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Embouchure Theory in Practice

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Theory in Practice: The teaching of Horn, Euphonium, and Tuba Embouchures

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Spring 2019

Senior Research Project

Music is an activity that allows people to experience fulfillment through artistic expression. The feeling of this fulfillment is so profound that music has been included in American public education. Many school districts begin this instruction through wind band programs at the fourth, fifth, and sixth grades. The instrumentation in a beginning band is typically made up of flute, Bb clarinet, alto saxophone, trumpet, trombone, and percussion. As students grow physically and musically, color instruments such as horn, euphonium, and tuba are added to the ensemble. Students selected to play these instruments usually “switchover” from different sections within the already existing band.

These switchover instruments enhance the sound of an ensemble by providing more voices that can be used to express a musical idea. For this variation in instrumentation to be effective, students must be able to produce a characteristic tone on these new instruments. The foundation of a characteristic tone is established through the embouchure, which is defined in the Merriam Webster dictionary as “the position and use of the lips, tongue, and teeth in playing a wind instrument”. Though it is not included in this definition, further research on this topic showed that breath is closely linked to the embouchure, so it was also addressed in this project.

Review of Literature

The pedagogy behind producing a characteristic tone on a brass instrument is focused on the musician’s embouchure. The embouchure shapes the musician’s air to produce a sound by creating a buzz. (Webster, Kelly, and Vorhees, 2001). Books by notable brass pedagogues such as Philip Farkas, Harvey Phillips, and Arnold Jacobs include entire chapters dedicated to the embouchure. The Instrumentalist, a notable journal for music educators, featured clinics about tone production on the horn, euphonium, and tuba. Throughout this literature, the categories of

breath, buzz, and mouthpiece placement were factors that seemed most important to embouchure and tone production.

The Breath

The quality of the tone is mostly determined by the amount and quality of air being used, while only about ten percent is attributed to the lips (Phillips and Winkle, 1992). To form an embouchure that will result in a characteristic tone, students must consider the way in which they utilize air when they breathe. Farkas (1979) described inhalation as being huge and soundless, while exhalation used the same abdominal muscles as coughing. Phillips and Winkle (1992), advocated for complete and total relaxation of the body when breathing. Relaxed breathing should produce air that is relaxed, and as natural as possible (Farkas, 1979; Phillips and Winkle, 1992). Observable characteristics of a relaxed breath include shoulders that remain relaxed and do not rise, an open and unobstructed throat, and a straight posture. Contrary to Phillips and Winkle's idea that the shoulders should not rise, Render and Clevenger (1997) wrote that it is permissible to allow any type of movement when breathing. This approach was written regarding the horn, with a focus on producing a sound by any means necessary.

While the embouchure controls the direction of the air, Farkas (1979) pointed out that air can also affect the embouchure. Therefore, a relaxed and natural breath would result in a relaxed and natural embouchure. To provide a visual of a relaxed breath, Boldin (2010) described the air stream as, "the sensation of air rushing across the tongue as water flowing over a waterfall". This visualization illustrated Farkas (1979) and Phillips & Winkle's about the importance of relaxed, natural air.

Both Phillips & Rocco (1997) and Boldin (2010) suggested that simplicity is the best way to teach students how to breathe when playing a brass instrument. Everett (2016) suggested the

use of exercises from *The Breathing Gym*, a video by Pilafian and Sheridan. Everett wrote, “low brass players will be particularly aware of the benefits of beginning by moving large quantities of air in a robust yet relaxed manner, but all wind instrument players will reap benefits from these exercises.” (2016, p. 24). Phillips and Rocco stated, “a student who has learned to inhale and exhale large quantities of air is ready to buzz on the mouthpiece” (1997, p. 16).

The Buzz

Webster, Kelly, and Vorhees (2001) defined the embouchure as the link between a musician’s air and their instrument. For brass instruments, the embouchure should allow the lips to vibrate (Farkas, 1956). The vibration of the lips establishes a buzz that is amplified through the rest of the instrument. Hunt (1968) wrote, “to produce the ‘buzz,’ the student should place the lips lightly together (as though humming the letter M) while keeping the teeth slightly apart” (p. 65). While this principle applies to each brass instrument, there are variations in factors such as the syllable being hummed, distance between teeth, and the tension of the lips.

The way in which the lips vibrate is important to consider when teaching embouchure to all brass instruments (Hunt, 1968). The tension of the lips affects how well they will vibrate, which directly affects the quality of the sound (Webster, Kelly, and Vorhees, 2001). It is also important to recognize that a “smile” or “stretch” shape will lead to a thin sound (May, 1953, Farkas, 1956). Although many authors agree with the importance of relaxation, Pettit-Johnson (2011) summarized the facial shape for horn playing as a “relaxed smile”. Hunt (1968) advocated for students to experiment with the lip tension of their embouchure to bend their pitch upwards and downwards. Music educators often referred to this exercise as “sirens”. In his writing, Hunt described the importance of focused and forward air, avoidance of excessive facial movement, and the maintenance of a gap between the upper and lower teeth. Through this

individual experimentation, the students can begin to feel what lip tensions result in the best tone while they focus on taking a natural breath for a relaxed yet large air supply.

The opening that is formed in the center of the lips is called the aperture. Webster, Kelly, and Vorhees (2001) wrote, “it is important to allow the lips to meet naturally, as if saying the letter ‘p’” (p. 6). Watson wrote that creating a successful embouchure required the musician’s feeling over theory. She stated, “most brass teachers focus on ‘buzzing’ the lips to create sound but there is a big difference between tensing one’s lips to buzz and feeling the air moving past your lips with a relaxed jaw that allows for a healthy, resonant vibration” (Watson, 2008, p. 21). In her article, Watson stated, “if you take a rock and throw it into water, concentric circles spread out on the surface. If we create vibrations with our lips by blowing air past them, those vibrations go out into the brass instrument” (Watson, 2008, p. 22). To continue the analogy, she stated that the waves created by the stones go out in all directions, including back towards the musician who created them. Watson believed that students should have the opportunity to experiment with different ways of producing the buzz, and then they should choose what feels most natural to them. Rocco (1997) also agreed with this idea of having the students create an embouchure that works best for them.

Since students who have not previously played brass instruments would be unaccustomed to the feeling of the buzz, Render and Clevenger (1997) advised that the creation of a sound should be the student’s first goal. Render and Clevenger advised that teachers should model a good tone while the student is attempting to produce a sound. Once a tone is produced, the student should proceed to glissando up and down their range. Everett (2016) suggested that, “A bit of mouthpiece daily buzzing promotes good pitch and helps to eliminate inefficiencies in student embouchures”. Matzen (2016) described the characteristic tone for mouthpiece buzzing

as being “softer and foggier” as opposed to “thick or meaty”. Although many sources agreed that the mouthpiece buzzing is an important part of a daily warm up, Matzen (2016) warned that students should still spend more time playing their instrument than buzzing.

Mouthpiece Placement

Brass pedagogues often addressed the physical placement of the mouthpiece. Experts suggested each instrument has a different upper to lower lip proportion for mouthpiece placement. Webster, Kelly, and Vorhees (2001), Render & Clevenger (1997), and Hoover (2000) explained that horn players should start with 2/3 upper to 1/3 lower lip. Webster, Kelly, and Vorhees (2001) also wrote that euphoniums should start with 1/2 and 1/2 lower lip, and tuba players should also start with 1/2 upper to 1/2 lower lip. While these exact proportions can serve as a beginning point to a student’s mouthpiece placement, it is important to find what proportion creates the most characteristic tone with the most ease (Farkas, 1979, Render and Clevenger, 1997, Ricco, 1997, Render & Clevenger, 1997). For example, Farkas (1979) wrote that students may find greater success if they utilize more upper lip, and some may find more success if they utilize more lower lip. To help students understand where the mouthpiece should be placed, Rocco and Phillips suggested that students should initially practice without an instrument.

Regarding the proper mouthpiece placement for the horn, May wrote, “as the vibrating surface of the lips becomes more equal in distribution within the mouthpiece, the tone approaches the stage of being pure in sound and less disturbed by the quality (buzz-like) that may have existed previously” (1953, p. 42). Rocco (1997) also agreed with the idea of using an equal distribution of mouthpiece. In addition to the horizontal and vertical placement of the horn mouthpiece, whether the student should place the mouthpiece in or on their lips is a topic that is often debated. Render and Clevenger (1997) advocated for the bottom rim of the mouthpiece to

be placed just inside the lower lip. It is also important to ensure that students are not putting too much bottom lip into the mouthpiece (Snyder, 2007).

Colwell and Hewitt (2011) advocated for the use of the tuba mouthpiece alone when a student is first learning the instrument and Render and Clevenger (1997) also believed this is necessary for young horn players. Colwell and Hewitt wrote that when using a tuba mouthpiece, it is important to cover 1/3-1/2 of the end hole with a finger to create a resistance that is similar to the full instrument. They also suggested that students first buzz without a mouthpiece to practice forming aperture that would result in a characteristic tone.

The way in which the air, embouchure, and mouthpiece interact determine the success of the embouchure. However, there is not one set way in which the embouchure should be formed (Rocco, 1997). The purpose of this project is to compare and connect information regarding the instruction of horn, euphonium, and tuba embouchure from multiple books, articles, and interviews, and present this information in the form of a written paper.

Method

This project was centered on the principles of action-based research due to the qualitative nature of the data. The process was divided into three phases: gather information from the literature, conduct interviews based on questions derived from the literature, then compare the information from the literature and the interviews.

Procedure

To provide a variety of pedagogical approaches to teaching embouchure, books such as *The Art of Brass*, and articles related to horn, tuba, and euphonium from *The Instrumentalist*, were compared for consistencies and discrepancies. The literature was selected based on recommendations by the university's applied faculty, as well as queries on the university's

library website. Though I included several books about general brass pedagogy, my search focused on books that were specific to each instrument by pedagogues such as Philip Farkas, Arnold Jacobs, and Harvey Phillips. Textbooks that were used in university methods courses were also included as sources of information for this study.

The Instrumentalist articles that were chosen were written within the past twenty-two years. I started with the most current issues, then worked backwards. I found that after ten to fifteen years the periodical would utilize articles written by the same authors, which is when I decided to stop going backwards. *The Instrumentalist* was selected as a major resource for this project due to the clinic-like nature of its content, consistent organization, and usage of accessible language. Overall, this reputable journal contains articles from a variety of notable pedagogues that were written for instrumental music educators.

Three collegiate professors were interviewed to gather information about what methods were used in collegiate applied music. At the time of this study, these professors taught at various mid-sized universities across northern Ohio. A professor of horn, and two tuba-euphonium professors were interviewed. One tuba-euphonium professor was interviewed with a focus on euphonium, and the other was interviewed with a focus on tuba. Both gave information regarding tuba and euphonium because the general concepts are similar between the two instruments. The horn professor has won various awards, most notably a Grammy for best classical recording from a small ensemble. He has played in multiple orchestras and chamber groups throughout the country, which indicates versatile abilities. The euphonium professor held tenure at his university, and taught euphonium and tuba for multiple decades. His experience in working with a variety of young musicians has resulted in the development and refinement of the way in which he taught these low brass instruments. The tuba professor also held tenure at his

university and has performed with multiple orchestras across the country. His experience as a higher-level educator included his prior professorship at another university out of the state of Ohio, as well as serving as a guest artist and clinician at multiple low brass festivals.

The tuba and euphonium interviews were conducted in person, while the horn interview was conducted by email. The interviews for each college professor consisted of eleven questions that were derived from the literature. They pertained to the use and development of breath support, the formation and maintenance of an embouchure, common embouchure problems, and inquired what manipulatives or further resources were recommended (See Appendix A). The goal of each question was to set a framework for a semi-structured interview that would lead to meaningful data.

Data Analysis

After the literature was selected, the content was read and annotated. The data from the annotations were organized then analyzed. From this analysis, the categories of air, buzz, and mouthpiece seemed to be the most logical way to organize the information.

Each interview was recorded on my tablet and transcribed. Each transcription then was analyzed for patterns, or coded, as described by Sladana (2009). The first wave included an *in vivo* method of coding. Ideas were highlighted and briefly summarized in the margins of the transcript. It also included a text-pattern analysis so that common words could be identified throughout the interviews. The second wave involved searching for common and contrasting thoughts. Results from coding provided the data for the findings below.

Findings

In order to maintain anonymous participation, the three professors have been given pseudonyms as follows: Dr. Perry, professor of horn, Dr. Beninger, professor of euphonium, and

Mr. Jones, professor of tuba. Through the coding process, the three categories of air, face, and metal, as was best stated by Beninger.

Air

When considering air all three professors suggested that the inhalation must be relaxed, and the exhalation must be controlled. Perry utilized ideas from Arnold Jacobs, a brass pedagogue referenced by all three professors, by stating, “training a fast, relaxed, full inhalation requires consistent practice away from the instrument, to normalize this function without the stimulus of the instrument and its inherent muscle memory.”

The consensus from all three interviews is that air is an essential factor to creating tone on a brass instrument. Beninger and Jones stated that the air fuels the embouchure, while Perry stated that, “air flow is the central part of the buzz, not the embouchure”. Beninger and Jones consider the buzz as part of the embouchure for their instruments, unlike Perry who stated that it was separate. Without being prompted, all three professors used some sort of nature/natural element to their explanation of how to consider air. While Perry and Beninger actually used the word “natural”, Jones continuously used the word “wind” when describing the movement of air. The consensus from all three professors was that the inhale and exhale of air must be relaxed if a good tone is to be produced.

Perry, Beninger, and Jones break the act of breathing into two steps: the inhale and the exhale. Tension is an issue that must be avoided when taking a full breath in. Jones stated, “the idea is to learn to breathe in and get the whole cavity full”. During his interview, Jones pointed out that your lungs reach from just under one’s shoulders, down to the middle of one’s core. This helps illustrate the amount of air that must be taken in to fill the lungs for a proper breath on the tuba. Quoting Arnold Jacobs, Beninger stated, “there is a difference between breathing to

expand and expanding to breathe”. Beninger explained that brass players should breathe to expand. He used an analogy of a glass filling up with water to illustrate this thought. He stated, “you don’t take the cup and pour the pitcher and have it [stop at the top and go down]. Nature goes bottom up”. Beninger also talked about treating the stomach like a balloon that expands with air to further illustrate the concept of filling from the bottom up. All three professors agreed that the exhalation must be relaxed, and Jones included the importance of controlling the air stream.

According to Perry, “proper relaxed, full breathing is a natural process, taken to unnatural amounts”. In other words, the act of inhalation and exhalation is natural, however the amount of air that must be moved is greater than normal breathing. The phrase, “full, fast breath” was used by both Beninger and Jones. All three professors advocated for using consistent breathing exercises away from the instrument to help develop this skill. Beninger and Jones describe an exercise that involves inhalation and exhalation for varying number of counts. An example would be inhale for four beats, exhale for eight beats. The goal of this exercise is to train the lungs to control the air in both the inhalation and exhalation. The final step of Jones’s exercise has the student inhale one quick breath and exhale for four counts. The purpose of this final step is to simulate how the student will have to breathe when they play in an ensemble.

Face

The term, “face”, refers to the corners of the mouth and the aperture. Perry, Beninger, and Jones described the shape of the mouth in terms of “smile” or “whistle”. When playing the horn, Perry stated, “puckered smile or whistling position usually does well”. This entails, “firm corners with a firm, flat chin, with the bottom lip slightly relaxed forward”. Jones stated that it is hard to think about a muscle and not make it tense. This means that using fewer words could

prove to be more effective than breaking the embouchure down to the smallest point and building it from there. Regarding the euphonium and tuba, Beninger established two different ways to form an embouchure: firm versus funnel. He described a firm embouchure as using the corners of the mouth to create tension in the lips which allows them to vibrate, like a bow on a string. The funnel embouchure is described as having the lips forward. The tension that allows vibration is created by the rim of the mouthpiece, and, “anything that happens outside the mouthpiece is not a big deal”. This means that the corners of the mouth should not be a point of focus for a euphonium or tuba player. When given the two options of firm or funnel, Beninger advocated for the funnel when playing the euphonium or tuba. Conversely, Jones stated that firm corners tend to result in the best tone.

Jones’s concern about the musician’s face was centered on the puffing of the cheeks. Jones stated, “what I found, in general, is that good embouchures generally have a flat chin, firm corners, and a good aperture so the cheeks don’t puff.” Beninger stated that the face will naturally inflate near the front of the mouth because there is tension present. However, he warned that inflated cheeks are a sign that air is not being directed through the mouthpiece efficiently. He pointed out that the puffing of cheeks would result in too much tension being placed on the corners of the mouth, and that it is impossible to puff if the aperture is wide enough. Jones also agreed that if the aperture is open, it is impossible to inflate the cheeks. Beninger recommended that students blow through a Starbucks straw so they can feel the size and shape of the embouchure, in addition to the direction of the air stream.

Perry was asked if he addressed the shape of the aperture with his students. He stated, “NEVER. The aperture cannot be felt when playing, so I do not discuss its shape. I find that discussing aperture size automatically makes a student play with too much ‘biting’ on the

airstream and a restricted embouchure, with impeded air flow.” Similarly, Beninger stated that he only addressed the aperture when the sound was no longer “round”. Jones also refrained from addressing the aperture. He explained that the concept of how to produce a sound on a brass instrument is completely foreign to beginning musicians, and that it is better to focus on the musician’s air. He reasoned that the aperture is formed by the musician’s air, and if they are able to form a relaxed wind column, then the aperture would also produce a characteristic tone.

All three professors strongly suggested that students use a mirror when they are learning a new embouchure. They stated that this allows the student to visualize what they are doing, because what they feel may be different from what is actually happening.

Metal

The term “metal” refers to the mouthpiece and its placement on the face. Beninger established that the role of the mouthpiece is to hold the lips so they can vibrate to produce a sound. Mouthpiece placement affects the way in which air is directed through the instrument. Each instrument requires a slightly different ratio of upper lip to lower lip covered by the mouthpiece. Jones stated that the vertical alignment, or ratio of upper lip to lower lip, can vary from students. The horizontal placement must be centered unless if the student has a dental condition that prevents centricity.

Regarding the horn, Perry stated, “80% top lip, 20% low lip (or thereabouts) and as centered and in-line as possible that the underlying dental and muscular structure will allow”. Horn players have the option of placing the mouthpiece on the lips (onset) or slightly in the lips (inset). Perry stated that this type of placement depended on each student, but he acknowledged that inset players tended to achieve a “warmer, fuller tone, thanks (to) the larger amount of soft flesh inside the cup”.

While this placement may be appropriate for the horn, Beninger and Jones stated that the lip ratio is about 50/50 for the euphonium and tuba. Beninger talked about the process of anchoring the rim mouthpiece against the lower lip, and simply “clicking” it up into place. As explained by Beninger, to anchor and “click” the mouthpiece, one should place the rim of the mouthpiece on the bottom lip line with the shank perpendicular to the floor. The musician then rotates the mouthpiece upwards so that it is against the top lip. The rim does not shift from the bottom lip during this rotation, and the upwards rotation sets the mouthpiece in the correct place. If done properly, this anchor-click method centers the mouthpiece perfectly for the student.

When first teaching mouthpiece placement for euphonium and tuba, Beninger suggested practicing the placement without the instrument so that students can understand how a correct placement feels. When it is time to add the instrument, Beninger advocated for the use of some type of tuba stand so that the instrument can be brought to the student, not the student to the instrument. Jones pointed out that tuba and euphonium players may have an incorrect mouthpiece placement due to the position of the director relative to the tuba player. He stated if the tuba player is placed so that the bell is covering the student’s vision of the director, the student will move his/her face to see the director.

Some students may have physical barriers that prevent them from forming a normal embouchure. Perry wrote, “Dental structure has a huge amount of impact on the placement and angle.” When asked about other physical barriers, Beninger stated, “Braces are probably the most common thing that’s in the way.” Jones explained that students with braces, or other dental abnormalities, often switch to the tuba. Jones said, “Tuba is big enough that the tiny things are not as big an issue.”

In addition to dental problems, skin reactions to the mouthpiece may cause pain for students when they are playing. Beninger talked about how students may have allergies to cheap mouthpieces due to the heavy amount of nickel in the material. He suggested that educators should ensure that the student is not experiencing any pain when they are playing their instrument due to their mouthpiece. He listed several solutions, including using a plastic mouthpiece, a gold-plated mouthpiece, and purchasing quality mouthpieces that have a reputation for being plated with pure silver. Neither Jones or Perry talked about mouthpiece materials.

Beninger suggested that students who are switching from a high instrument to euphonium should play on a shallow mouthpiece. He stated, “it’s going to be bright, but they’re going to be playing and they’re going to be playing successfully”. He suggested that teachers should establish a plan that can help students grow into larger mouthpiece as they mature. Beninger’s approach to this is starting from a point of success and moving forward from there, regardless of the initial quality of the tone.

Recommended Resources

These interview questions barely scratch the surface of the information about horn, euphonium, and tuba embouchure. The professors were asked if they had any further resources that could benefit music educators (See appendix C). Perry listed: *The Art of Horn Playing*, by Farkas; *Horn Technique*, by Schuller; *Pivot System for Brass*, by Reinhardt; *Essentials of Brass Playing*, by Fox; *Roy Poper’s Guide to the Stamp Warm-ups*, by Poper; and *On Playing the Horn*, by Cousins. Beninger echoed Perry’s suggested about *The Art of Horn Playing*, and also recommended *The Art of Tuba and Euphonium*, by Philips and Winkle. Beninger also suggested the *Breeze Easy* method books for students who are beginners. He talked pacing of the series,

and how it slowly introduces new concepts while reinforcing previous concepts. In addition to literature, Beninger recommended that students should utilize YouTube to listen to good recordings of fun pieces that would develop aural skills. Jones also suggested the use of performance as a resource through side-by-side rehearsals with high school and beginning students.

Discussion

The purpose of this project was to provide a resource that teachers can quickly reference when they switch students to horn, baritone, and tuba. This was done through the comparison and connection of information regarding the instruction of horn, euphonium, and tuba embouchure from multiple books, articles, and interviews. Common principles about embouchure that apply to all brass instruments emerged from these resources.

First, relaxation is an important factor for a successful embouchure. Extreme tension will result in a pinched and uncharacteristic tone. Many of the sources advocated for the use of a “puckered smile” shaped embouchure. The tuba embouchure does not include a smile of any kind because due to its large and relaxed nature. In the tuba embouchure, a circular aperture will produce the best result. The baritone embouchure is the a mixture of horn corners and tuba forwardness. There must be slight tension in the corners of the mouth, however a circular aperture should be strived for. Having the student blow through the shank of their mouthpiece, or through a straw, is an effective way to help with this visualization since the term, “form a circular aperture” would make very little sense to a beginning student.

Second, the way in which air is inhaled and exhaled is just as important as the amount of air that is used; a controlled air stream will lead to a focused tone. This control is established through dedicated practice. One common exercise found throughout the literature and interviews consisted of breathing in for four counts, out for four counts, in for two counts, out for four

counts, and in for one count, and out for four counts. The purpose of this exercise is to have the student experience multiple repetitions of taking in a relaxed breath. The difficulty of the exercise is increased when the student is given less time to inhale. The student's first goal should be ensuring the breath is through the mouth. Students who switch to a bigger mouthpiece may breathe through their nose because the corners of their mouth are covered by the rim. The student must be encouraged to continue to breathe through the corners of their mouth even though it will require slightly more effort than for an instrument with a smaller mouthpiece. Constant reminders about breathing through the mouth must be made to ensure the student does not fall into this bad habit. Exercises to help with breath and embouchure development can be found in appendix B. Second, the breath should be soundless. As stated by the professors of euphonium and tuba, students will often try to make a soundless breath by opening their mouth wide and choking near the top of their esophagus. This means that a visual assessment should be paired with an aural assessment to determine if a breath is relaxed; it is truly about listening for silence. Farkas (1979) emphasized the importance of using the abdominal muscles when taking an effective inhalation. The abdominal muscles are utilized in Arnold Jacobs's approach of "breathing to expand", as opposed to "expanding to breathe".

Third, it is important to adapt mouthpiece placement to the student's physiology; some students may be able to create a characteristic tone with ease with slightly more upper or lower lip in the mouthpiece. In his interview, Beninger also talked about the physical state of the mouthpiece. The shiny finish on the rim of the mouthpiece must be present. Any scrapes that expose a dark metal will cause the student to put raw brass on their face.

A successful tone for each instrument require the corners of the mouth to be treated differently. Some sources advised that firm corners are the best way to create a characteristic

sound for all brass instruments. However, the way in which the corners are addressed could cause a student to use unnecessary tension. The literature listed specific observable behaviors that could be used, however they may not be effective. In practice, Jones pointed out that when it is hard to relax a muscle when it is addressed. In the efforts of effective and efficient instruction, it may be best to only address the muscles if they cause an issue that obstructs the production of a characteristic tone. If the tone sounds too pinched, the student needs to relax the corners of their mouth. If the tone is too unfocused, the student needs to focus on a circular aperture to focus the air column.

The placement of the mouthpiece determines where the air stream will travel. Its placement on the lips is factor that can be considered on two planes: vertical and horizontal. For the horn, the suggested vertical placement is $\frac{2}{3}$ upper lip and $\frac{1}{3}$ lower lip. For the euphonium and tuba, an even ratio of upper to lower lip is suggested. However, this is a starting point. The student should be able to feel what is most natural. Beninger's anchor-click method is an effective way to find that natural point. Another affective way to establish the correct position of the mouthpiece is to blow through the mouthpiece without the instrument. If the air stream is still silent, then the air is being directed through the cup, which is most desirable. If the air is noisy, then the cup of the mouthpiece is catching a part of the stream which bends the stream. A silent air stream will create a focused sound when the student plays the assembled instrument. Each of the sources that addressed mouthpiece placement stated that the mouthpiece should be centered on the lips. However, an off-centered mouthpiece placement is an effective accommodation for students with dental issues. The literature and interview results emphasize the importance of helping the student find the most natural way to form a successful embouchure.

Several sources, including the professor of euphonium's interview, addressed the importance of success. If a student does not experience success, then a change must be made in the student's embouchure. Issues such as pinched sounds and uncommonly quick fatigue results from undue tension. A tense breath is one factor that will create a tense sound. Taking five or ten minutes after school or between classes to do breathing exercises is the most effective way to address these individual issues. Above all, almost every resource recognized that consistency is the most important factor to consider when teaching a new embouchure. For example, breathing exercises are only effective if they are consistently practiced. Good embouchures require months of consistent practice of good habits to form muscle memory. Similarly, poor embouchures are formed with months of consistently poor practice. There is not a universal way to create an embouchure. It is important to recognize that the theory found in literature is only practical if they are specifically applied to each student.

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Appendix A: Interview Questions

1. What is the connection between air and embouchure?
 - a. What are some exercises you use to teach proper breathing?
2. Can you please describe the ideal embouchure for your applied instrument?
 - a. Do you focus on the student's aperture? If so, what shape do you recommend for horn, euphonium, and tuba?
 - b. Do you use any analogies to help students visualize a proper embouchure technique? If so, what are they?
3. What exercises do you use to develop the embouchure?
4. How do you address facial tension with your students?
 - a. Do you allow a controlled cheek puffing?
5. Is lip moisture an important factor to consider when teaching embouchure?
 - a. If so, have you seen more success when students play with wet or dry lips?
6. How should the mouthpiece be placed vertically and horizontally on the lips?
 - a. Do you teach your horn players to set their lower lip embouchures "in" or "on" the mouthpiece? (Horn)
7. What are some manipulatives you recommend using when helping a student learn/develop a new embouchure?
8. Do you find any differences between students who started on their instruments and students who switched over from a different instrument?
9. What are some of the common embouchure faults that you find from incoming students?
 - a. How do you change an ineffective embouchure?

- b. What are some physical conditions that may create a barrier to forming a proper embouchure? How do you help students overcome these obstacles?
10. Do you have any advice for band directors who are trying to develop and refine a student's embouchure during a large group rehearsal?
11. Do you have any recommended resources that others can reference to further learn about embouchure development?

Appendix B: Embouchure Exercises

Exercise 1. Breathing Control *from Jones and Beninger*

Using a steady beat of 60 bpm, the student will breathe in for four counts and out for four counts. The student will then breathe in for two counts and out for four counts, then in for one count and out for four counts. At a faster tempo of 100 bpm, the student will breathe in for one count and out for eight. The inhale should be through the mouth and soundless. The shoulders should stay relaxed and should not rise.

The goal of this exercise is to help increase the elasticity of the student's lungs. The final step of breathing in for one and out for eight simulates how a student will have to take a quick breath while playing in an ensemble setting. It is important that the student maintains a relaxed posture when doing this exercise, or bad habits of tension will form.

Exercise 2. Aperture Development (For tuba and euphonium) *from Beninger*

This exercise requires a straw or pvc pipe that is roughly the same diameter of mouthpiece shank, or the end of the mouthpiece that is placed in the horn. In his tuba and euphonium studio, Beninger utilizes the large Starbucks straws. The student will blow through the straw for eight counts. This process will be repeated three times. The student will then play any comfortable note on their instrument with a focused, characteristic tone.

The purpose of this exercise is to encourage the students to be aware of the size of their airstream. Especially with the euphonium and tuba, the direction in which the air travels is just as important as the amount of air that is used. Results are best when students blow a note on their instrument after blowing through the straw. This allows the visualization and feeling to be transferred from the exercise to playing.

Exercise 3. Breath Intake *from Beninger*

The student will place their hands on their mid abdomen. They will be instructed to visualize their stomach as a balloon. When they are instructed to breathe in, the student will be told to inflate the balloon, and feel the inflation with their hands. This process will be repeated until the student is taking a full, relaxed breath.

This exercise helps students visualize from where they should inhale. Many students breathe from their chest, which results in a shallow breath and the shoulders rising. Breathing from the stomach results in more efficient use of the lungs.

Exercise 4. Air and Fingers *from Jones*

With the mouthpiece in the instrument, the student will inhale a full breath, and exhale a controlled breath. The air should sound like there is little resistance. It is permissible for the student to accidentally buzz on their instrument while they are doing this exercise.

The purpose of this exercise is to take away the buzz and isolate the exhalation. Since students may change their air stream when they are playing in differing registers, it helps to have them finger along to simulate playing. If the student correctly directs the air through the mouthpiece, then there should be little to no hissing. If the student is still having issues with focusing on their exhalation, then take away the finger movement.

Exercise 5. Long Tones

The student will ascend the first five notes of the Bb scale. Each note will be held for eight beats at a quarter note equaling 60 bpm. As time progresses, the duration of the notes can be increased. Once the student gets to the fifth scale degree, they will jump down to the tonic.

This exercise develops a student's stamina. It is crucial that the student maintains a steady air stream throughout the duration of the note.

Appendix C: Recommended Resources

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