judged by others to be a proficient choral instructor. But I really wanted to know if I was affecting individual change among my students. After reading the student surveys and watching the pre- and post-recordings, I am happy to say I saw the growth I had hoped for. It has been a

goal of mine to take a step back from my processes and examine with a critical eye the why and how of what I do and see if it can be made better. I see places that need work, but I also see a very successful vocal pedagogy that I can now adjust and refine and use in future years. As choral instructors work to improve the sound of the whole ensemble, the time must be spent in developing individual vocal skills. I feel like I took a step forward in being prepared to do that with my students.

There are many areas that I still would like to research and as I learn more, I know that my teaching will change. I hope that my teaching never stops changing, as I believe that is a sign that one has stopped learning. The topics that interest me and that I feel have not yet been fully resolved are the mutational chink, individual instruction and assessment in choral ensembles, the effect of imagery vs. explanation on adolescent voice students, and other related topics. It is very recent that technology and our understanding of the voice are at a place to really uncover many of the mysteries that have existed for hundreds of years. As voice teachers and scientists begin to collaborate and the field of vocology expands, I believe we will see an exponential growth in the research on the voice, especially the adolescent voice.

Recommendations for Music Education

Education reform continues to make teachers more accountable for what and how they are teaching, as well as how well their students are learning. Most of this accountability has been given to the subjects of math, science, and English in the form of standardized tests and increased requirements and professional development for teachers. Music educators have remained relatively untouched until now in our individual “caves.” I believe it will not be long before this bubble of seclusion is broken. The demand for assessments and data will be required of us, especially if we hold to the argument that we deserve to be part of a core curriculum.

Music teachers must be able to state what their learning outcomes and objectives are for their choirs and individual students, especially when we give individual grades. Along with these objectives, music educators will need a well-sequenced, research-based plan that will bring students success. As teachers, we must commit to be purposeful about skill acquisition in our rehearsals. More research is needed, but even more importantly, more collaboration is needed. Many teachers are already doing great things with their students and are already assessing and collecting data—even if they don't see it that way. This active research needs to be documented and shared so our profession can grow to keep up with the changing times. More collaboration is needed between the scientists of the voice and the artists and teachers of the voice. Choir teachers never seem to have extra time left over at the end of their busy day, however important research is available and more is coming. Each teacher is responsible for remaining informed and adjusting teaching objectives and techniques with the information others are sharing. All students deserve to have rich experiences in music that will add to the quality of their life. The responsibility of providing these experiences lies with each music teacher. It is the duty of every teacher to develop research-based, well-sequenced practices that transform the lives of the students within her care.

Appendix A: References

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Appendix B: Full Table of Student Scores

This table shows the individual judges' scores for the pre- and post-recordings for each student.

Stud	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Tota	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Tota
A	5	3	5	3	2	2	2	22	5	4	5	6	6	3	6	35
	4	2	3	3	4	2	2	20	6	6	2	2	4	5	4	29
	3	4	4	4	2	2	2	21	4	2	3	3	3	2	3	20
	3	3	3	4	3	2	2	20	6	7	6	6	6	6	5	42
Avg	3.75	3	3.75	3.5	2.75	2	2	20.7	5.2	4.7	4	4.25	4.75	4	4.5	31.5
B	5	2	2	4	4	3	4	24	5	2	6	6	5	4	6	34
	4	2	1	3	3	3	3	19	3	5	6	5	5	6	5	35
	4	2	2	3	2	2	3	18	4	2	3	6	2	2	4	17
	6	5	3	5	3	5	3	30	6	7	6	6	6	6	6	43
Avg	4.75	2.7	2	3.75	3	3.25	3.25	22.7	4.5	4	5.2	5.66	4.5	4.5	5.2	33.6
C	6	3	4	1	4	4	3	25	5	2	6	3	5	5	5	31
	6	3	3	3	3	6	2	26	6	6	3	3	6	6	3	33
	5	4	4	5	4	4	6	32	5	5	4	5	6	4	4	33
	5	3	5	3	5	5	3	29	6	5	6	7	7	6	6	43
Avg	5.5	3.2	4	3	4	4.75	3.5	28	5.5	4.5	4.7	4.5	6	5.2	4.5	35
D	4	3	4	3	4	3	4	25	3	5	6	5	6	6	6	37
	4	2	2	4	3	4	2	21	5	5	7	2	4	6	7	36
	4	3	3	3	2	2	4	21	3	5	5	3	5	5	5	31
	5	3	5	5	5	5	5	33	6	6	7	7	7	6	6	45
Avg	4.25	2.7	3.5	3.75	3.5	3.5	3.75	25	4.2	5.2	6.2	4.25	5.5	5.7	6	37.2
E	6	2	3	3	5	5	5	29	6	2	2	4	6	4	2	26
	6	3	3	3	4	5	2	26	6	5	2	3	6	6	2	30
	4	2	3	3	5	4	2	23	4	2	3	4	5	2	3	23
	6	3	3	4	3	2	3	24	6	5	4	4	6	5	3	29
Avg	5.5	2.5	3	3.25	4.25	4	3	25.5	5.5	3.5	2.7	3.66	5.75	4.2	2.5	27.9
F	3	2	2	4	2	2	2	17	2	2	1	3	2	2	2	14
	5	3	1	4	2	1	2	18	5	2	1	3	3	4	2	20
	3	2	2	4	1	1	1	14	4	3	1	2	2	2	2	16
	3	2	1	4	2	2	1	15	5	6	2	6	2	5	2	
Avg	3.5	2.2	1.5	4	1.75	1.5	1.5	16	4	3.2	1.2	3.5	2.33	3.2	2	19.5
G	5	4	5	3	5	5	3	30	6	2	6	3	5	5	4	31
	3	2	3	6	5	3	4	26	6	5	6	4	5	3	5	34
	5	5	5	3	2	3	4	27	4	2	5	5	5	5	4	30
	3	2	5	3	3	3	3	22	6	5	6	6	6	6	6	41
Avg	4	3.2	4.5	3.75	3.75	3.5	3.5	26.2	5.5	3.5	5.7	4.5	5.25	4.7	4.7	34
H	6	2	3	3	4	3	2	23	4	2	1	4	2	2	2	17
	5	3	2	2	2	2	1	17	6	6	1	3	4	3	1	24
	3	2	2	3	3	2	3	18	3	2	2	3	2	2	3	17
	5	5	3	4	3	3	3	26	6	5	3	6	6	5	4	35
Avg	4.75	3	2.5	3	3	2.5	2.25	21	4.7	3.7	1.7	4	3.5	3	2.5	23.2
I	5	3	2	2	3	2	3	20	6	2	2	3	2	2	4	21
	3	2	1	4	2	2	3	17	6	2	2	4	4	3	2	23
	3	2	2	4	2	2	4	19	5	2	2	4	2	2	3	20
	3	3	2	3	3	3	3	20	6	6	3	4	3	4	3	29

Avg	3.5	2.5	1.75	3.25	2.5	2.25	3.25	19	5.7	3	2.2	3.75	2.75	2.7	3	23.2
J	2	3	2	2	2	2	3	16	4	4	5	5	6	3	6	33
	6	3	3	4	4	2	4	26	7	2	2	4	4	4	5	28
	3	5	2	4	2	2	4	22	4	3	2	5	5	2	5	26
	6	3	3	3	3	2	3	20	7	7	7	7	7	7	7	49
Avg	4.25	3.5	2.5	3.33	2.75	2	3.5	21.8	5.5	4	4	5.25	5.5	4	5.7	34
K	2	2	4	2	2	2	3	17	5	2	2	3	4	4	5	25
	2	2	4	2	2	4	1	17	6	5	2	2	2	5	5	27
	3	2	3	3	2	2	2	17	4	3	2	4	3	2	4	22
	5	3	3	5	3	3	3	25	7	5	6	6	6	6	2	38
Avg	3	2.2	3.5	3	2.25	2.75	2.25	19	5.5	3.7	3	3.75	3.75	4.2	4	28
L	5	2	5	5	3	4	5	29	6	3	6	5	5	4	6	35
	3	2	2	2	4	3	3	19	7	2	6	1	5	5	2	28
	5	2	3	4	2	2	4	22	6	3	6	4	5	5	4	33
	6	5	3	6	3	4	3	30	7	7	7	6	4	5	6	42
Avg	4.75	2.7	3.25	4.25	3	3.25	3.75	25	6.5	3.7	6.2	4	4.75	4.7	4.5	34.5
M	5	2	2	2	3	4	4	22	7	6	6	4	4	3	5	35
	5	2	5	2	3	2	3	22	5	7	6	3	3	6	2	32
	3	2	3	3	2	2	2	17	6	6	6	3	5	5	3	34
	5	3	3	3	3	3	2	22	7	7	6	3	4	3	3	33
Avg	4.5	2.2	3.25	2.5	2.75	2.75	2.75	20.7	6.2	6.5	6	3.25	4	4.2	3.2	33.5
N	6	4	5	4	3	4	3	29	5	3	5	3	6	5	5	32
	6	4	3	3	5	5	4	30	6	6	2	5	4	5	6	34
	5	5	4	5	3	4	4	30	5	5	4	4	4	3	3	28
	5	5	4	6	6	5	3	34	7	6	6	6	5	4	3	37
Avg	5.5	4.5	4	4.5	4.25	4.5	3.5	30.7	5.7	5	4.2	4.5	4.75	4.2	4.2	32.7
O	5	2	2	2	3	3	2	19	6	2	4	4	3	4	3	26
	5	2	2	3	2	3	2	19	6	2	2	1	3	3	6	23
	4	4	3	4	2	2	4	23	4	3	4	3	3	2	3	22
	6	5	5	6	3	5	3	33	6	5	3	5	4	5	5	33
Avg	5	3.2	3	3.75	2.5	3.25	2.75	23.5	5.5	3	3.2	3.25	3.25	3.5	4.2	26
P	3	2	3	1	2	2	2	15	5	4	4	4	6	3	2	28
	4	2	2	2	2	1	2	15	4	2	2	2	4	3	2	19
	4	2	2	4	3	2	4	21	4	2	2	4	3	2	2	19
	1	2	3	4	2	2	2	16	6	6	5	5	3	4	5	34
Avg	3	2	2.5	2.75	2.25	1.75	2.5	16.7	4.7	3.5	3.2	3.75	4	3	2.7	25
Q	4	2	4	3	5	4	3	25	7	5	2	6	2	4	2	28
	5	2	1	4	4	3	4	23	6	6	4	3	6	5	6	36
	4	2	3	4	2	2	3	20	5	5	3	4	5	3	4	29
	5	3	2	5	3	5	5	28	6	6	5	5	3	5	5	35
Avg	4.5	2.2	2.5	4	3.5	3.5	3.75	24	6	5.5	3.5	4.5	4	4.2	4.2	32
R	4	4	2	2	3	2	4	21	4	3	2	4	4	2	4	23
	5	2	1	4	2	2	4	20	3	6	3	3	6	3	7	31
	3	2	2	3	2	2	3	17	4	2	3	3	4	2	4	22
	3	2	2	4	2	3	2	18	6	5	5	6	5	5	5	37
Avg	3.75	2.5	1.75	3.25	2.25	2.25	3.25	19	4.2	4	3.2	4	4.75	3	5	28.2
S	5	2	3	2	2	2	3	19	6	5	3	3	5	3	5	30
	6	6	2	2	3	4	1	24	7	7	4	4	5	4	4	35
	4	2	3	4	1	2	2	18	6	5	3	3	2	2	3	24

	5	3	5	5	3	5	3	29	6	6	5	4	3	5	3	32
Avg	5	3.2	3.25	3.25	2.25	3.25	2.25	22.5	6.2	5.7	3.7	3.5	3.75	3.5	3.7	30.2
T	3	4	6	2	2	2	2	21	6	2	4	4	2	2	2	22
	3	3	6	6	2	2	1	23	7	7	3	3	4	4	2	30
	3	2	4	3	1	1	3	17	5	5	3	3	2	2	2	22
	3	2	5	3	2	2	2	19	6	6	6	6	3	5	3	35
Avg	3	2.7	5.25	3.5	1.75	1.75	2	20	6	5	4	4	2.75	3.2	2.2	27.2
U	5	4	5	4	4	4	5	31	6	5	5	5	6	4	6	37
	4	2	1	3	3	2	4	19	6	7	2	4	6	6	6	37
	5	3	2	5	2	2	4	23	5	5	3	4	5	3	4	29
	5	5	5	4	3	5	5	32	6	6	5	6	5	5	5	38
Avg	4.75	3.5	3.25	4	3	3.25	4.5	26.2	5.7	5.7	3.7	4.75	5.5	4.5	5.2	35.2
V	5	2	4	2	3	4	4	24	6	6	6	4	6	2	6	36
	4	1	2	2	3	2	4	18	6	6	2	3	5	4	6	32
	5	2	3	3	3	2	4	22	5	5	3	5	5	3	5	31
	6	5	5	6	5	5	5	37	6	5	6	6	5	5	5	38
Avg	5	2.5	3.5	3.25	3.5	3.25	4.25	25.2	5.7	5.5	4.2	4.5	5.25	3.5	5.5	34.2
W	3	2	3	2	1	2	2	15	3	4	2	4	2	2	4	21
	4	1	2	2	2	2	2	15	6	5	3	4	3	5	4	30
	3	2	3	4	1	2	4	19	3	2	3	4	3	2	3	20
	2	2	3	4	2	2	4	19	5	3	3	4	5	5	3	28
Avg	3	1.7	2.75	3	1.5	2	3	17	4.2	3.5	2.7	4	3.25	3.5	3.5	24.7
X	4	2	4	3	3	4	2	22	6	7	6	3	3	5	4	34
	3	2	3	3	4	4	2	21	6	7	5	3	5	5	6	37
	3	2	3	3	1	2	3	17	5	6	6	3	4	4	3	31
	3	2	3	4	2	2	3	19	6	7	6	6	6	6	6	43
Avg	3.25	2	3.25	3.25	2.5	3	2.5	19.7	5.7	6.7	5.7	3.75	4.5	5	4.7	36.2
Y	5	3	6	4	5	5	6	34	5	3	2	3	4	3	3	23
	3	2	3	3	4	2	2	19	6	3	3	4	5	5	5	31
	5	3	3	4	2	2	4	23	5	5	3	5	4	3	4	29
	1	2	2	3	2	2	3	15	6	6	5	6	5	5	6	39
Avg	3.5	2.5	3.5	3.5	3.25	2.75	3.75	22.7	5.5	4.2	3.2	4.5	4.5	4	4.5	30.5
Z	4	4	4	6	5	5	5	33	2	2	2	3	5	4	5	23
	2	4	3	3	4	4	5	25	4	2	3	5	3	3	3	23
	4	3	2	4	2	2	4	21	4	2	3	4	4	2	3	22
	3	2	3	4	2	2	3	19	6	5	5	6	5	5	5	37
Avg	3.25	3.2	3	4.25	3.25	3.25	4.25	24.5	4	2.7	3.2	4.5	4.25	3.5	4	26.2
AA	6	3	6	5	4	5	5	34	6	5	5	4	6	5	6	37
	4	1	3	4	3	3	4	22	5	6	6	3	6	6	6	38
	5	3	4	4	2	3	4	25	4	5	4	5	5	4	5	32
	3	3	5	5	3	3	5	27	6	6	6	6	6	6	6	42
Avg	4.5	2.5	4.5	4.5	3	3.5	4.5	27	5.2	5.5	5.2	4.5	5.75	5.2	5.7	37.2
AB	5	3	3	3	5	4	4	27	5	6	6	3	6	6	6	38
	4	1	2	4	2	3	3	19	5	7	6	3	6	5	6	38
	4	5	3	3	2	2	2	21	5	5	3	3	5	3	4	28
	6	5	3	6	3	5	3	31	6	7	6	6	5	6	6	42
Avg	4.75	3.5	2.75	4	3	3.5	3	24.5	5.2	6.2	5.2	3.75	5.5	5	5.5	36.5
AC	4	3	3	2	2	2	3	19	4	4	3	3	2	1	2	19
	4	2	3	4	3	3	5	24	2	3	4	3	5	2	5	24

	4	3	3	4	2	2	3	21	3	2	3	3	2	2	4	19
	3	2	2	4	2	2	3	18	5	5	3	5	3	3	3	27
Avg	3.75	2.5	2.75	3.5	2.25	2.25	3.5	20.5	3.5	3.5	3.2	3.5	3	2	3.5	22.2
AD	5	2	2	4	2	4	4	23	6	4	3	4	5	5	3	30
	5	2	2	3	4	2	4	22	4	6	4	4	5	5	4	32
	3	2	2	4	1	2	2	16	3	4	3	4	2	2	3	21
	6	5	3	5	3	4	3	29	5	5	3	5	3	5	3	29
Avg	4.75	2.7	2.25	4	2.5	3	3.25	22.5	4.5	4.7	3.2	4.25	3.75	4.2	3.2	28
AE	6	2	5	4	4	5	6	32	7	6	4	4	7	6	5	39
	6	3	2	4	4	3	4	26	6	7	2	3	5	3	5	31
	5	2	3	4	2	2	3	21	5	6	3	3	5	2	4	28
	6	3	5	5	3	5	5	32	7	7	5	6	5	6	3	39
Avg	5.75	2.5	3.75	4.25	3.25	3.75	4.5	27.7	6.2	6.5	3.5	4	5.5	4.2	4.2	34.2
AF	6	5	2	2	3	2	1	21	6	4	4	4	5	5	6	34
	4	6	5	3	4	4	3	29	5	4	2	3	6	4	5	29
	5	5	3	3	2	2	3	23	3	3	3	4	6	2	4	25
	6	6	6	6	6	6	6	42	6	6	5	6	6	6	5	40
Avg	5.25	5.5	4	3.5	3.75	3.5	3.25	28.7	5	4.2	3.5	4.25	5.75	4.2	5	32
AG	3	4	2	3	3	4	5	24	6	5	6	3	5	5	5	35
	7	3	5	6	3	5	6	35	5	4	3	3	5	3	5	28
	5	2	2	4	3	2	4	22	5	3	4	5	5	3	6	31
	6	3	5	5	5	5	5	34	6	6	5	6	5	6	6	40
Avg	5.25	3	3.5	4.5	3.5	4	5	28.7	5.5	4.5	4.5	4.25	5	4.2	5.5	33.5
AH	6	2	4	2	4	3	4	25	7	5	5	3	6	6	6	38
	3	2	6	2	2	5	3	23	5	5	4	2	2	6	5	29
	5	2	4	3	2	2	3	21	5	4	4	5	5	3	4	30
	5	3	3	2	2	3	3	21	6	6	6	6	6	6	6	42
Avg	4.75	2.2	4.25	2.25	2.5	3.25	3.25	22.5	5.7	5	4.7	4	4.75	5.2	5.2	34.7
AI	3	2	5	3	2	3	2	20	5	4	3	3	3	4	3	25
	5	1	3	4	2	2	2	19	6	6	3	4	5	5	4	33
	4	2	3	4	2	2	3	20	4	5	3	4	3	2	3	24
	5	3	3	4	3	4	3	25	6	5	5	6	5	5	5	37
Avg	4.25	2	3.5	3.66	2.25	2.75	2.5	20.9	5.2	5	3.5	4.25	4	4	3.7	29.7
AJ	6	2	2	3	2	4	3	22	5	6	6	2	4	4	4	31
	5	6	2	2	5	4	3	27	6	6	3	3	5	4	6	33
	5	2	3	4	2	2	2	20	5	6	5	3	6	3	2	30
	6	3	3	6	3	5	3	29	6	6	5	6	5	6	6	40
Avg	5.5	3.2	2.5	3.75	3	3.75	2.75	24.5	5.5	6	4.7	3.5	5	4.2	4.5	33.5
AK	2	1	2	4	2	2	4	17	7	4	5	3	5	5	4	33
	6	2	2	3	3	4	3	23	5	6	3	4	5	3	4	30
	4	2	3	3	2	2	3	19	5	5	3	4	6	3	4	30
	5	6	5	5	6	5	5	37	6	7	6	6	6	6	6	43
Avg	4.25	2.7	3	3.75	3.25	3.25	3.75	24	5.7	5.5	4.2	4.25	5.5	4.2	4.5	34
AL	2	2	2	2	2	3	2	15	3	3	6	3	2	3	4	24
	2	2	3	3	2	2	4	18	3	4	4	5	5	5	6	32
	3	2	2	3	2	2	3	17	4	2	4	4	2	2	5	23
	3	3	3	4	3	5	3	24	6	5	6	6	5	5	5	38
Avg	2.5	2.2	2.5	3	2.25	3	3	18.5	4	3.5	5	4.5	3.5	3.7	5	29.2
AM	3	2	5	3	4	3	2	22	7	3	5	3	5	5	5	33

	3	2	3	4	3	2	3	20	6	2	6	2	5	5	5	31
	4	2	3	3	3	2	3	20	6	3	6	4	5	3	6	33
	5	5	5	5	5	5	3	33	6	5	5	6	5	5	5	37
Avg	3.75	2.7	4	3.75	3.75	3	2.75	23.7	6.2	3.2	5.5	3.75	5	4.5	5.2	33.5
AN	6	3	5	3	4	4	2	27	5	4	6	4	2	4	4	29
	3	1	2	2	2	3	5	18	6	3	5	2	4	5	4	29
	4	2	4	4	2	2	3	21	5	4	4	4	2	2	3	24
	3	2	3	3	2	3	3	19	6	6	5	6	3	5	3	34
Avg	4	2	3.5	3	2.5	3	3.25	21.2	5.5	4.2	5	4	2.75	4	3.5	29
AO	4	3	2	2	3	2	3	19	6	6	2	3	5	4	3	29
	4	2	3	4	2	2	2	19	5	7	2	3	4	3	3	27
	3	2	3	4	2	2	2	18	4	5	2	2	2	2	3	20
	5	3	2	4	3	3	4	24	6	6	3	6	3	5	3	32
Avg	4	2.5	2.5	3.5	2.5	2.25	2.75	20	5.2	6	2.2	3.5	3.5	3.5	3	27
AP	5	4	5	3	3	2	3	25	5	5	3	3	6	6	6	34
	4	2	4	2	3	2	3	20	5	6	3	4	5	5	5	33
	5	4	3	4	2	2	4	24	5	5	4	3	5	4	5	31
	3	3	5	3	3	3	3	23	6	7	5	5	5	5	5	38
Avg	4.25	3.2	4.25	3	2.75	2.25	3.25	23	5.2	5.7	3.7	3.75	5.25	5	5.2	34
AQ	5	4	6	5	5	5	6	36	5	2	3	4	6	4	4	28
	5	2	3	4	4	3	4	25	5	2	2	5	5	3	4	26
	4	3	2	4	2	2	3	20	4	2	3	5	4	3	4	25
	5	3	3	5	3	3	3	25	5	3	5	5	5	5	5	33
Avg	4.75	3	3.5	4.5	3.5	3.25	4	26.5	4.7	2.2	3.2	4.75	5	3.7	4.2	28
AR	4	4	6	2	4	4	3	27	5	5	6	3	4	6	6	35
	3	4	5	1	3	2	3	21	4	5	6	2	6	6	6	35
	3	3	3	3	4	3	3	22	5	5	6	5	5	5	6	37
	6	5	5	2	5	6	3	32	6	6	6	6	6	6	6	42
Avg	4	4	4.75	2	4	3.75	3	25.5	5	5.2	6	4	5.25	5.7	6	37.2
AS	6	2	1	2	3	3	2	19	6	5	2	3	4	4	4	28
	4	2	1	2	3	3	2	17	5	4	2	4	5	4	4	28
	3	2	2	4	2	2	2	17	4	2	2	4	4	2	4	22
	5	2	2	4	3	3	2	21	6	3	3	5	3	5	5	30
Avg	4.5	2	1.5	3	2.75	2.75	2	18.5	5.2	3.5	2.2	4	4	3.7	4.2	27
AT	5	2	2	3	2	2	2	18	5	3	2	2	5	4	3	24
	4	2	2	4	3	2	2	19	5	5	3	3	5	3	2	26
	4	2	3	4	3	2	3	21	3	2	2	4	3	2	3	19
	5	3	3	5	2	3	3	24	6	3	3	5	5	5	3	30
Avg	4.5	2.2	2.5	4	2.5	2.25	2.5	20.5	4.7	3.2	2.5	3.5	4.5	3.5	2.7	24.7
AU	6	3	2	3	5	4	2	25	6	5	2	2	5	4	2	26
	5	2	3	3	4	2	3	22	6	5	3	3	4	3	3	27
	5	2	2	3	2	1	3	18	5	4	3	4	5	2	3	26
	5	2	1	5	2	2	2	19	6	3	3	5	5	3	3	28
Avg	5.25	2.2	2	3.5	3.25	2.25	2.5	21	5.7	4.2	2.7	3.5	4.75	3	2.7	26.7
AV	6	2	5	3	2	4	2	24	7	5	5	4	6	6	6	39
	5	2	2	4	3	2	3	21	6	3	3	3	5	5	6	31
	4	2	2	3	2	2	3	18	5	5	3	5	5	4	5	32
	3	2	2	2	2	2	2	15	6	5	6	6	6	6	6	41
Avg	4.5	2	2.75	3	2.25	2.5	2.5	19.5	6	4.5	4.2	4.5	5.5	5.2	5.7	35.7

AW	6	5	6	4	4	5	6	36	6	5	6	3	5	5	5	35
	5	1	2	2	5	4	6	25	6	6	3	4	6	6	6	37
	4	3	4	3	3	2	4	23	5	5	4	4	4	4	5	31
	6	6	6	6	5	6	6	41	6	6	6	6	6	6	6	42
Avg	5.25	3.7	4.5	3.75	4.25	4.25	5.5	31.2	5.7	5.5	4.7	4.25	5.25	5.2	5.5	36.2
AX	2	2	3	2	2	2	2	15	4	4	2	2	2	2	2	18
	3	2	2	3	2	2	2	16	4	2	1	3	5	2	4	21
	3	2	2	4	1	1	2	15	3	2	3	3	2	2	2	17
	3	2	2	4	2	2	2	17	6	4	3	4	3	3	4	27
Avg	2.66	2	2.33	3.33	1.66	1.66	2	15.6	4.2	3	2.2	3	3	2.2	3	20.7
AY	5	1	4	4	2	2	7	23	5	3	5	3	3	3	2	24
	5	2	3	3	2	3	2	20	5	6	3	4	3	4	4	29
	5	2	4	3	2	1	3	20	4	4	3	4	2	2	3	22
	6	3	6	6	5	4	4	34	6	5	3	3	3	3	4	27
Avg	5.25	2	4.25	4	2.75	2.66	4	24.9	5	4.5	3.5	3.5	2.75	3	3.2	25.5
AZ	6	3	4	3	2	2	2	22	7	3	4	3	4	3	3	27
	5	2	2	3	3	2	3	20	5	5	3	3	2	2	4	24
	4	2	3	4	2	2	3	20	5	2	3	4	2	2	3	21
	5	3	4	5	3	3	4	27	6	3	3	3	2	3	3	23
Avg	5	2.5	3.25	3.75	2.5	2.25	3	22.2	5.7	3.2	3.2	3.25	2.5	2.5	3.2	23.7
BA	4	5	3	6	3	2	5	28	5	4	5	5	3	3	4	29
	3	7	2	3	4	2	3	24	5	6	2	4	5	5	3	30
	3	5	3	4	2	2	3	22	5	4	3	3	3	2	3	23
	5	7	3	6	5	5	3	34	6	5	3	4	5	5	5	33
Avg	3.75	6	2.75	4.75	3.5	2.75	3.5	27	5.2	4.7	3.2	4	4	3.7	3.7	28.7
BB	5	2	6	3	4	5	5	30	4	4	7	3	6	6	4	34
	3	2	4	2	4	5	3	23	3	4	6	3	5	6	3	30
	4	2	4	4	2	3	5	24	5	5	4	5	3	5	4	31
	5	3	5	5	5	5	5	33	6	5	6	5	5	6	6	39
Avg	4.25	2.2	4.75	3.5	3.75	4.5	4.5	27.5	4.5	4.5	5.7	4	4.75	5.7	4.2	33.5
BC	3	2	2	2	1	1	2	13	6	3	2	2	2	1	2	18
	3	2	1	2	2	2	3	15	6	4	2	4	2	2	4	24
	3	2	3	3	2	2	3	18	5	2	2	4	2	2	2	19
	3	2	2	2	2	2	3	17	6	5	3	4	3	3	4	28
Avg	3	2	2	2.33	1.66	1.66	2.66	15.3	5.7	3.5	2.2	3.5	2.25	2	3	22.2
BD	5	4	5	3	6	5	6	34	6	6	6	5	6	6	6	41
	4	2	3	2	5	2	5	23	6	6	6	6	4	6	5	39
	5	5	3	4	3	3	4	27	5	6	6	5	5	5	5	37
	5	5	5	5	5	5	5	35	6	6	6	6	6	6	6	42
Avg	4.75	4	4	3.5	4.75	3.75	5	29.7	5.7	6	6	5.5	5.25	5.7	5.5	39.7
BE	4	2	2	4	2	2	2	18	6	5	2	2	3	3	3	24
	4	1	1	2	2	3	1	14	6	3	1	4	2	2	4	22
	4	2	2	2	2	2	2	16	5	5	3	4	3	2	3	25
	5	3	2	4	3	4	2	23	6	5	2	4	2	3	4	26
Avg	4.25	2	1.75	3	2.25	2.75	1.75	17.7	5.7	4.5	2	3.5	2.5	2.5	3.5	24.2
BF	3	2	5	3	3	4	3	23	5	3	6	4	4	5	5	32
	2	2	6	3	3	6	6	28	6	3	6	6	3	5	3	32
	4	3	3	3	2	2	2	19	4	2	4	3	3	3	3	22
	3	2	5	4	3	3	3	23	6	3	5	5	5	5	5	34

Avg	3	2.2	4.75	3.25	2.75	3.75	3.5	23.2	5.2	2.7	5.2	4.5	3.75	4.5	4	30
BG	3	3	2	3	2	2	2	17	5	4	4	3	3	4	4	27
	5	2	4	3	4	2	4	24	5	4	3	3	3	1	4	23
	3	2	2	4	2	2	3	18	3	4	2	4	1	1	4	19
	5	3	2	3	2	2	3	20	5	3	3	4	3	2	3	23
Avg	4	2.5	2.5	3.25	2.5	2	3	19.7	4.5	3.7	3	3.5	2.5	2	3.7	23
BH	5	3	6	4	5	3	2	28	5	5	6	4	6	5	4	35
	5	2	4	2	4	4	3	24	6	6	4	2	5	5	3	31
	4	3	2	2	2	2	2	17	4	5	3	3	3	4	3	25
	5	2	3	3	3	3	3	22	6	6	3	2	3	2	3	25
Avg	4.75	2.5	3.75	2.75	3.5	3	2.5	22.7	5.2	5.5	4	2.75	4.25	4	3.2	29
BI	4	4	2	4	4	5	4	27	6	6	6	4	6	6	6	40
	3	2	2	3	4	3	4	21	6	3	3	4	5	5	5	31
	3	3	2	4	1	2	4	19	5	5	3	3	2	2	4	24
	3	3	3	5	3	3	3	23	6	7	6	6	6	6	6	43
Avg	3.25	3	2.25	4	3	3.25	3.75	22.5	5.7	5.2	4.5	4.25	4.75	4.7	5.2	34.5
BJ	6	5	1	2	3	4	3	24	7	6	1	3	5	4	4	30
	5	2	2	4	4	5	2	24	4	6	1	4	4	3	4	26
	4	4	2	3	2	2	3	20	5	5	2	4	4	2	4	26
	6	3	2	4	2	3	2	22	6	5	2	4	3	3	3	26
Avg	5.25	3.5	1.75	3.25	2.75	3.5	2.5	22.5	5.5	5.5	1.5	3.75	4	3	3.7	27
BK	6	2	2	2	2	2	2	18	6	6	2	2	2	4	4	26
	3	1	1	4	2	3	3	17	6	6	2	4	4	2	3	27
	3	2	2	3	1	2	4	17	3	5	3	4	2	2	3	22
	3	2	3	4	2	2	2	18	3	5	3	4	3	2	2	22
Avg	3.75	1.7	2	3.25	1.75	2.25	2.75	17.5	4.5	5.5	2.5	3.5	2.75	2.5	3	24.2
BL	6	3	6	5	5	5	6	36	6	5	6	4	6	5	5	37
	5	3	3	2	4	5	2	24	6	6	5	2	4	3	4	30
	4	2	4	4	3	2	4	23	5	3	4	4	4	3	3	26
	6	6	6	6	6	6	6	42	6	3	5	5	5	3	5	32
Avg	5.25	3.5	4.75	4.25	4.5	4.5	4.5	31.2	5.7	4.2	5	3.75	4.75	3.5	4.2	31.2
BM	5	3	6	4	2	3	6	29	6	5	6	6	6	6	6	41
	3	2	2	5	3	3	6	24	5	5	3	5	5	3	3	29
	3	2	3	3	2	2	3	18	5	4	3	5	5	4	5	31
	3	2	3	4	3	2	3	20	6	5	5	5	5	5	5	36
Avg	3.5	2.2	3.5	4	2.5	2.5	4.5	22.7	5.5	4.7	4.2	5.25	5.25	4.5	4.7	34.2
BN	5	6	6	3	5	4	4	33	6	6	6	5	4	5	5	37
	5	5	5	5	3	3	5	31	6	5	6	2	5	5	5	34
	5	2	3	3	3	2	4	22	5	3	3	3	5	4	5	28
	5	5	3	5	5	5	5	33	6	5	5	5	5	5	5	36
Avg	5	4.5	4.25	4	4	3.5	4.5	29.7	5.7	4.7	5	3.75	4.75	4.7	5	33.7
BO	2	2	5	2	2	2	2	17	6	4	5	2	5	4	2	28
	2	1	2	2	2	2	2	13	6	4	6	3	5	5	1	30
	2	2	4	5	2	2	2	19	4	3	3	3	2	2	2	19
	2	2	5	3	3	2	4	21	5	3	3	5	3	3	2	24
Avg	2	1.7	4	3	2.25	2	2.5	17.5	5.2	3.5	4.2	3.25	3.75	3.5	1.7	25.2

Appendix B: Average Change by Student

The table below represents the average change for each criteria for each students' pre- and post-recording. The shaded scores at the end represent the average change of all the subjects.

Stud	Q1	Q2	Q3	Q4	Q5	Q6	Q7	TOTAL
A	1.50	1.75	0.25	0.75	2.00	2.00	2.50	10.75
B	-0.25	1.25	3.25	1.92	1.50	1.25	2.00	10.92
C	0.00	1.25	0.75	1.50	2.00	0.50	1.00	7.00
D	0.00	2.50	2.75	0.50	2.00	2.25	2.25	12.25
E	0.00	1.00	-0.25	0.42	1.50	0.25	-0.50	2.42
F	0.50	1.00	-0.25	-0.50	0.58	1.75	0.50	3.58
G	1.50	0.25	1.25	0.75	1.50	1.25	1.25	7.75
H	0.00	0.75	-0.75	1.00	0.50	0.50	0.25	2.25
I	2.25	0.50	0.50	0.50	0.25	0.50	-0.25	4.25
J	1.25	0.50	1.50	1.92	2.75	2.00	2.25	12.17
K	2.50	1.50	-0.50	0.75	1.50	1.50	1.75	9.00
L	1.75	1.00	3.00	-0.25	1.75	1.50	0.75	9.50
M	1.75	4.25	2.75	0.75	1.25	1.50	0.50	12.75
N	0.25	0.50	0.25	0.00	0.50	-0.25	0.75	2.00
O	0.50	-0.25	0.25	-0.50	0.75	0.25	1.50	2.50
P	1.75	1.50	0.75	1.00	1.75	1.25	0.25	8.25
Q	1.50	3.25	1.00	0.50	0.50	0.75	0.50	8.00
R	0.50	1.50	1.50	0.75	2.50	0.75	1.75	9.25
S	1.25	2.50	0.50	0.25	1.50	0.25	1.50	7.75

T	3.00	2.25	-1.25	0.50	1.00	1.50	0.25	7.25
U	1.00	2.25	0.50	0.75	2.50	1.25	0.75	9.00
V	0.75	3.00	0.75	1.25	1.75	0.25	1.25	9.00
W	1.25	1.75	0.00	1.00	1.75	1.50	0.50	7.75
X	2.50	4.75	2.50	0.50	2.00	2.00	2.25	16.50
Y	2.00	1.75	-0.25	1.00	1.25	1.25	0.75	7.75
Z	0.75	-0.50	0.25	0.25	1.00	0.25	-0.25	1.75
AA	0.75	3.00	0.75	0.00	2.75	1.75	1.25	10.25
AB	0.50	2.75	2.50	-0.25	2.50	1.50	2.50	12.00
AC	-0.25	1.00	0.50	0.00	0.75	-0.25	0.00	1.75
AD	-0.25	2.00	1.00	0.25	1.25	1.25	0.00	5.50
AE	0.50	4.00	-0.25	-0.25	2.25	0.50	-0.25	6.50
AF	-0.25	-1.25	-0.50	0.75	2.00	0.75	1.75	3.25
AG	0.25	1.50	1.00	-0.25	1.50	0.25	0.50	4.75
AH	1.00	2.75	0.50	1.75	2.25	2.00	2.00	12.25
AI	1.00	3.00	0.00	0.58	1.75	1.25	1.25	8.83
AJ	0.00	2.75	2.25	-0.25	2.00	0.50	1.75	9.00
AK	1.50	2.75	1.25	0.50	2.25	1.00	0.75	10.00
AL	1.50	1.25	2.50	1.50	1.25	0.75	2.00	10.75
AM	2.50	0.50	1.50	0.00	1.25	1.50	2.50	9.75
AN	1.50	2.25	1.50	1.00	0.25	1.00	0.25	7.75
AO	1.25	3.50	-0.25	0.00	1.00	1.25	0.25	7.00
AP	1.00	2.50	-0.50	0.75	2.50	2.75	2.00	11.00

AQ	0.00	-0.75	-0.25	0.25	1.50	0.50	0.25	1.50
AR	1.00	1.25	1.25	2.00	1.25	2.00	3.00	11.75
AS	0.75	1.50	0.75	1.00	1.25	1.00	2.25	8.50
AT	0.25	1.00	0.00	-0.50	2.00	1.25	0.25	4.25
AU	0.50	2.00	0.75	0.00	1.50	0.75	0.25	5.75
AV	1.50	2.50	1.50	1.50	3.25	2.75	3.25	16.25
AW	0.50	1.75	0.25	0.50	1.00	1.00	0.00	5.00
AX	1.58	1.00	-0.08	-0.33	1.33	0.58	1.00	5.08
AY	-0.25	2.50	-0.75	-0.50	0.00	0.33	-0.75	0.58
AZ	0.75	0.75	0.00	-0.50	0.00	0.25	0.25	1.50
BA	1.50	-1.25	0.50	-0.75	0.50	1.00	0.25	1.75
BB	0.25	2.25	1.00	0.50	1.00	1.25	-0.25	6.00
BC	2.75	1.50	0.25	1.17	0.58	0.33	0.33	6.92
BD	1.00	2.00	2.00	2.00	0.50	2.00	0.50	10.00
BE	1.50	2.50	0.25	0.50	0.25	-0.25	1.75	6.50
BF	2.25	0.50	0.50	1.25	1.00	0.75	0.50	6.75
BG	0.50	1.25	0.50	0.25	0.00	0.00	0.75	3.25
BH	0.50	3.00	0.25	0.00	0.75	1.00	0.75	6.25
BI	2.50	2.25	2.25	0.25	1.75	1.50	1.50	12.00
BJ	0.25	2.00	-0.25	0.50	1.25	-0.50	1.25	4.50
BK	0.75	3.75	0.50	0.25	1.00	0.25	0.25	6.75
BL	0.50	0.75	0.25	-0.50	0.25	-1.00	-0.25	0.00
BM	2.00	2.50	0.75	1.25	2.75	2.00	0.25	11.50

BN	0.75	0.25	0.75	-0.25	0.75	1.25	0.50	4.00
BO	3.25	1.75	0.25	0.25	1.50	1.50	-0.75	7.75
AVG	1.03	1.71	0.72	0.50	1.38	1.00	0.92	7.25