



**Trijntje Teixeira
de Lima van den Geest**

Vocalization in Saxophone Class

Vocalização na Aprendizagem do Saxofone



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Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Ensino de Música, realizada sob a orientação científica do Doutor Jorge Manuel Salgado Castro Correia, Professor Auxiliar do Departamento de Comunicação e Arte da Universidade de Aveiro.

I dedicate this work to my husband Luis.

o júri

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agradecimentos

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palavras-chave

Articulação, imaginação musical, saxofone, timbre, vocalizar.

resumo

Alunos iniciantes de saxofone demonstram por vezes dificuldade na aquisição de um timbre consistente. Associada a esta dificuldade observa-se também uma falta de imaginação musical o que pode ter uma influência direta na performance. O objetivo deste projeto educacional é o desenvolvimento de um método que pretende ajudar alunos de saxofone a enriquecer o seu timbre e a melhorar o seu uso da articulação e das dinâmicas através de exercícios cantados com vogais e consoantes.

keywords

Articulation, musical imagination, saxophone, tone quality, vocalizing.

abstract

Initiating saxophone students often demonstrate difficulties in playing with a consistent sound. In addition, many initiating music students demonstrate difficulties with imagining the music before they play it. Consequently, their performances lack musical interpretation. The aim of this educational project is to develop a vocalization method in order to help initiating saxophone students to improve their tone quality and the use of articulation and dynamics, by singing and playing with vowels and consonants.

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Introduction

Motivation

As a saxophone teacher of mainly young initiating students, I often see my students struggling with the development of a stable saxophone sound. They face difficulties in maintaining a stable breathing and embouchure, which results in sound emission problems. In addition, most initiating saxophone students do not imagine the sound they want to hear, before or while they play the saxophone. The development of a stable saxophone sound is a process, which takes time and training. Good indications of the teacher might help the student to improve the sound quality. However, many beginning saxophone students regularly face difficulties in playing with a consistent sound. In addition, more advanced students often keep struggling with the development of a saxophone timbre that is rich in harmonics and the ability of playing with a larger variety of tonal colors.

Between 2012 and 2013, I have developed a master research on the influence of vowels, consonants and linguistic stress to respectively the saxophone timbre, articulation and musical phrasing of advanced saxophone students. I developed an experiment to measure the relation and influence of linguistic to musical features. The results of the experiment showed that vowels and consonants provide a deeper conscience and ability of the students in order to apply a larger variety of timbre and articulation in their performances (Geest, 2013).

I realized that the experience I gained with my previous research might be valuable to help my younger saxophone students in order to develop a stable saxophone sound. I decided to develop a series of exercises that relate vocalizing to playing the saxophone. With these exercises, I aim to investigate the possible role of vocalizing to the (1.) tone quality, (2.) the articulation and (3.) the use of dynamics of saxophone students of the third and fourth grade of the Portuguese music education system.

Many saxophonists wrote about the positive relation they experience between vocalizing and playing the saxophone. However, there is little information available about the possible effects of the implication of vocalizing, i.e. singing and playing with syllables, in the classroom with beginning saxophone students. Therefore, I expect that my research will be valuable for saxophone teachers who want to guide their initiating and young students in order to develop a stable saxophone sound, and the ability to play with dynamics and articulation. In addition, I expect that by investigating the possible relation between vocalizing and playing the saxophone on a short and long term will help me to improve my teaching methods. I hope that by writing this investigation, I will be able to develop myself as a saxophone teacher and to help my students to enjoy playing the saxophone!

Structure of the Thesis

Chapter 1, or the State of the Art, contains a selection of the most important literature on the subject. First, in §1.1, I write about the benefits of singing; in §1.2 about the importance of including vocalization exercises in instrumental class and in §1.3 about the effect of the vocal tract to the timbre of wind instrument players. Further in chapter 1, I write about the impact of vowels in shaping the timbre (§1.4) and the impact of consonants in shaping the articulation (§1.5).

Chapter 2 presents the problematic of the thesis. In paragraph 2.1, I describe that many music students demonstrate a lack of musical imagination which often results in performance difficulties. §2.2 presents the hypothesis and theme; §2.3 denotes the aim of the research and §2.4 presents the objectives and the research plan.

In chapter 3 I describe how saxophonists can use syllables as a strategy to develop timbre and articulation of the saxophone. §3.1 denotes the basic linguistic terms and §3.2 presents the parallels between linguistic and musical terms. In §3.3 I describe the impact of the four extreme vowels in shaping the saxophone timbre; §3.3.1 delineates the experiences of colleague saxophonists on singing and playing with vowels. Further in chapter 3, I describe the place and manner of articulation of consonants (§3.4) and the impact of consonants in shaping the saxophone articulation (§3.5). Finally, §3.5.1 explains how to use consonants as a strategy to discover different articulations on the saxophone; §3.5.2 describes how to use consonants as a strategy to develop extended techniques on the saxophone and §3.5.3 denotes the experiences of colleague saxophonists on singing and playing with consonants.

Chapter 4 describes the experiment protocol. In the introduction I describe the process of developing the research experiment. §4.1 points out the pilot study with an overview of the various stages. Part 1 describes the preparation; Part 2 denotes the first performance and evaluation of student M.; Part 3 describes the process of working on the vocalization exercises with the same student; Part 4 sets out the second performance and evaluation of student M. Finally, I present the results of student M., followed by the results of student J. Next, I describe the actual experiment of this research. In §4.2 I explain the purposes of the vocalization exercises: §4.2.1 describes exercise 1; §4.2.2 points out exercise 2. The paragraphs 4.2.3 and 4.2.4 demonstrate etude n° 18 by Guy Lacour (1989, p. 14), first without and later with syllable indications. The paragraphs 4.3, 4.4, and 4.5 describe respectively the participants, the jury and the questionnaires. In §4.6 I denote the various procedures of the experiment: Part 1 sets out the preparation of the experiment; Part 2 denotes the first performance and evaluation of the participants; Part 3 describes the process of working on the vocalization exercises with the experimental group and finally Part 4 delineates the second performance and evaluation of the totality of participants.

In Chapter 5 I point out the results of the research experiment and discuss the results. The paragraphs 5.1.1 until 5.1.6 describe the results on each of the parameters namely the air pressure; the tone color in the high register; the tone color in the medium and low register; the use of tone colors; the use of dynamics and the use of articulation. In the paragraphs 5.2.1 until 5.2.6 I discuss the results of the experiment in relation to the written literature on the subject per research parameter.

Finally, the conclusion delineates the conclusion of the research and implications for further research.

Chapter 1 - State of the Art

1.1 The Benefits of Singing

During the last decades, saxophonists and flutists have written very valuable information on vocalization, in particularly on the influence of syllables to timbre or tonal shadings and articulation (Liebman, 1994; Rascher, 1994; Quantz, 2001; Ioan, 2007). Recent research shows that singing with vowels improves the quality of the sound of flute players (Ioan, 2007). Furthermore, the use of consonants as modes of articulation shows to result in a clearer articulation on the saxophone (Liebman, 1994).

In order to use vocalization to improve musical performance, it is necessary to be able to sing. Singing is extremely important for the musical development of human beings and forms the basis for further musical instruction (Gordon, 1999). According to Gordon, a child needs to form a listening vocabulary of music during the first three years of its life in order to be able to learn to sing or to play a musical instrument. He states that it is necessary to sing to children instead of asking them to sing before they learned to listen. *Unless children hear singing along with speaking in their formative years, their speaking voices will become one, and as they increase in age, it will become more and more difficult to separate the two voices so they will be able to learn to sing* (Gordon, 1999, p. 43). According to Gordon, the process of learning language is very similar to the process of learning music. People ideally develop four music vocabularies: listening, performing, reading and writing. Gordon summarizes this whole process in one word: 'audiation'. According to Gordon, *audiation takes place when we hear and understand in the mind music that we have just heard performed or have heard performed in the past* (Gordon, 1999, p. 42). Table 1 points the similar learning processes of language and music according to Gordon.

Table 1. Similar learning processes in language and music according to Gordon (1999).

Language	Music
<i>Result of the need to:</i>	
Communicate	Communicate
<i>The way of communication is:</i>	
Speech	Performance
<i>What we communicate is:</i>	
Thought	Audiation

In my daily practice of playing and teaching the saxophone, I use audiation in the following way. For example, whenever I play my saxophone, I try to imagine what I want the written music to sound like in order to improve my performance. Also, whenever I am able to

sing an interval, it is easier for me to improve my intonation because I can hear the sound in my mind before I play it. The development of my inner listening is essential for me in order to improve my performance.

However, most of my saxophone students reveal immense difficulties in imagining the music, before or while they play it. I notice that there is a general lack of methods and exercises in order to help music students to improve their inner listening. Many wind instrument teachers, including myself, often focus on the right execution of the written notes and the denoted dynamics, articulation and other musical indications. There is nothing wrong with expecting a student to play what is written, but above all a student should be able to understand the meaning of the musical content. In other words, a music student should be able to understand the written content and from there on create a 'soundtrack' in his or her mind. Music teachers should try to offer tools to their students in order to help them to create these 'soundtracks'. A first step towards the improvement of the inner listening of students could be singing. As singing adopts great techniques for training the inner listening (Edlund, 1963; Ioan, 2007), it should be necessary to include more vocalization exercises in instrumental lessons.

1.2 Vocalization in Instrumental Class

Several researchers investigated the use of vocalization exercises in instrumental class. All of them notice that many music teachers fear the use of vocal instruction in the instrumental class or band rehearsal (Lee, 1996; Robinson, 1996; Wolbers, 2002). Reasons for this mistrusting attitude towards singing are lack of confidence of the teachers towards their singing capacities, lack of time, the idea that rehearsing over and over again is more effective in order to prepare a performance than singing and the idea that students won't like the singing exercises (Robinson, 1996; Wolbers, 2002). Both Robinson and Wolbers encourage music teachers to include vocalization exercises in instrumental class in order to help their students to develop on many musical levels (Robinson, 1996; Wolbers, 2002).

According to Robinson, vocalization in instrumental classroom helps music students to resolve their own intonation difficulties and helps them to develop a consistent sense of tonality. He states that introducing vocalization techniques at the beginning of a band or orchestra rehearsal can improve musical and critical thinking skills of young performers (Robinson, 1996). In a similar investigation, Wolbers states that singing can help students to develop their aural perception and provides an alternative to a "button-pushing mentality", e.g. a mentality where students simply blow and open and close keys in order to produce sound. He states that students need to imagine in their minds the music they want to play, instead of simply seeing it. In order to help his students, he proposes that band students should sing their scores and naturally develop breathing points, dynamics and phrasing (Wolbers, 2002). In addition, Lee states that vocalization with tonal patterned instruction will enhance beginning instrumental conception and

performance of articulation and phrases over note to note instruction (Lee, 1996; Scavone, Lefebvre, & da Silva, 2008).

In the case of my saxophone students I notice that many of them demonstrate difficulties with singing. Most of them only sing during the choir rehearsal at the music school. Singing at home, in the church or during festivities becomes every time more rare, while these more informal ways of acquiring musical aptitude are very important (Gordon, 1999). In addition, some students feel embarrassed and insecure about their singing capacities. I have noticed that it helps to sing with them for a short period of time during every lesson.

Flutist Cristina Ioan shows that vocalizing has a positive influence on the sound quality of flutists (Ioan, 2007). Ioan described how breathing, singing and vocalizing exercises helped her students to develop their flute sound. She proposes an alternative method to develop the flute tone through singing: *My idea was that if I will achieve a desired resonance when singing, I could then use the resonators in the same way when playing the flute, thereby modifying the colors of the flute tone* (Ioan, 2007, p. 71). Ioan states that every musician needs a clear image of sounds in order to produce them, in particular the intonation, consistence, dynamic and color. Without this clear image, the muscles will not drive the body towards what to do and there will be little or no coordination (Doscher, 1994; Ioan, 2007). Ioan further states that training the inner listening through singing will help flutists to train this sound image. The inner listening is necessary to sing and so by singing the flutist will train to first create a clear sound image and then sing or play the sound (Ioan, 2007).

The renowned saxophonist Sigurd M. Rascher states appoint very similar to Ioan. According to Rascher a music student should develop the inner listening as much as possible because without a clear imagination of the music it will be harder to reproduce it (Rascher, 1994). Rascher speaks about this process in his book *Top-Tones for the Saxophone* (Rascher, 1994). He draws a series of exercises in the book to train the inner listening through mental activity. One of the exercises Rascher proposes is to play a note and to imagine the sound of a fifth above this note (e.g. playing a C or Dó and trying to imagine the sound of a G or Sol). Only after clearly imaging the pitch of the note, the student should advance and play the note. The exercise practices both the inner listening and tone producing at the same time. In Rascher's approach, the imagination of a tone should be as concise as the imagination of an object such as a table, namely by comparing sound properties such as pitch, loudness, quality, timbre, stability, and duration to characteristics of objects such as size, shape, color and structure. It is a challenge for instrumental teachers to help their beginning students to develop the inner listening from the start of their musical education. In addition, it necessary to adapt quite complex exercises, such as the ones proposed by Rascher (1994) into more accessible ones that are suitable for initiating students.

It remains clear that singing adopts great techniques for training the inner listening and the creation of a clear imagination of sound, tone quality, timbre, intonation, a relaxed body position and airflow (Edlund, 1963; Liebman, 1994; Rascher, 1994; Ioan, 2007). However, there is a general lack of methods for instrumental teachers in order to help their students to improve their inner listening. Also, scientists do not always agree on the effect of the vocal tract to the timbre of wind instrument players.

1.3 The Effect of the Vocal Tract to Timbre

As wind instrument players use their breath in order to produce sound, the vocal tract can be intimately involved (Wolfe, Garnier, & Smith, 2010). Moreover, the resonances of the vocal tract can contribute to both timbre (Berio, 1966; Wolfe, Tarnopolsky, Fletcher, Hollenberg, & Smith, 2003) and pitch control (Scavone, Lefebvre, & da Silva, 2008; Wolfe, Garnier, & Smith, 2010). Scientists do not always agree about the effect of the vocal tract to the timbre (Wolfe, Tarnopolsky, Fletcher, Hollenberg, & Smith, 2003). According to Wolfe *et al.* (2003) possible reasons for these doubts are first that it's difficult to measure specific aspects of the vocal tract, such as the shape of the mouth, without changing for example the lip tension. Second, it is difficult to explain the effect of the vocal tract to the sound, because the acoustic currents on either side of the reed most of the time aren't equal. For example: in the case of the didgeridoo the influence of the vocal tract on the sound is very clear, because the bore of the instrument and the vocal tract have comparable dimensions (Wolfe, Tarnopolsky, Fletcher, Hollenberg, & Smith, 2003). In many other wind instruments the influence of the vocal tract on the sound is not always that clear. The reason is that the bore of most instruments is narrow and has therefore high resonances in comparison to the weaker resonances of the vocal tract. However, many wind instrument players, including myself, defend the importance of the shape of the mouth and vocal tract on the sound.

According to Wolfe saxophonists tune the vocal tract to produce the altissimo register, but *in the normal range of the instrument, below about 700 Hz. there is no simple relation between the frequencies of the note played and the tract resonance* (Wolfe, Garnier, & Smith, 2010, p. 14). In a similar research, Scavone *et al.* (2008) defend that tongue movement by saxophone players, results in vocal-tract manipulation which can be used to produce subtle timbre variations throughout the playing range of the saxophone. However, the vocal-tract influence becomes significant in the high and altissimo register of the saxophone (Scavone, Lefebvre, & da Silva, 2008).

I relate to the findings of the above mentioned investigators. Whenever I play in the high or altissimo register of the saxophone, it is easier to bend the pitch or produce major tonal shadings in the timbre by changing my vocal tract. In the middle and lower register it is more difficult to bend the pitch and changes in the timbre are less extreme in comparison to the high register. According to Scavone *et al.* (2008) saxophone players can produce subtle timbre

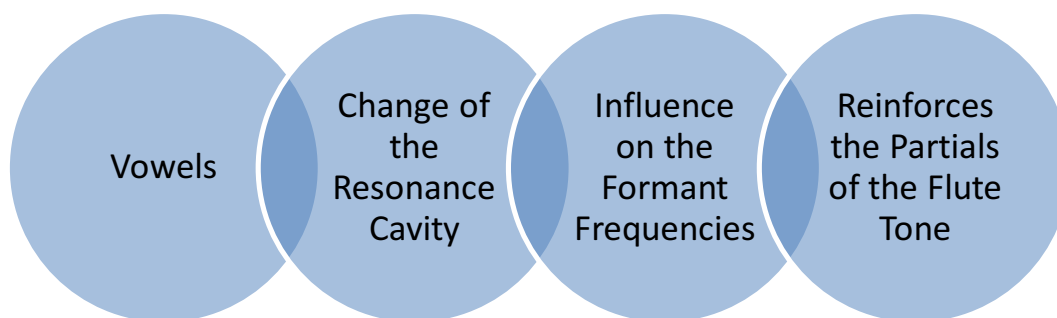
variations throughout the playing range of the saxophone, although not as significant as in comparison to the high and altissimo register. Even though scientists do not find significant influence on the effects of the vocal tract to the sound of the saxophone in the middle and low register, the subtle changes in timbre in the middle and lower register are a beautiful tool for musical expression. I really like to use vowels in the process of producing subtle changes in timbre. Vowels are a tool which help me to remember specific tongue positions and shapes of my mouth, which consequently influences the timbre.

In the case of my saxophone students, I notice it is very difficult for them to imagine the sound they want to produce. Normally, they simply blow and don't even think of the sound result. In order to help them to think about their sound and to discover different sound possibilities, I expect that vowel exercises could be very useful to them. In order to better understand how to shape the saxophone timbre with vowels, I investigated the vocalization approaches of several wind instrument players.

1.4 The Impact of Vowels in Shaping the Timbre

The use of vowels is a ground principle for tone producing according to Ioan (2007). She states that each vowel gives a different timbre to the flute tone. A vowel consists of different formant frequencies or formants. These formants have an influence on the tone color of the flute. Ioan claims that when singing a vowel, one changes the resonance cavity. This changes the formant frequencies and reinforces the partials of the flute tone (Ioan, 2007, p.64). Ioan demonstrates a series of spectrograms where she sings and plays the flute with the vowels a, e, i, o, and u. She shows that the spectrum of the flute sound changes by shaping the vocal tract as if for singing (Ioan, 2007). Ioan proved that adopting vowels while playing changes the resonance cavities, which influences the formant frequencies and reinforces the partials of the flute tone (see Figure 1).

Figure 1. Chain of events in tone producing on the flute by tuning the resonances cavities (adapted from Ioan, 2007).



In her research paper, Ioan presents a series of exercises inspired on the singing practice, in particular exercises for breathing and tone development. After exposing the exercises to a group of flute students, Ioan concludes that the exercises improve the tone quality, the inner listening and intonation, the coordination of the air column, projection and flexibility of the flute tone, and a more relaxed position of throat and larynx. The quality of the flute tone improved in general by applying singing techniques to flute playing (Ioan, 2007).

Some of Ioan's exercises focus on the vocalization process. Ioan approaches the voice as a wind instrument, with the air from the lungs as the actuator of the vocal folds. The focal folds become the primary vibrator and produce the sound wave. Ioan describes that phonation takes place in the larynx and that from there the sound passes by two important resonance cavities: the throat and the mouth or oral cavity. Furthermore, these cavities can be tuned on the same frequency as the flute sounds by adjusting the tongue, lips, jaw positions and soft palate. As a result, the cavity will start resonating and this reinforces the voice or the flute tone (Ioan, 2007). The term of this process is 'sympathetic resonance'. Flutists can train the use of sympathetic resonances to improve their flute tone with Ioan's exercises (see Figure 1). This whole process has its origin in the singing practice as described by Doscher, the author of the book *The Functional Unity of the Singing Voice* (Doscher, 1994).

Ioan's research has been very helpful to me, especially in order to better understand the process of 'sympathetic resonance'. As the saxophone is a different instrument with a different shape, I noticed there are differences in the choice of vowels in order to produce a specific timbre. In the following section, I will describe the vocalization approach of saxophonist, teacher and researcher David Liebman.

Saxophonist David Liebman uses a similar approach in his book *Developing a Personal Saxophone Sound* (Liebman, 1994). Liebman points out that the tongue position has a major influence on the direction and velocity of the airstream before it enters the saxophone mouthpiece. The airstream comes from the lungs, passes through the larynx and oral cavity and finally enters the saxophone mouthpiece. Liebman states that the goal is to create maximum velocity and minimum dispersion of the airflow to produce a well-balanced sound. The same author writes that the use of syllables can be useful for demonstrating the various tongue positions while playing the saxophone. He distinguishes three tongue positions: (i) the middle position, demonstrated with the vowel 'e' as in 'she', (ii) the low position, demonstrated with the syllable 'aw' as in 'law' and (iii) the high position, demonstrated with the syllable 'ah' as in 'father'. Liebman offers a clear strategy for the various tongue positions in order to discover different tonal shadings and maximum air velocity. He also states that the 'middle position' of the tongue (as in 'e') will result in maximum direction and velocity of air (Liebman, 1994).

I relate to Liebman's writing and like to use the vowel 'e' as in 'she' in order to improve the velocity of the air in the low register. However, I prefer the vowel 'u' as in 'you' in the

middle and high register in order to create a more round and full saxophone timbre. Whenever I use the syllable 'aw' as in the 'law' I easily lose control over my airstream and my sound becomes too open. Naturally, every musician is unique and looks for different specific tonal shadings. Therefore, opinions on which vowel is ideal, can differ between saxophonists. Also, the mother-tongue can play an important role in this preference because it naturally defines our pronunciation and consequently influences the way we play our instruments.

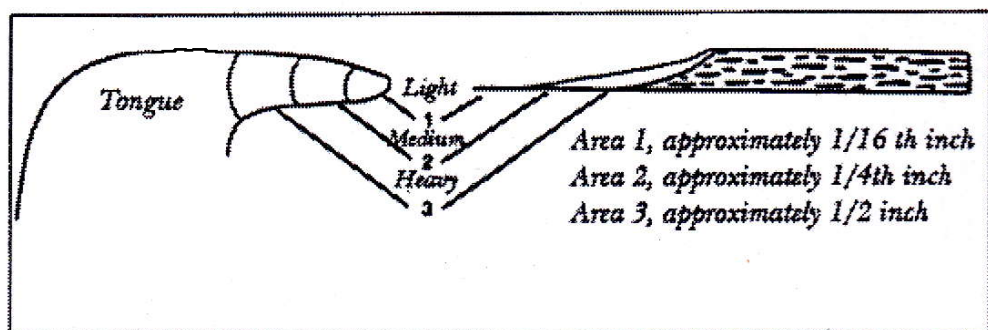
In the following section, I will further describe the impact of consonants and/or syllables in shaping articulation. Like vowels, consonants can be a tool which help wind instrument players to improve their interpretation. Moreover, consonants might be useful as tools to help my saxophone students to discover more articulation possibilities.

1.5 The Impact of Consonants in Shaping Articulation

Flutist Johann Joachim Quantz pointed that articulation is a crucial expressive element of music (Quantz, 2001, p. 71). Besides expressive nuance and phrasing, saxophonist Liebman underlines the importance of articulation in phrasing. The intensity and the type of tongue attack are important elements in determining the rhythmic flow of a phrase. Liebman states that a mature and artistic musician will vary these two factors in order to create many different types of articulation (Liebman, 1994).

In order to create articulation a saxophonist has to move the tip of the tongue upwards stroking the reed. The result is that the reed's vibrations stop for a moment, which consequently stops the sound. After the tongue releases the reed, the sound of an articulation is hearable. In Liebman's opinion, many saxophonists accept whatever tongue position as good, ignoring the numerous possibilities of tongue positions in order to articulate. Liebman (1994) categorizes three different tongue and reed areas. He states that by combining different areas, saxophonists will discover maximum flexibility in articulation (see Figure 2).

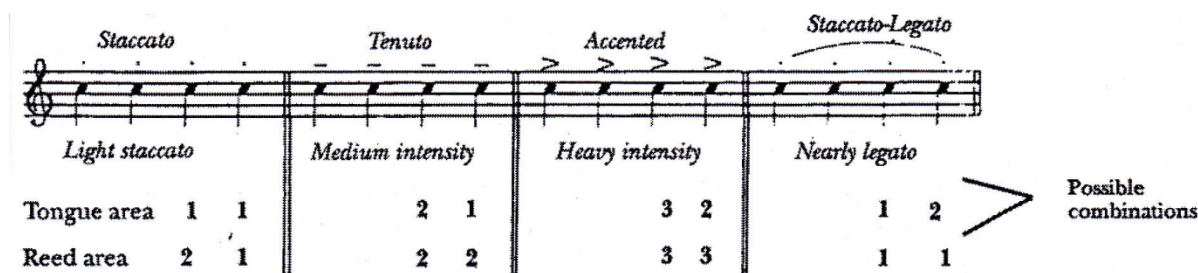
Figure 2. Tongue and reed areas according to Liebman (1994).



To visualize these tongue positions Liebman uses many syllable examples. *There are numerous syllables useful for hearing as well as conceptualizing various shadings of articulations. Some examples are tee, tay, la, lou, dee, day, etc. They differ from each other in that voice activation and the vowel sounds after the initial bring about different results* (Liebman, 1994, p. 27).

In order to train articulation Liebman proposes the so-called 'middle position' with the vowel 'e' (as in the word 'she'). According to Liebman, this tongue-position not only maximizes the direction and velocity of the airstream, but also places the tongue in a strategic position in relation to the edge of the reed. The tongue naturally strokes the reed while using the least amount of motion (Liebman, 1994). Liebman gives a series of further examples using consonants in order to train the articulation. He mentions the following examples: (i) 'tee', (ii) 'dee', (iii) 'ke-ge' and (iv) 'n'). Every example relates to a specific reed area as demonstrated in Figure 3.

Figure 3. Overview of several types of articulation with corresponding tongue and reed areas according to Liebman (1994). The tongue and reed areas are defined in Figure 2.



Liebman proposes to use the consonant 't' in order to play a light staccato (area 1), the syllable 'the' in order to play tenuto (area 2) and the consonant 'n' in order to play an intense articulation (area 3). Quantz uses a similar approach with several syllable examples such as 'ti' and 'di'. According to Quantz, the syllable 'ti' should be used for short, equal, lively and quick notes, while the contrasting syllable 'di' "must be used in slow melodies (Quantz, 2001, p. 71 – 72).

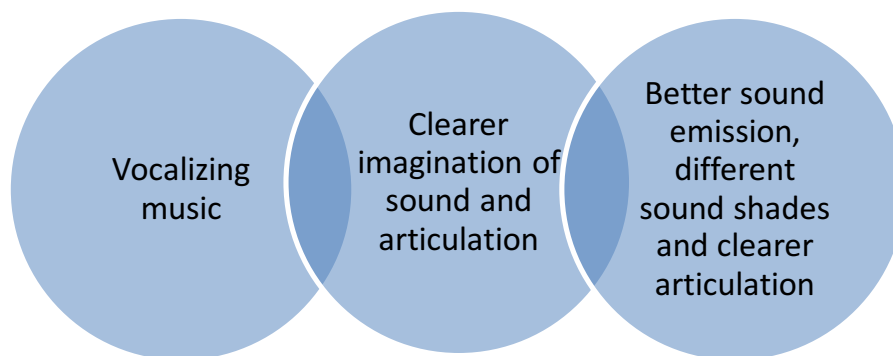
Another musician who uses syllables as a strategy to improve a musical interpretation, namely the timbre and the articulation, is saxophonist Fernando Ramos, one of the most prolific and multidisciplinary Portuguese saxophonists. Between 2011 and 2013 I studied saxophone with Fernando at the Escola Superior de Música e Artes de Espectáculo [ESMAE] in Porto, where Ramos is a saxophone and chamber music teacher since 2001. During that period I had the opportunity to learn how to use syllables as tools to improve my musical interpretation. Besides ESMAE, Ramos teaches at the Aveiro University (since 2005) and at the Escola Profissional de Música de Espinho (since 2009). Ramos plays a crucial role in saxophone teaching in Portugal as he 'raised' a new generation of performers and teachers. Ramos is regularly invited to be a jury

member at music competitions in Portugal and Spain and gives saxophone masterclasses throughout Europe. Besides his innumerable activities as a teacher, Ramos is an active musician and a core member of QuadQuartet, KinetixTRIO (with Sergio Carolino & Jeffery Davis), STP|Trio (with Gonalo Dias and Telmo Marques), Grain[z] (with Nuno Aroso and Dimitris Andrikopoulos) and KinetixDuo (with Jeffery Davis), and in 2010 founded the F.L.U.X Collective with all of which he has performed throughout Europe. Amongst a variety of ensembles and orchestras, Ramos has performed with the Remix Ensemble-Casa da Msica, Educational Department-Casa da Msica, the Portuguese Saxophone Orchestra, and the Porto Symphonic Orchestra - Casa da Msica. Fernando actively works together with various composers in creating a new saxophone repertory having more than 40 works dedicated to him both solo pieces and for the diverse ensembles he belongs to. He has performed at the Berlin Philharmonic, Concertgebouw Amsterdam, Casa da Msica, Splendor Amsterdam; Teatro Helena S e Costa, amongst many other concert halls. At this moment he is completing his Doctorate degree in Performing Arts at the University of Aveiro and is working on his first solo cd.

In the vocalization approach of Ramos, the first step to improve timbre and articulation is a stable sound with maximum air velocity and minimum waste. Ramos proposes a relaxed body position, a stable breathing and a not too open position of the tongue as in the syllable 'she'. This is very comparable with Liebman's so-called 'middle-position' with the vowel 'e' as in 'she' (Liebman, 1994).

When a student is able to maintain a relaxed body position, he/she can focus on the use of syllables to alter the timbre. Ramos proposes that a student instinctively vocalizes music by imagining and singing the vocal sounds that could fit into the style of the piece. It is helpful for the student to have these syllables written into the musical score. Afterwards the student can try to imitate these vocal sounds. Automatically, the student will improve the timbre due to the change of the syllables.

Figure 4. Vocalization approach of saxophonist Fernando Ramos.



Ramos states that the right choice of syllable will contribute to a more interesting musical interpretation, in particular to a better control of the airstream in general and in different dynamical ranges, a controlled change between registers and a bigger variety of timbre and articulation. The vocalization approach of Ramos, as demonstrated in Figure 4, results in a clear imagination of sound and subsequent articulation possibilities. This consequently augments the color palette available to the performer and allows a vaster array of articulation options that the performer can apply within various musical contexts.

The use of linguistic elements assists the saxophonist to experiment with different timbre and articulation variations. Besides this, the syllables help a saxophonist to feel the tongue positions directly in the mouth cavity, which helps to produce a more clear articulation base as a whole. It seems that vocalizing with syllables has a strong influence on tone producing and that vocalizing helps to develop a more stable saxophone sound and provides a wider color palette to the performer.

In sum I learned with Fernando Ramos, that I can try to instinctively vocalize the music I play, by imagining and singing the vocal sounds that could fit into the style of the piece. If necessary, I can write these syllables in the musical score and afterwards try to imitate these vocal sounds. Automatically, I will improve timbre and articulation due to the change of vowels and consonants. From here on, I can create more simplified exercises for my students in order to help them to train the inner listening and to discover more timbre and articulation possibilities.

Chapter 2

2.1 Beginning saxophone students and their lack of musical imagination

As a saxophone teacher of mainly beginning students, I often see my students struggling with the development of a stable saxophone sound. They face difficulties in maintaining a stable breathing and embouchure, which results in sound emission problems. The development of a stable saxophone sound is a process, which takes time and training. Good indications of the teacher might help the student to improve the sound quality. However, many initiation saxophone students regularly face difficulties in maintaining a steady sound. In addition, students who play for three or four years often keep struggling with the development of a beautiful sound and the ability of applying a bigger variety of timbres.

Also, many of my second, third and fourth grade students reveal difficulties in interpreting a musical piece. Every time there are specific articulation or dynamical indications written into the musical score, I need to remember them to execute these indications. Even after remembering them once or twice, they still forget to play with the denoted articulations and dynamics.

Reasons for these difficulties in terms of sound, articulation and playing with dynamics, might be that students experience overall difficulties in imagining the music before or while they play it. A possible reason for this lack of imagination might be that many teachers mainly focus on the right execution of the written music. However, I believe it is essential to create methods in order to help students to create the ability of imagining the music they want to play in their minds. In other words, students need to create a 'musical soundtrack' in their minds of the music they want to execute, instead of simply reading, blowing and opening and closing keys on their instruments. A first step towards the improvement of the inner listening and imagination of the music might be singing or vocalizing.

Many saxophonists wrote about the positive relation they experience between vocalizing and playing the saxophone (Liebman, 1994; Rascher, 1994). Vowels seem to be useful as tools to improve the saxophone timbre. In addition, consonants seems to be useful as tools to improve articulation. Singing in general seems to help students to imagine the music, which consequently might help them to create a clearer image of sound and articulation and the use of dynamics. However, most of the existing information and developed exercises focus on advanced saxophone students. There is little information available about the possible effects of the implication of vocalizing, i.e. singing and playing with syllables, in the classroom with saxophone students who play for two, three or four years. Therefore, I expect that my research will be valuable for saxophone teachers who want to help their beginning and third and fourth

grade students in order to develop a stable saxophone sound, and the ability to play with dynamics and articulation. In addition, I expect that by investigating the possible relation between vocalizing and playing the saxophone on a short and long term will help me to improve my teaching methods.

2.2 Hypothesis and theme

In sum, three questions arise from the above written text:

1. Are vowels useful as tools to improve the tone quality of third and fourth grade saxophone students?
2. Are consonants useful as tools to improve the saxophone articulation of third and fourth grade saxophone students?
3. Does singing help third and fourth grade students to play with a larger dynamic range?

I raised the following hypothesis:

Vocalizing with syllables has a noteworthy influence on the (1.) tone quality, (2.) the use of dynamics and (3.) articulation of initiating saxophone players.

2.3 Aim of the research

In this research, I will focus specifically on the tone quality and the use of articulation and dynamics of initiating saxophone players between the third and fourth grade of the Portuguese music system. I chose to work with students of this level because these students are able to read music and know how to produce a sound. In addition, students of this level have had three or four years of saxophone lessons and are able to start thinking about their sound, articulation and use of dynamics.

I propose the following theme:

In this educational project, the aim is to develop a vocalization method in order to help initiating saxophone students to improve their tone quality and the use of articulation and dynamics, by singing and playing with syllables. By singing and playing with syllables, the students are challenged to alter the tongue position, which influences the resonance cavity and results in different tonal shadings and articulations. Finally, by singing, the student is challenged to imagine the music before he or she plays it, which might influence the use of dynamics.

Between 2011 and 2013 I studied with Fernando Ramos and during that time I learned a lot about how to use vocalization in order to develop articulation and timbre on the saxophone. Ramos is developing a PHD thesis wherein he focusses on vocalization on a superior level. My

educational project differs from Ramos' PHD thesis in the way that I focus on initiating saxophone students, who start to learn how to apply vocalization in their daily practice, while Ramos focusses on vocalization of saxophonists in general and especially on a superior level.

2.4 Objectives and research plan

In order to test the hypothesis, I formulated the following objectives:

1. To deepen my knowledge about vowels and consonants.
2. To sing and play with vowels and to discover if vowels are useful as tools to improve my own tone quality on the saxophone.
3. To sing and play with consonants and to discover if consonants are useful as tools to improve my articulation.
4. To develop two vocalization exercises for third and fourth grade students.
5. To set up an experiment and to discover if these exercises help third and fourth grade students them to improve their tone quality, articulation and the use of dynamics.

During the last years, I have studied the place and manner of articulation of vowels and consonants. From there on I experimented by imitating as much vocal sounds as possible with my saxophone in order to develop my own vocalization approach. Chapter 3 describes the knowledge I gathered on vowels and consonants and my own experiences on singing and playing with syllables. In addition, chapter 3 describes which vowels and consonants fellow saxophonists prefer to play with and why. With this information, I will be able to further develop two more simplified vocalization exercises and to execute the experiment with third and fourth grade saxophone student, which I will describe in Chapter 4.

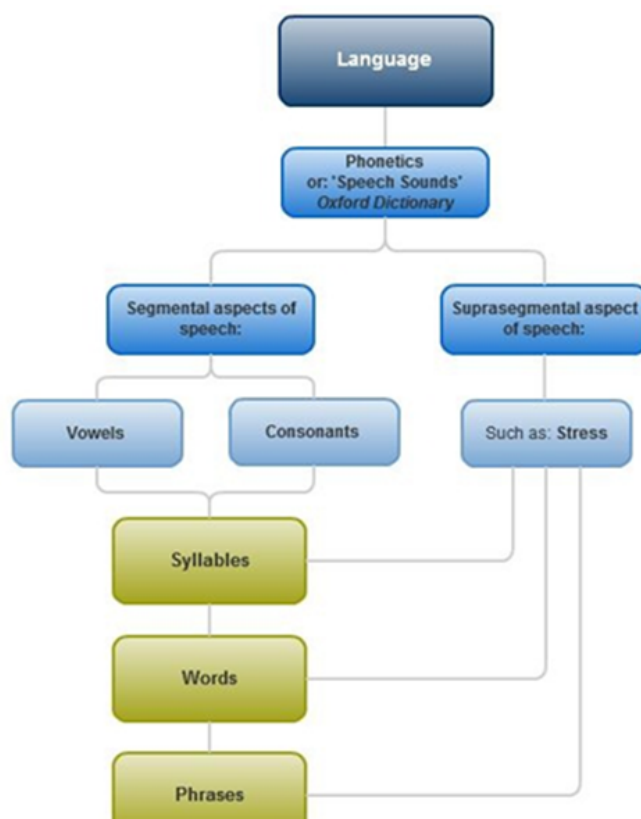
Chapter 3 – Syllables as strategy to develop timbre and articulation on the saxophone

In the following chapter, I will further explore the relationship between vowels and timbre, and consonants and articulation. The established correspondences are based on the place and manner of articulation of the vowels and the consonants, related to the formation of timbre and types of articulation of the saxophone. The chapter starts with an overview of the basic linguistic terms and a parallel between linguistic and musical terms.

3.1 Basic linguistic terms

Language is articulated through phonetics or speech sounds (Oxford Dictionary Online, 2013). Phonetics is the basic unit of spoken language and it can be divided into two groups: (i) vowels, such as: a, e, i, o, u, and (ii) consonants, such as b, d, n, r, c. Vowels and consonants are the elementary units of spoken language and are therefore called segmental aspects of language. The combination of various phonemes allows the creation of higher-level elements of the language called syllables. Groups of syllables form words and consequently groups of words form phrases (see Figure 5 for an overview of the hierarchical organization of linguistic elements and their mutual relationship).

Figure 5. Overview of the hierarchical organization of the basic linguistic elements and their mutual relationship.



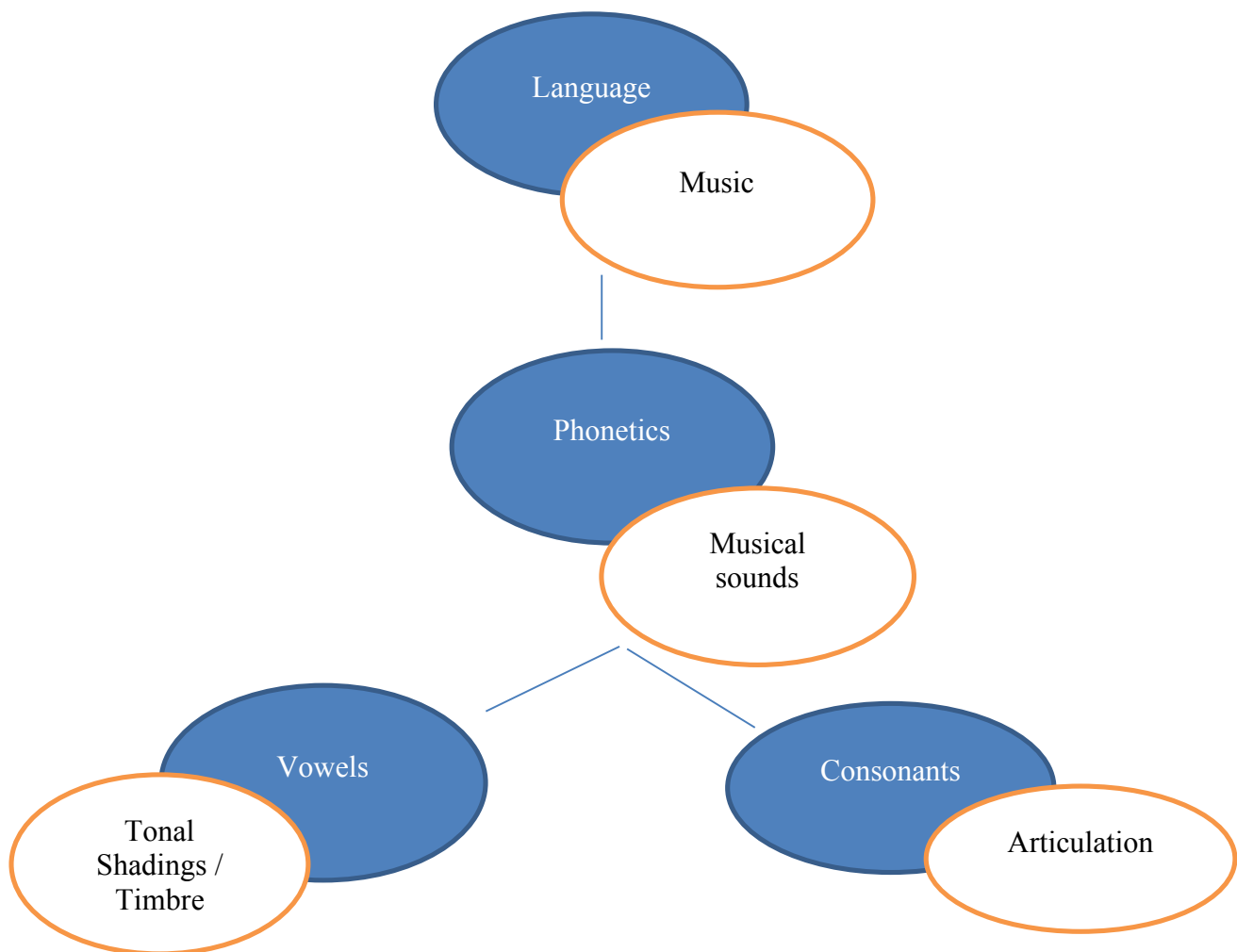
Prosody is the patterns of stress and intonation in language (Oxford Dictionary Online, 2013). Prosody can be improved through intonation, loudness, timing and stress. These properties of spoken language are called supra-segmental aspects of speech, as they tend to form patterns that vary independently of the segmental aspects or extend over several segments (IPA, 1999).

In my approach of using linguistic elements such as vowels or consonants as tools to improve musical performance, the Handbook of the International Phonetic Association has been very useful to me (IPA, 1999). The International Phonetic Association (hereafter, IPA) promotes the study of phonetics and its various applications. The IPA was founded in 1886 and developed a series of symbols that cope with the wide variety of sounds found in languages all over the world since then. In 1999, the IPA published the Handbook of the International Phonetic Association, a Guide to the Use of the International Phonetic Alphabet (IPA, 1999), which has a great importance for this research as it promotes a clear and basic knowledge about language and particularly about phonetics. Of notice is that the acronym IPA not only refers to the name of the association, but also to their work, namely the International Phonetic Alphabet. In the following section I will set out some parallels between linguistic and musical terms.

3.2 Parallels between linguistic and musical terms

The IPA distinguishes vowels from consonants by the way they are produced in the mouth. Speech involves narrowing and opening of the vocal tract (IPA, 1999). While consonants involve narrowing or ‘stricture’ of the airflow, vowels imply a more open articulation. The IPA makes a distinction between vowels and consonants in their alphabet reflecting the different ways they are produced in the vocal tract. Figure 6 establishes a parallel between linguistic and musical terms of interest here.

Figure 6. Parallel between linguistic and musical terms.



Vowels imply an open articulation, which means that little or no narrowing is necessary for the production of vowels in the mouth. The most common approach to saxophone playing implies a similar position, i.e., an open or slightly narrowed position of the vocal tract. In order to produce a sound on the saxophone a constant airflow from the lungs to the mouthpiece is

necessary, which is only possible with an open vocal tract. However, to maintain the airflow constant for a certain amount of time, it is important not to open the vocal tract as wide as possible because the air will disappear in a very short amount of time. A slightly narrowed vocal tract will be more effective to maintain a stable airflow.

The production of consonants differs substantially from vowels, since it involves narrowing or 'stricture' in the vocal tract. Each consonant involves a closure of the vocal tract, followed by an opening of the vocal tract. For example, producing the word 'banana' involves three closures of the vocal tract followed by three openings of the vocal tract (IPA, 1999, p. 6). A similar process happens in order to produce saxophone articulation. The tip of the tongue touches the reeds and stops the airflow for a moment, followed by a sudden release of air. This results in an articulation.

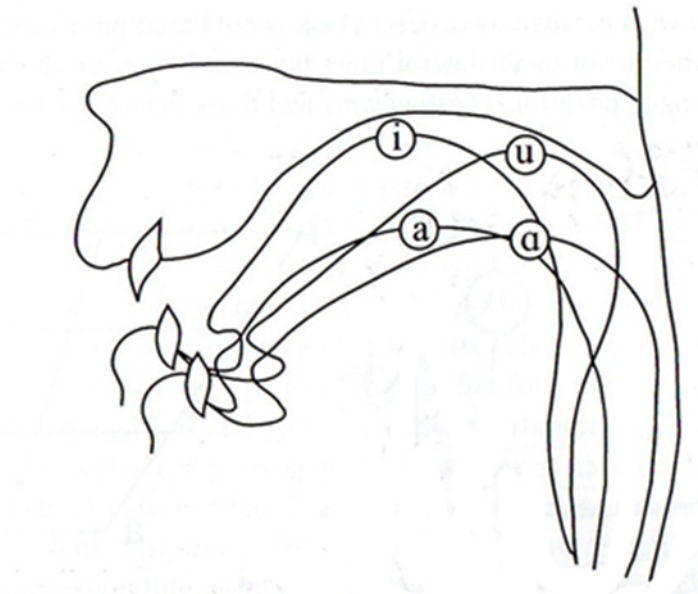
Linguistic stress is the emphasis given to a particular syllable or word in speech. Stress improves communication because it enhances the most important words of a sentence. The use of stress in language improves the natural flow of speech. Linguistic stress is comparable with agogic in music. Agogic is the emphasis given to a certain note by expressive means. The slight lengthening of a note underlines the importance of a certain note and improves the direction of a musical phrase. The use of dynamics, accentuation, vibrato, color and intensity may also contribute to the enlightenment of a particular note. In an instrumental class, it is helpful to motivate a student to sing from his or her score. Whenever the student is able to sing, he or she will naturally develop musical phrasing while singing. The use of dynamics and maintaining the direction of the phrase will become clearer when the student tries to play the music on his or her instrument.

Wolbers describes a helpful exercise in order to help students improve their performance by singing their parts (Wolbers, 2002). He suggests that band leaders write a melody on a board and ask students for detailed suggestions concerning the unwritten dynamic nuances. Afterwards the students try to sing the melody with the proposed dynamics. *It is often amazing how the voice will make the phrase shapes sound natural. In addition, the breathing points will manifest themselves, and the line will take on human, not mechanical, characteristics* (Wolbers, 2002).

3.3 The impact of the four extreme vowels in shaping the saxophone timbre

Vowels imply an open articulation. It means that little or no narrowing is necessary for the production of vowels in the mouth. Figure 7 depicts the most extreme tongue positions in the mouth for producing vowels. The IPA (1999) describes these four vowels as the four extreme vowels because in order to produce them the tongue assumes the most possible extreme positions in the mouth (see Figure 7).

Figure 7. Place of the tongue during the production of the four extreme vowels (IPA, 1999, p. 11).



The position of the vocal tract during the vowels' production is comparable with the position of the vocal tract while playing a wind instrument such as the saxophone. Saxophonists commonly control the vocal tract opening by the position of the tongue in the mouth (see §1.3). This is comparable with the production of different vowels due to different tongue positions in the mouth.

The IPA distinguishes the following four tongue positions depending on how close the tongue is from the palate: (i) close, (ii) open, (iii) front and (iv) back. A close position means that the tongue is close to the hard palate, while an open position means that the tongue is far from the hard palate. The front and back positions of the tongue depend on the position of the tongue towards the front or the back part of the mouth. A front position means that the tip of the tongue is in front of the mouth. A back position means that the tip of the tongue is in the back part of the mouth. Table 2 describes the tongue positions in the vocal cavity for each of the four extreme vowels.

Table 2. Overview of the four extreme vowels and their tongue positions according to IPA (1999).

Vowel	Word Example	Tongue Position
i	'she' (English)	Close and front.
α	'calm' (English)	Open and back
u	'you' (English)	Close and back.
a	'cat' (English)	Open and front.

Of notice is that the IPA (1999) uses the vowel 'i' but Liebman (1994) uses the vowel 'e' to describe the sound of the same vowel namely as in the word 'she'.

My personal experience while playing with the four extreme vowels denotes considerable changes in my sound each time I change to a different vowel. Table 3 shows the expected results on the saxophone timbre when a saxophonist imitates the tongue position of the four extreme vowels.

Table 3. Overview of the four extreme vowels and the expected results on the saxophone timbre.

Vowel	Expected results in the saxophone timbre
i	Projected and very compact sound
α	Very open sound without projection
u	Projected and round, brilliant sound
a	Brilliant sound without projection

In the following section, I will describe the experiences of colleague saxophonists on singing and playing with vowels based on an experiment I developed in 2013 (Geest).

3.3.1 Experiences of colleague saxophonists on singing and playing with vowels

In 2013, I raised the hypothesis that the use of the four extreme vowels would shape the saxophone timbre significantly (Geest, 2013). Researchers such as Ioan (2007) and Liebman (1994) support this hypothesis. I developed an experiment, applying a convenience sample procedure to measure the relation and influence of linguistic to musical features. A group of highly trained saxophonists participated in the research experiment to evaluate how linguistics might improve musical performance. I developed a series of exercises to improve timbre, articulation and phrasing by singing with vowels, consonants and song excerpts. I recorded all of the participants before and after they studied the exercises, and presented the results to a group of experienced saxophone teachers from Portugal and The Netherlands.

According to the experts' evaluation, the difference in the evaluation prior to and after the exercises was non-significant (Geest, 2013). One possible explanation might be that perhaps the participants would need more time to interiorize the new study approach. Another explanation might be that the jury couldn't notice the small and delicate changes in timbre, articulation and musical phrasing on the recordings and that live evaluation might have given significant results.

However, the results of the participants' questionnaires indicated that the totality of participants referred sound differences each time they changed to a different vowel. Furthermore, the majority of the participants pointed that the exercises made them more aware of timbre possibilities and helped them to create a clear idea about which saxophone timbre to apply in various musical contexts. In this way, I concluded that the proposed vowel exercises helped all of the participants to discover a bigger variety of tonal shadings on the saxophone (Geest, 2013).

The majority of the participants indicated the vowel 'u' as their favorite vowel. Participants commented that the vowel 'u' gave a warm, full and dark saxophone timbre and a projected sound. This preference of the participants differs from Liebman who proposes the 'i' (as in the word 'she') as the ideal tongue-position in order to create maximum velocity of air, and minimum waste.

Although the vowel 'i' (as in the word 'she') is more closed (IPA, 1999) and offers an optimal airflow according to Liebman (1994), the majority of the participants of my 2013 study referred to 'u' as the vowel which is comfortable to imitate on the saxophone and results in a warm saxophone sound. A possible explanation for this difference is that the research experiment did not focus on the projection of the saxophone sound. The participants evaluated their own sound by listening to themselves while playing. The sound of the vowel 'u' (as in the word 'you') may result in a full and warm sound close to player, but will probably have less projection especially in a larger room, then the vowel 'i' (Geest, 2013).

There was no general tendency regarding to the vowels the participants did not like. A small group of participants did not like to imitate the vowel 'α' (as in the word 'calm') on the

saxophones. The main pointed reason was the too open sound result, the not functionality of the vowel in combination with the mouthpiece and reed choice and the too open throat which tires the player. This dislike is in line with Liebman (1994) who propose a not too open tongue-position in order to maintain stable airflow (Geest, 2013).

It remains clear that vowels seem to have a strong influence on tone producing and that using vowels helps developing a personal sound. In the following sections I will describe the effect of consonants on shaping articulation on the saxophone.

3.4 Place and manner of articulation of consonants

The production of consonants differs significantly from the production of vowels, namely because consonants demand narrowing the vocal tract. The IPA categorizes the consonants according to the following two parameters: (i) place and (ii) manner of articulation. The place of articulation describes where the tongue touches the mouth in order to produce a consonant. Figure 8 depicts the various elements that compose the vocal tract. For example, the place of articulation of the consonant 'd' is alveolar. In order to produce the consonant 'd' the tongue has to touch the alveolar ridge in the mouth. The manner of articulation describes how a consonant is produced in the mouth. For example, the consonant 'd' implies a plosive way of articulation. This means that in order to produce the consonant 'd' the tongue touches and releases the alveolar ridge in the mouth. This results in a sudden release of air, which is called a plosive manner of articulation. The other manners of articulation are nasal, trill, tap or flap, fricative, lateral fricative, approximant and lateral approximant (IPA, 1999).

Figure 8. Vocal tract with labels for place of articulation (IPA, 1999, p. 7).

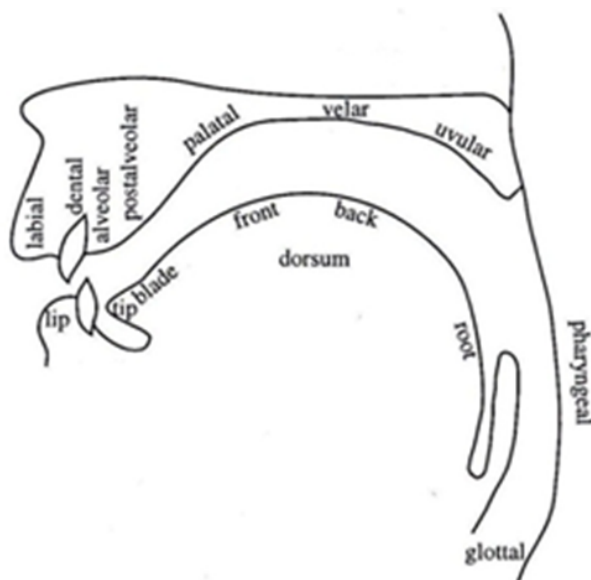


Table 4 demonstrates some examples of consonants and their manner and place of articulation, according to the IPA (1999).

Table 4. Examples of consonants and their manner and place of articulation according to IPA (1999).

Consonant	English Word Example	Manner of Articulation	Place of Articulation
b	'bear'	Plosive	Bilabial
d	'dear'	Plosive	Alveolar
f	'fat'	Fricative	Labiodental
j	'you'	Approximant	Palatal
l	'lie'	Lateral Approximant	Alveolar
n	'no'	Nasal	Alveolar
t	'toe'	Plosive	Alveolar

It remains clear that the use of different consonants results in different saxophone articulations. I feel supported in this assumption by my former teacher Fernando Ramos, and by researchers such as Liebman (1994) and Quantz (2001). Ramos states that the use of vocalization gives a clear imagination of sound and improves the clearness of the articulation. Liebman proposes the use of consonants such as 'd', 't', 'k' and 'n' in order to produce different types of articulation.

I have tried to establish a link between all consonants and different type of articulation on the saxophone. In order to do so, I studied the manner and place of articulation of each consonant as described in the IPA, and attempted to replicate it as different modes of articulation. I discovered that consonants have an influence on my saxophone articulation in two different ways:

1. Consonants help discovering and improving different articulations on the saxophone;
2. Consonants are a useful support do develop extended techniques on the saxophone.

An extensive explanation of the two aforementioned topics follows.

3.5 The impact of consonants in shaping the saxophone articulation

I have tried to apply any kind of consonant of the alphabet as modes of articulation on the saxophone. This helped me to think about how I articulate. The systematic approach to articulation is interesting, because it offers a different way of understanding and developing a saxophone articulation. Traditional indications such as legato, staccato and tenuto are necessary and indicate very clearly the type of articulation a composer wants to hear. However, these indications do not function as strategies to develop articulation. Consonants help to feel the

position of the tongue in the mouth and help the saxophonist to create a clearer idea of what each articulation should sound like. In this way, consonants can be used as a complementary strategy to explore the many possibilities of saxophone articulations.

From all existing consonants, saxophonists may use the consonants 'd' and 't' to improve existing saxophone articulations (see Table 5). These two consonants are directly applicable to the saxophone articulation because their manner and place of articulation stand very close to the embouchure of a saxophonist. Table 5 demonstrates the two consonants and their expected results on saxophone articulation.

Table 5. Overview of two directly suitable consonants and the expected results on the saxophone articulation.

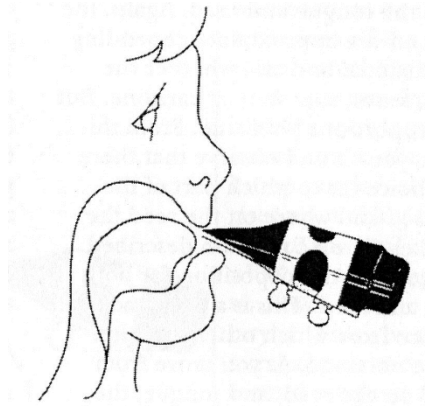
Consonant	Expected saxophone articulation
d	Short, soft and clear articulation (<i>tenuto</i> -like)
t	Very short and clear articulation (<i>staccato</i> -like)

I expect the consonant 'd' to result in a type of articulation comparable to tenuto and the consonant 't' in a type of articulation comparable to staccato. In my experience, the application of these consonants in the saxophone articulation helps to define saxophone articulations such as tenuto and staccato. By imitating the place and manner of articulation of the consonants 'd' and 't', I created a clearer concept of tenuto and staccato, which resulted in a clearer articulation on my saxophone.

Both consonants ('d' and 't') have a plosive manner of articulation and are produced at the alveolar ridge in the mouth. The consonants are directly applicable as modes of articulation because of the following two reasons:

1. The place of the articulation of the consonants is in front of the mouth and the application to the saxophone articulation will be close to the tip of the mouthpiece and the reed (see Figure 9);
2. The manner of articulation of the consonants implies a stricture of air by holding the tip of the tongue to the hard palate (alveolar ridge) followed by a sudden release of air. This is very much comparable with the stricture of the airflow by holding the tip of the tongue against the tip of the reed, followed by a sudden release of air in order to produce a saxophone articulation.

Figure 9. Position of the saxophone mouthpiece in the mouth.



I can conclude that imitating the production of consonants on the saxophone results in a clearer articulation. In addition, by imitating the sound result of not-directly suitable consonants a saxophonist can develop a greater variety of articulations. In the following section I will describe how saxophonists can use consonants as a strategy to discover different articulations on the saxophone.

3.5.1 Consonants as strategy to discover different articulations on the saxophone

I noted that many of the consonants were not directly applicable as modes of articulation in the saxophone because they imply a manner and/or place of articulation that conflicts with the saxophone embouchure or the airflow. Among the consonants that are not directly suitable for the saxophone articulation I may mention: 'b' (plosive, bilabial), 'c' (plosive, palatal), 'f' (fricative, labiodental), 'g' (plosive, velar), 'h' (fricative, glottal), 'l' (lateral approximant, alveolar), 'm' (nasal, bilabial), 'n' (nasal, alveolar), 'p' (plosive, bilabial), 's' (fricative, alveolar), 'v' (fricative, labiodental), 'x' (fricative, velar) and 'z' (fricative, alveolar).

The fact that not all consonants are directly suitable as modes of saxophone articulation did not prevent me from trying to imitate the sound result of the consonants. In other words, I did not try to imitate the place and manner of articulation of this group of consonants; instead, I tried to imitate its sound result. With this strategy, I have discovered different types of articulation on the saxophone, which I did not use before. An example of this is the consonant 'n'. The place of articulation of this consonant is on the alveolar ridge in the mouth and the manner of articulation is nasal. This means that the articulation of the consonant 'n' implies a closure of the tip of the tongue to the alveolar ridge and a lowering of the velum (soft part of the palate at the back of the mouth), which results in a contribution of the nasal cavities to the sound. The place of articulation of this consonant is not a problem for the imitation to the saxophone articulation. However, the manner of articulation is nasal, and this is impossible to imitate on the saxophone,

because playing the saxophone implies a direct airflow from the lungs through the vocal tract into the mouthpiece. However, the sound result of the consonant 'n' could be described as soft and long and this sound result is possible to imitate on the saxophone. Studying with the consonant 'n' allows the saxophonist to explore possibilities of a tenuto-like articulation.

In sum, the consonants that are not directly suitable as modes of saxophone articulation, can be useful as sound references, which can be imitated on the saxophone to discover different articulations. Table 6 demonstrates two examples of these types of consonants and their expected sound results.

Table 6. Overview of some of the not-directly suitable consonants and the expected saxophone articulation.

Consonant	Expected Saxophone Articulation
n	Very soft and long articulation
h	Articulation using only the airflow

Figure 10 and 11 demonstrate examples of excerpts of saxophone music where one might respectively use of the consonants 'n' and 'h' in order to play with the desired saxophone articulation. It is important to note that the way people pronounce each consonant differs from person to person, depending on their mother-tongue. For example, as a native Dutch speaker, I pronounce the consonant 'h' with an airflow coming from the back of my mouth, while Spanish or Portuguese native speakers only pronounce the vowel that follows after a word that starts with the 'h'. Therefore, the examples of Table 6 are personal examples that serve as an example for anyone who wishes to create his or her own consonant examples.

Figure 10. Example of the use of the consonant 'n' in an excerpt of 'Concerto' written by A. Glazunov and A. Petiot (1936).

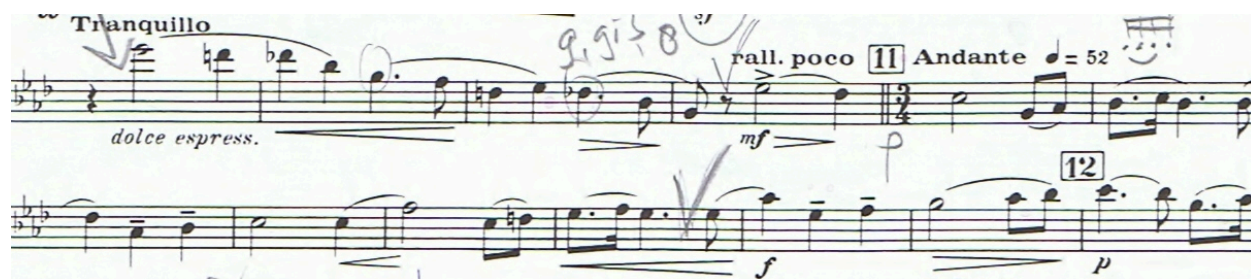


Figure 10 demonstrates an excerpt of the 'Concerto' for alto saxophone and piano (Glazounov & Petiot, 1936), one of the main works of the classical saxophone repertoire. In the *Andante* part, all the notes that don't have *legato*-slurs need a soft articulation and a constant

airflow in order to maintain the tension of the musical phrase. The notes 'a' (lá) and 'b' (si) in the second line of the example in Figure 10, need to be played *tenuto*. In order to create a very soft and *legato*-like articulation without losing the air pressure, I like to imitate the sound of the consonant 'n'.

Figure 11. Example of the use of the consonant 'h' in an excerpt of the second movement of the work 'Tre pezzi' by Giacinto Scelsi for soprano or tenor saxophone solo (1999).



With 'Tre pezzi', written in 1956, composer Giacinto Scelsi explores the complex and innumerable nuances that could be generated from a single note. He challenges the performer to

not only play with an extreme variety of dynamics as with a variety of tonal shadings. With this 'Scelsi-like' use of dynamics and a horizontally written (broken) harmony of notes that keep coming back, several musical layers are created that seem to have a conversation throughout the work. When I studied this work, I liked to use the consonant 'h' as a sound example in order to create a sound that seems to appear out of nowhere. Examples in Figure 11 are the pianissimo 'd' (ré) and a-flat (lá-bemol) on the second line and the pianissimo g (sol) at the fifth line.

3.5.2 Consonants as strategy to develop extended techniques on the saxophone

Besides the focus on saxophone articulation, the use of consonants may be fruitful for training several extended saxophone techniques. Therefore, I will provide limited information concerning the use of consonants as a strategy for improving extended techniques on the saxophone.

Extended saxophone technics imply radical changes to the most common tongue position while playing, and many saxophonists have difficulties producing them. The use of consonants such as 'j', 'k', 't' and 'r' can be very helpful in the study of technics such as vibrato, double-tonguing and Flatterzunge. For example, as a Dutch native speaker, the consonant 'r' helped me to develop my Flatterzunge. In order to produce the consonant 'r' with the Dutch pronunciation, my tongue touches the alveolar ridge of my mouth. The air that passes through the mouth is interrupted by the tip of my tongue, which results in a tap of trill manner of articulation. When I place my tongue slightly on top of the tip of the mouthpiece and try to imitate the consonant 'r', the sound result is a Flatterzunge. Table 7 depicts some of the consonants, which might be helpful in the development of extended saxophone technics.

Table 7. Overview of four useful consonants to develop extended saxophone technics.

Consonant	Word Example	Place and Manner of Articulation	Saxophone Technic	Reference
j (+ 'u')	'you-you-you' (English)	Fricative, palatal	Vibrato	Empirical research by Fernando Ramos
k + t	'keh-teh-keh-teh' (English)	Plosive, velar / Plosive, alveolar	Double-tonguing	Liebman, 1994, p.27
r	'raam' (Dutch)	Tap or Trill, alveolar	Flatterzunge	Empirical research

It is very important to realize that the expected result of each consonant strongly depends on the saxophonist's mother tongue. Since my mother tongue is Dutch, the consonant 'r' as I pronounce it will result in a Flatterzunge when I imitate the consonant with my saxophone.

However, the Dutch 'r' differs very much in pronunciation from the English or the Portuguese 'r'.

In the following section, I will describe the experiences of colleague saxophonists on singing and playing with consonants (Geest, 2013).

3.5.3 Experiences of colleague saxophonists on singing and playing with consonants

Fellow colleague saxophonists who participated in my research in 2013, studied exercises with the syllables 'du', 'tu' and 'nu'. After they sung the exercises, they tried to imitate the vocal sounds they sung, with the saxophone. Results from the questionnaires indicated that the great majority of participants referred that the exercises regarding consonants and articulation were helpful to explore a bigger variety of articulations on the saxophone. In sum, they gained a better control over their articulation and discovered new types of articulation. Some of the participants commented that they were already familiar with the use of consonants as modes of articulation, because of their work with saxophone teacher Fernando Ramos.

The results of the experiment showed that the influence of consonants to articulation is less significant than the influence of vowels to the saxophone timbre. Although most of the participants indicated in the questionnaire that the exercises regarding consonants and articulation were helpful to explore a bigger variety of articulation on the saxophone, it did not show in the recordings as evaluated by the experts.

The results of the participants' questionnaire regarding the relation between consonants and articulation were generally in line with researchers such as Liebman (1994) and Quantz (2001). Liebman and Quantz both propose the consonants 't' for *staccato* and lighter articulation, and 'd' for softer, *tenuto*-like articulation. The participants mentioned that the consonants 'd' and 't' were easy to apply as modes of articulation on the saxophone. The consonant that the majority of the participants preferred to use was 'd'. Reasons for that choice as indicated by the participants were the soft and clear articulation results on the saxophone.

Almost half of the participants indicated that their articulation had changed after they studied the exercises. The majority of the participants noticed the positive effects of using consonants as a strategy to discover a bigger variety of articulation and mentioned they would like to continue exploring the articulation possibilities.

In the following chapter, I will describe the experiment protocol. I will demonstrate the exercises I developed for saxophone students, in order to develop their musical performance, namely their sound, articulation and use of dynamics. The experiment I developed in 2013 (Geest) has been very helpful to me in order to develop the actual experiment.

Chapter 4 – Experiment Protocol

Introduction

In order to help my students to develop the quality of their sound and articulation, I first tried to develop my own sound and articulation. I studied the Handbook of the International Phonetic Alphabet (IPA, 1999) which gave me a deeper understanding of vowels and consonants and their place and manner of production in the mouth. Next, I tried to sing with vowels and consonants and tried to imitate these vocal sounds with my saxophone. I discovered that some vowels and consonants felt more comfortable to imitate than others. Also, I discovered that singing helped me to naturally develop my musical interpretation, such as phrasing and playing with dynamics.

Second, I tried to apply the vocalization approach of Fernando Ramos, by instinctively vocalizing music and by imagining and singing the vocal sounds that could fit into the style of a piece. I experimented to write these syllables into the musical score and tried to imitate the vocal sounds. I noticed that my study became more effective and that I was able to play with a bigger variety of tonal shadings and a clearer articulation.

In addition, I used the results of the experiment I developed in 2013 (Geest, 2013). During this experiment, fellow saxophone students executed a series of exercises wherein they sang and played with syllables. The preferences of the superior saxophone students on vowels and consonants, helped me to determine which vowels and consonants to use in my actual experiment.

As the majority of the participants of the 2013 experiment indicated the vowel 'u' as their favorite vowel, I decided to use this vowel in my actual experiment. Participants of the 2013 experiment commented that the vowel 'u' gave a warm, full and dark saxophone timbre and a projected sound (Geest, 2013, p. 57). In order to create maximum velocity of air and minimum waste, I also selected the vowel 'i' (as in the word 'she') as proposed by Liebman (1994).

As it concerns to the relation between consonants and articulation, participants of the 2013 experiment mentioned that the consonants 'd' and 't' were easy to apply as modes of articulation on the saxophone. The consonant that the majority of the participants preferred to use was 'd'. Reasons for that choice, as indicated by the participants, were the soft and clear articulation results on the saxophone (Geest, 2013, p. 58). The actual experiment aims to saxophone students from the third and fourth grade in order to help them develop their articulation. Therefore, I selected the consonant 't' for my experiment. Reasons for that choice are first that 't' will be easy to apply as a mode of articulation. Second, in my experience 't' will give more clear results in terms of articulation in comparison to 'd' for students of the third and

fourth grade. From my teaching experience students of this level do not exaggerate as much as superior saxophone students, and therefore I expect the consonant 't' to give clearer articulation results in comparison to the consonant 'd'.

I set up a pilot experiment with two of my saxophone students. I selected an etude for each of them and developed two vocalization exercises. I asked my colleague teachers to help me execute the pilot experiment and to give me feedback. This process helped me to improve the experiment and the questionnaire.

Afterwards I prepared for the actual experiment. I selected a group of young students (third and fourth grade of the Portuguese music education system) and a jury, consisting of three saxophone teachers and a clarinet teacher. Participants played etude N° 18 (Lacour, 1989, p. 14) in front of the jury and the jury felt in a questionnaire. Afterwards I worked with half of the group of participants (the experimental group) on the two exercises I developed. At the same time, the control group studied the etude of Lacour (1989, p. 14). Afterwards, all participants performed the etude again in front of the jury and the jury felt in a questionnaire. Results of the experiment are based on the questionnaires as filled in by the jury members. A detailed overview of the stages and procedures of the pilot study and the experiment follows in this chapter.

4.1 Pilot Study

In order to develop the experiment, I carried out a pilot study. This was helpful in order to (i) reformulate the questions of the questionnaire in order to obtain clear results; (ii) analyze the reactions of my students towards the vocalization exercises; and (iii) receive feedback of fellow colleague teachers when listening to the saxophone students and filling in the questionnaires. The procedures of the pilot study were the following:

Part 1 Preparation

I asked two of my saxophone students if they were willing to participate in my research experiment. In addition, I contacted their parents and asked their permission which they trustfully gave. At the time, these students studied saxophone in the second and third grade of the Portuguese music education system at the school where I worked. I executed two experiments: first with my student of the second grade who I will call 'student M.'; second with my student of the third grade who I will call 'student J.'. For student M. I selected etude n° 5 by Guy Lacour (1989, p. 4) and for student J. I selected etude n° 18 by Guy Lacour (1989, p. 14). I choose different etudes for each of the students because I wanted them to play a study that was adequate to their playing capacities (see Appendix 1 and 2).

In addition, I asked three of my fellow colleagues at the music academy where I worked, to participate in my experiment and to listen to my students and to evaluate them by filling in a questionnaire. All of these colleagues were wind instrument teachers, teaching respectively the trumpet, the flute and the bassoon.

I designed a vocalization exercise (see Appendix 5). In addition, I experimented by playing etude n° 5 by Guy Lacour (1989, p. 4) with different syllables. I selected the syllables that in my experience would fit the best into the style of the etude and would give the best results in terms of air pressure, sound quality and use of articulation and dynamics. I did exactly the same with etude n° 18 of Guy Lacour (1989, p. 14).

Part 2 First performance and evaluation

Stage overview:

- S.1 On the 19th of March of 2015 student M., my three fellow colleague teachers and I joined in one of the teaching rooms of the music academy where I worked. I explained the proceedings of the experiment and asked them if they had any doubts.
- S.2 Student M. had some minutes to warm up, while I handed in questionnaire 1 to the jury members (see Appendix 3).
- S.3 Student M. played etude N° 5 by Guy Lacour (1989, p. 4) in front of the jury and I recorded her performance. M. had studied the etude during a month and felt comfortable playing it.
- S.4 After this performance, the jury members took some minutes to evaluate student M. by filling in questionnaire 1.

Part 3 Working with student M.

- S.5 After filling in questionnaire 1, the jury members left the room and student M. and I had time to work on the vocalization exercises. First, I introduced M. to the idea of singing and playing with syllables. I asked M. to sing with the syllable 'tu' and to imitate this sound when playing the saxophone. Afterwards we did the same with the syllable 'ti'. We repeated this introduction exercise for more or less five minutes.
- S.6 After we continued with exercise 1 (see Appendix 5), we sung the exercise together, and after each passage M. repeated the same passage on her saxophone and tried to imitate the sounds of the syllables. We worked on this exercise for no longer than ten minutes.

- S.7 Afterwards, we sung etude N° 5 by Lacour (1989, p. 4) with the syllables 'tu' and 'ti'. I had written the syllables into the sheet music of the etude (see Figure 12). After singing a passage, I asked M. to play the same passage with her saxophone and to remember the syllables written in her score. We repeated this exercise for no longer than fifteen minutes. I recorded parts of our study session.

Part 4 Second performance and evaluation

- S.8 The jury came back into the classroom and M. played etude N° 5 by Guy Lacour (1989, p. 4) with the syllable indications (see Figure 12). I asked her to concentrate on the vocal sounds of the syllables written into the score and recorded her performance.
- S.9 After listening to M., the jury felt in questionnaire 2 (see Appendix 4). Questionnaire 2 is identical to Questionnaire 1, with exception of the last question where I ask the jury members which performance they preferred (the first or the second) and why.
- S.10 I thanked all of the jury members and student M. for their participation.

Figure 12. Etude N° 5 by Guy Lacour (1989, p. 4) with syllable indications.

4

5

The image shows a musical score for Etude N° 5 by Guy Lacour. The score is written on ten staves, each with a treble clef and a key signature of one sharp (F#). The tempo is marked 'Allegretto' with a metronome marking of 112. The score includes various musical notations such as notes, rests, and dynamic markings (mf, p, f, rall.). Below the notes, syllable indications 'tu' and 'ti' are written, often with horizontal lines indicating the duration of the syllable. The syllables are written in a way that they align with the notes, with 'tu' typically under a half note and 'ti' under a quarter note. The score ends with a double bar line and a final 'i' syllable.

Results Student M.

The following table denotes the results of the pilot study with student M. based on the questionnaires filled in by three jury members, all of them wind instrument teachers.

Table 8. Results of the pilot study with student M.

Sound control			
1 = very poor sound control, 2 = poor sound control, 3 = reasonable sound control, 4 = good sound control, 5= very good sound control			
	Jury member 1	Jury member 2	Jury member 3
1 st Performance	2	3	2
2 nd Performance	3	3	3

Two of the jury members noticed a slight improvement of the sound control, while one jury member didn't notice and difference.

Air pressure			
1 = very poor air pressure, 2 = poor air pressure, 3 = reasonable air pressure, 4 = good air pressure, 5= very good air pressure			
	Jury member 1	Jury member 2	Jury member 3
1 st Performance	2	2	1
2 nd Performance	3	3	3

All of the jury members noticed improvement in terms of air pressure.

Brightness and/or clearness of the sound			
1 = very unclear sound, 2 = unclear sound, 3 = more or less bright sound, 4 = bright sound, 5= very bright sound			
	Jury member 1	Jury member 2	Jury member 3
1 st Performance	3	2	3
2 nd Performance	3	3	4

Two of the jury members noticed that the sound of student M. became slightly brighter / clearer, while one jury member didn't notice any difference.

Timbre 1 = very poor timbre, 2 = poor timbre, 3 = more or less in timbre, 4 = rich timbre, 5= very rich timbre			
	Jury member 1	Jury member 2	Jury member 3
1 st Performance	3	3	2
2 nd Performance	3	3	4

One of the jury members noticed improvement in terms of the timbre, while the other two jury-members didn't notice any difference.

Use of dynamics – Student M. 1 = no use of dynamics, 2 = poor use of dynamics, 3 = reasonable use of dynamics, 4 = rich in use of dynamics, 5= very rich in use of dynamics			
	Jury member 1	Jury member 2	Jury member 3
1 st Performance	1	2	1
2 nd Performance	2	2	2

Two of the jury members noticed a slight improvement in terms of the use of dynamics, while one jury member didn't notice any difference.

Use of articulation – Student M. 1 = no use of articulation, 2 = poor use of articulation, 3 = reasonable use of articulation, 4 = rich in use of articulation, 5= very rich in use of articulation			
	Jury member 1	Jury member 2	Jury member 3
1 st Performance	3	3	2
2 nd Performance	3	3	3

One of the jury members noticed a slight improvement in terms of the use of articulation, while two jury members didn't notice any difference.

At the end of the second questionnaire, all jury members described which performance they preferred and why. All of the jury members denoted that they preferred the second performance, because student M. demonstrated a better control of sound and air pressure. As a result, two of the jury members mentioned, that the timbre also improved. Jury member 1 mentioned that she didn't notice major differences in terms of the brightness of the sound and the

use of articulation, but that the use of dynamics was a bit more perceptible during the second performance. Jury member 2 mentioned an improvement in terms of respiration. Jury member 3 mentioned that he thinks the results would be even more perceptible when the student would study the exercises for a longer period of time.

In relation to the questionnaire, the jury members mentioned that they found the criterion 'brightness and/or clearness of the sound' very unclear. They suggested eliminating this criterion because they found it very similar to the criterion 'timbre'. I changed the questionnaire to the actual questionnaire as demonstrated in Appendix 3 and 4.

On the 23rd of April of 2015, I repeated this pilot study with student J. The difference between the first and second pilot study was that I used etude N° 18 (see Appendix 2) by Guy Lacour (1989, p. 14). Student J. was a third-grade student at the moment of the experiment and the level of difficulty seemed adequate to him. In addition, I developed a second exercise with excerpts of etude N° 18 by Guy Lacour (1989, p. 14) as demonstrated in Figure 14. I felt the necessity for the student to make a bridge between the first exercise and the etude with syllable indications. Another difference in comparison to the first pilot study was that there were only two jury members to evaluate student J. during the second pilot study. The stages of the second pilot study were the same in comparison to the first.

Results Student J.

Table 9. Results of the pilot study with student J.

Air pressure		
1 = no air pressure, 2 = poor air pressure, 3 = just enough air pressure, 4 = consistent air pressure, 5 = very consistent air pressure		
	Jury member 1	Jury member 2
1 st Performance	2	3
2 nd Performance	4	3

Jury member 1 noticed a clear improvement in terms of air pressure, while jury member 2 didn't notice any changes.

Tone color in the high register
1 = very dark tone color, 2 = dark tone color, 3 = no specific tone color, 4 = bright tone color, 5 = very bright tone color

	Jury member 1	Jury member 2
1 st Performance	1	2
2 nd Performance	3	3

Both jury members noticed that the tone color became less dark in the high register.

Tone color in the medium/low register		
1 = very dark tone color, 2 = dark tone color, 3 = no specific tone color, 4 = bright tone color, 5 = very bright tone color		
	Jury member 1	Jury member 2
1 st Performance	3	3
2 nd Performance	4	4

Both jury member noticed that the tone color became brighter in the medium and low register.

Use of tone colors (i.e. to play with brighter and darker tone colors)		
1 = no use of tone colors, 2 = poor use of tone colors, 3 = minimal use of tone colors, 4 = rich in use of tone colors, 5 = very rich in use of tone colors		
	Jury member 1	Jury member 2
1 st Performance	2	2
2 nd Performance	3	3

Both jury members denoted that student J. started to use a minimal use of tone colors during the second performance.

Use of dynamics		
1 = no dynamics, 2 = poor dynamics, 3 = minimal use of dynamics, 4 = rich in dynamics, 5 = very rich in dynamics		
	Jury member 1	Jury member 2
1 st Performance	3	3
2 nd Performance	3	3

Both jury members didn't notice any change in terms of the use of dynamics of student J.

Use of articulation		
1 = no articulation, 2 = unclear articulation, 3 = minimal use of articulation, 4 = clear articulation, 5 = very clear articulation		
	Jury member 1	Jury member 2
1 st Performance	2	3
2 nd Performance	3	3

Jury member 1 noticed a slight improvement in the use of articulation of student J., but jury member 2 didn't notice any difference.

Both jury members described that they preferred the second performance in comparison to the first. Jury member 1 denoted that the air pressure of the student improved and that consequently the quality of the sound improved specially in the high register. Both jury members described that the dynamics improved during the second performance and jury member 2 also described an improvement in terms of articulation. However, the jury-members didn't fill in notes that correlate to these written observations on dynamics and articulation. Jury member 2 described she denoted an improvement in terms of sound control and a slight use of tone colors during the second performance.

Both pilot studies helped me to improve the questionnaire, the exercises and gave me a bit more experience in order to execute the research experiment.

4.2 Exercises

The objective of the exercises is to discover the relationship between (i) vowels and saxophone timbre, (ii) consonants and articulation, and (iii) singing and playing with dynamics. The exercises tend to improve the saxophone timbre through the study of vowels, articulation through the study of consonants and playing with dynamics by singing the exercises.

All exercises switch between saxophone playing and singing. Singing forces one to create a sound image before playing. It is my conviction that singing is essential in the education of every musician (see §1.1 and §1.2). The final goal of the exercises is to imitate on the saxophone the vocal sounds or sound image created beforehand, and therefore the exercises do not aim a training a highly singing performance. I tried to make the exercises as easy as possible for the students so they would be able to discover slight changes in timbre, articulation and use of dynamics. Whenever a student wishes to discover a bigger variety of tonal shadings and articulation in the future, he or she knows which tools to use, namely different syllables.

4.2.1 Exercise 1

Exercise 1 explores the relation between (i) vowels and saxophone timbre and (ii) consonants and saxophone articulation. The aim of the exercises is that students discover (i) two different tone colors on the saxophone with the vowels 'u' and 'i', and (ii) a clear type of saxophone articulation with the consonant 't'. The fact that the student is challenged to sing, will help him or her to naturally improve musical aspects such as the use of dynamics.

Figure 13. Exercise 1.

1. Sing the exercise with the indicated syllables.
2. Next, play the exercise and try to keep your mouth and tongue in the same position as the indicated syllables. Do you note any difference?

The figure shows two musical staves. The top staff is labeled 'Alto Saxophone' and the bottom staff is labeled 'Alto Sax.'. Both staves are in treble clef with a key signature of one sharp (F#). The top staff contains four measures of music with notes and rests, with syllables 'Tu', 'Tu', 'Tu', and 'Ti' written below. The bottom staff starts with a measure number '5' and contains five measures of music with notes and rests, with syllables 'Ti', 'Ti', 'Tu', 'Ti', and 'Ti' written below.

4.2.2 Exercise 2

Exercise 2 continues with the exploration between (i) the vowels 'u' and 'i' and the saxophone timbre and (ii) the consonant 't' and articulation. Besides, the general act of singing, encourages the student to develop a natural manner of phrasing and using dynamics.

Exercise 2 is based on excerpts of etude n° 18 by Guy Lacour (1989, p. 14). The student is challenged to develop a more warm, full and dark sound in the high register with the vowel 'u' (as in the word 'you'). This register often becomes very sharp with lack of low frequencies. In the middle and low register, the student is challenged to develop a more brilliant and sharp sound with the vowel 'i' (as in the word 'she'). This register often becomes flat with lack of high frequencies. Besides, the vowel 'i' will help the student to create maximum velocity and direction of air in the lower register, which is something that is often difficult for students.

Figure 14. Exercise 2.

1. Sing the exercise with the indicated syllables.
2. Next, play the exercise and try to imitate the position of the syllables.
Do you notice any differences?

The musical score for Exercise 2 consists of four staves, each with a treble clef and a key signature of one sharp (F#). The first staff is labeled 'Alto Saxophone' and the subsequent three are labeled 'Alto Sax.'. The first staff has a common time signature (C) and contains the following notes and syllables: Tu_ Tu_ Tu (quarter notes), Ti_ Ti_ Ti (quarter notes), Tu_ (half note), and Ti_ (half note). The second staff starts at measure 5, has a 3/4 time signature, and contains: Tu (half note), Tu_ (half note), Tu (quarter note), Ti_ (half note), Ti (quarter note), and Tu (half note). The third staff starts at measure 11, has a 3/4 time signature, and contains: Tu_ (half note), Tu_ (half note), Tu_ (half note), i_ (half note), and Ti_ (half note). The fourth staff starts at measure 17, has a 3/4 time signature, and contains: Tu_ (half note), Ti_ (half note), Tu_ (half note), Ti_ (half note), Ti (quarter note), and Ti_ (half note). The score ends with a double bar line.

4.2.3 Etude N° 18 by Guy Lacour (1989, p. 14)

I selected etude n° 18 by Guy Lacour (1989, p. 14) for several reasons. First, the level of this study seemed appropriate to me for students of the third and fourth grade. I expected participants to not have too many difficulties in studying and executing this etude. Second, the study contains a lot of interval jumps and flows from the low to the high register. These characteristics gave me the possibility to select appropriate syllables which I expect will help the students to (i) better control the airstream in general and in different dynamical ranges and (ii) will result in a controlled change between registers.

Figure 15. Etude N° 18 by Guy Lacour (1989, p. 14).

14

18

T° di Valse ♩ = 138

mf

p

mf

f

p

mf

f

p

mf

p

4.2.4 Etude N° 18 by Guy Lacour (1989, p. 14) with syllables indications

Figure 16 depicts etude n° 18 (Lacour, 1989, p. 14) with the syllables I selected written into the part. I used the same selection of syllables as in exercise 1, namely 'tu' and 'ti'. The syllable 'ti' is mainly used in the lower register, while I used the syllable 'tu' in the higher register. Every slur corresponds with the consonant 't'. Students often forget to articulate and I expect that when students sing the etude with the syllables, they will automatically study the articulation.

Figure 16. Etude N° 18 by Guy Lacour (1989, p. 14) with syllable indications.

14

18

T° di Valse ♩ = 138

The musical score for Etude N° 18 is presented on ten staves. The key signature is one sharp (F#), and the time signature is 3/4. The tempo is marked as 138 beats per minute. The score includes various musical notations such as slurs, ties, and dynamic markings (mf, f, p). Syllable indications 'tu' and 'ti' are placed below the notes, corresponding to the vocalizations. The syllable 'tu' is used for higher notes, and 'ti' is used for lower notes. The score is divided into two systems, with the first system containing staves 1-5 and the second system containing staves 6-10.

4.3 Participants

For my experiment, I was looking for young saxophone students who were able to easily read and play beginners level etudes written by Guy Lacour (1989). I wanted them to be able to start thinking about how to play with a beautiful and controlled sound, articulation and dynamics. I decided that students of the third and fourth grade of the Portuguese musical education system would be indicated for my experiment. From my own experience as a music teacher, I noticed that most students of this level overcome their initial difficulties, and are able to start thinking about musical interpretation.

At the time of the experiment I followed an internship at the *Conservatório de Aveiro*, which is a music institution financed by the Portuguese state. At this music institution children from on six years old, can combine their regular school schedules with a complete offer of musical disciplines, which are a part of their final school results. I followed my internship with saxophone teacher João Figueredo. As he was very familiar with all proceedings at the *Conservatório de Aveiro* I decided to ask his help. João joined all saxophone students between the third and fourth grade who were studying at the *Conservatório de Aveiro*, a total of eight students. The student's ages varied between twelve and fourteen years old. All of them had weekly saxophone lessons, besides a complete offer of disciplines such as general musical formation, choir, ensemble playing and solfege. Table 10 enumerates all participants and provides some basic information such as: participant's number, gender, and grade.

Table 10. Overview of the participants' number, gender and grade.

Participants Number	Gender	Grade
1	Male	3
2	Male	3
3	Male	4
4	Male	4
5	Female	4
6	Male	4
7	Male	4
8	Male	4

I have chosen a convenience sample procedure given the accessibility and proximity of the participants. All the selected participants took part in the experiment and successfully finished it.

4.4 Jury

A panel of experts evaluated the participants by filling in a questionnaire. The jury consisted of four wind instrument teachers: three saxophone teachers and one clarinet teacher. During the time of the experiment, all of them were active as teachers at the *Conservatório de*

Aveiro. João Figueredo helped me during the process of selecting the jury members. The four jury members took part in the experiment and successfully finished it.

4.5 Questionnaires

I developed two questionnaires for the jury members (see Appendix 3 and 4). I asked the jury members to listen to each participant, and to fill in a questionnaire afterwards. Each participant played twice in front of the jury. Therefore, each jury member filled in two questionnaires per participant.

The first questionnaire (see Appendix 3) consisted of six closed questions about air pressure, the use of tone colors, the type of tone colors used in the high and medium/low register, the use of dynamics and the use of articulation. The second questionnaire (see Appendix 4) is identical to the first in the way that it contains the same six closed questions. In addition, the second questionnaire contains two questions where the jury members were asked to compare both performances of each participant. One of these questions is closed, but the other one is open.

4.6 Procedures

Part 1 Preparation

I contacted João Figueredo, saxophone teacher at the *Conservatório de Aveiro*, and he gave me full support to execute my experiment at the *Conservatório*. João helped me joining a group of eight saxophone students who were at the moment of the experiment studying in the third and fourth grade of the Portuguese music education system. In addition, João participated in the jury and asked a fellow clarinet colleague to join him. As I knew the other two saxophone teachers of the *Conservatório* personally, I asked them to participate as jury members myself. All of them agreed to participate and João helped me to mark a date that would be suitable for all teachers and students, which became the 21st of April of 2015.

Two months before the date of the experiment, I asked the three saxophone teachers of the *Conservatório de Aveiro* to hand in etude n° 18 by Guy Lacour (1989, p. 14) to their third- and fourth-grade students. In addition, I asked the teachers to make sure that all of the students would study the etude and be able to play it without major difficulties.

Part 2 First performance and evaluation

Stage overview:

- S.1 On the 21st of April of 2015, eight participants and four jury members met in the *Conservatório de Aveiro*. I introduced myself and explained the proceedings of the experiment. In addition, I asked if the students or jury members had any doubts.

- S.2 The participants had some minutes to warm up, while the jury members found their places. I handed in questionnaire 1 and gave the jury members some time to read the questions and clarify eventual doubts. Afterwards, João lined up the students in random order.
- S.3 Student 1 played etude n° 18 by Guy Lacour (1989, p. 14) in front of the jury members.
- S.4 After this performance, the jury members took some minutes to evaluate student 1 by filling in questionnaire 1.

Stage 3 and 4 were repeated with the other seven students.

Part 3 Working with the experimental group

- S.5 Afterwards the jury members left the room, and I randomly divided the group in two. I made sure both groups contained the same amount of third- and fourth-grade students. Table 11 depicts an overview of the experimental group and the control group with the participants' number, gender and grade.

Table 11. Overview of the experimental and the control group.

Experimental group		
Participants number	Gender	Grade
2	Male	3°
3	Male	4°
6	Male	4°
8	Male	4°
Control group		
Participants number	Gender	Grade
1	Male	3°
4	Male	4°
5	Female	4°
7	Male	4°

- S.6 I brought the participants of the control group to another teaching space in the *Conservatório*. I asked them to perform etude n° 18 (Lacour, 1989, p. 14) in front of each other, and to help each other to improve their performances. The control group had 40 minutes to work on the musical interpretation of the etude.

- S.7 Participants of the experimental group remained in the same space. I explained them that we were going to work on the interpretation of the etude by doing two exercises that included singing and playing. Also, I explained that I would help them executing the exercises.
- S.8 I sang and played the first six bars of exercise 1 in front of the participants of the experimental group. I asked them to repeat these bars along with me, first by singing, and afterwards by playing the saxophone. Also, I asked them to concentrate on maintaining the shape of their mouth and the position of their tongue in the same position as when singing the syllables. After we executed the six bars several times together, I asked each participant to try singing and playing the same bars individually. Next, we discussed if the participants heard any differences in their performances. They indicated slight changes in their timbre. In the same way, we finished the rest of exercise 1.
- S.9 I explained the participants of the experimental group that I designed exercise 2 (see Figure 14) with excerpts of etude n° 18 of Guy Lacour (1989, p. 14) in order to help them improve their performance. I sang and afterwards played the first five bars of the exercise in front of the participants. Afterwards, we sang and played the same fragment together and finally all participants sang and played individually. I asked the students if they could hear changes in their performance or the performance of their colleagues. In the same manner, we executed the rest of exercise 2.
- S.10 I gave all the participants of the experimental group etude n° 18 by Guy Lacour (1989, p. 14) with my syllables indications (see Figure 16). First, I sang and play excerpts of the etude in front of the participants. Second, we sang and play several fragments together, and third, each participants choose some fragments to sing and play individually. Finally, we discussed how they experienced the exercises and if they heard any changes in their performances.

Part 4 Second performance and evaluation

- S.11 All jury members and participants of both the experimental and the control group returned to the initial teaching space in the *Conservatório de Aveiro*. The participants were lined up in a random order. The participants of the experimental group would play etude n° 18 (Lacour, 1989, p. 14) with the syllable indications (see Figure 16), while participants of the control group would play the etude without syllable indications (see Figure 15).
- S.12 Student 1 played etude n° 18 (Lacour, 1989, p. 14) in front of the jury.

- S.13 After this performance, the jury members took some minutes to evaluate student 1 by filling in questionnaire 2. Stage 12 and 13 were repeated with the other seven students.
- S.14 I thanked all the participants and jury members for their collaboration and gathered all the questionnaires.

In the following chapter I will describe the results of the experiment, based on the questionnaires that the jury members filled in. Further in Chapter 5, I will discuss the outcome of the experiment with the existing literature on the subject.

Chapter 5 - Results and discussion

5.1 Results

The following tables demonstrate the results of the questionnaires as filled in by the four jury members on the 21st of April of 2015. Every table depicts a parameter of the research and each parameter corresponds with a question of the questionnaire (see Appendix 3 and 4). The control group represents the group of students who didn't receive the vocalization exercises, but studied individually. The experimental group represents the group of students who worked with me on the vocalization exercises.

Every participant performed twice in front of the jury and therefore every participant received two evaluations per jury member. The tables are an interpretation of the filled in questionnaires and demonstrate the comparison of the results of the first with the second performance of each participant. For example: jury member 2 evaluated that student 6 scored a 3 (= just enough air pressure) at the first performance on parameter 1: air pressure. At the second performance, jury member 2 filled in that student 6 scored a 4 (= consist air pressure) on parameter 1: air pressure. This means, that according to the filled in questionnaires of jury member 2, student 6 improved by 'one point' in terms of air pressure. Whenever there is a lack of information as filled in by the jury members in the questionnaires, no information appears on the table.

5.1.1 Results on parameter 1: air pressure

Table 12. Results of the experiment on parameter 1: air pressure.

Q1 – Air Pressure									
Control Group					Experimental Group				
Student 1	E	E	E	I	Student 2	I	E	E	E
Student 4	I	I	E	D	Student 3	I	I	I	SD
Student 5	E	-	E	E	Student 6	I	I	I	SI
Student 7	E	I	I	I	Student 8	SI	I	E	E
	Jury 1	Jury 2	Jury 3	Jury 4		Jury 1	Jury 2	Jury 3	Jury 4
SD – Significant Decline D – Decline E – Equal I – Improvement SI – Significant Improvement									

Objective of the vocalization exercises related to air pressure: the vowel 'i' as in the word 'she' will help the students of the experimental group to create maximum velocity and direction of air in the lower register.

Expected results: students of the experimental group will improve more (in comparison to students of the control group) in terms of air pressure as they studied the vocalization exercises with the vowel 'i'.

According to jury member 1, the experimental group demonstrated overall improvement in terms of air pressure, comparing to an overall equal performance (three students) of the control group. Jury member 2 doesn't indicate a clear difference between the performances of the control group with the experimental group, also due to lack of information (see student 5). Jury member 3 indicates an improvement on two students of the experimental group in terms of air pressure, while most of the students of the control group (three students) performed equally. Jury member 4 indicates that the vocalization exercises weren't necessarily helpful to the students of the experimental group. The results of the students according to the evaluation of jury member 4 vary from significant decline (one student) to significant improvement (one student), while the students of the control group improved (two students), performed equally (one student) or declined (one student) in terms of air pressure.

In sum jury member 1 and 3 clearly noticed that the vocalization exercises were helpful to the students of the experimental group in order to perform with more consistent air pressure. The other two jury members did not indicate a clear improvement nor a clear decline in terms of air pressure of the experimental group.

When comparing the evaluation of the students of the experimental group with the students of the control group, I see that students of the experimental group were more often evaluated with 'I' (improvement) than students of the control group, who were more often evaluated with 'E' (equal). These results confirm the hypothesis that playing with the vowel 'i' will improve the consistency of the air pressure of students of the third and fourth grade of the Portuguese music education system.

5.1.2 Results on parameter 2.A: tone color in the high register

Table 13. Results of the experiment on parameter 2.A.: tone color in the high register.

Q2.A – Tone color in the high register									
Control Group					Experimental Group				
Student 1	E	B	E	D	Student 2	E	D	E	E
Student 4	B	VD	D	B	Student 3	E	E	E	E
Student 5	E	E	E	B	Student 6	E	VD	E	B
Student 7	E	D	E	E	Student 8	B	D	E	B
	Jury 1	Jury 2	Jury 3	Jury 4		Jury 1	Jury 2	Jury 3	Jury 4
VD – Very dark tone color D – Dark tone color E – Equal B – Bright tone color VB – Very bright tone color									

Objective of the vocalization exercises related to the tone color in the high register: using the vowel 'u' as in 'you' in order to develop a fuller, warmer and darker sound in the high register. The tone color in the high register is often very shrill with lots of high frequencies and the tongue position of the 'u' seems to result into a warmer and darker sound with lower frequencies.

Expected results: students of the experimental group will perform with a darker tone color in the high register in comparison to students of the control group.

According to the evaluation of jury member 1, there was no difference in terms of the tone color in the high register between the experimental and the control group. The evaluation of jury member 2 reveals that most students of the experimental group played with a dark tone color in the high register (two students – dark, one student – very dark) while only half of the students of the control group performed with a dark tone color in the high register (one student – dark, one student very dark). Jury member 3 barely noticed changes in terms of the tone color in the high register. Only one student of the control group played with a darker tone color according to jury member 3. The evaluation of jury member 4 also did not reveal major differences between the experimental and the control group in terms of tone color in the high register. Jury member 4 even indicated that two of the four students of the experimental group played with a brighter tone color in the high register, while I expected students of this group to perform with a darker tone color.

When comparing the results of the experimental group with the control group, I see that the evaluation that half of the totality of students received, was mainly equal ('E'). This means that the jury members evaluated that student 5 and 7 (control group) and student 2 and 3 (experimental group) performed with an equal tone color in the high register during both performances, according to the majority of the jury members.

It is remarkable that the students who did not mainly receive an equal evaluation ('E'), receive contrary evaluations per jury member. For example: student 4 (control group) was evaluated by two jury members as performing with a bright tone color, while at the same time the student was evaluated as performing with a dark and a very dark color. This occurs with three more students namely student 1 (control group), 6 and 8 (experimental group). Because this situation occurs with half of the participants' evaluation, I conclude that the jury members do not interpret the tone color of students in the same manner. Jury member 1 and 4 more often interpret the tone color of students as being bright but jury member 2 and 3 more often interpret the tone color of students as dark or very dark. In addition, I analyze that both the experimental and the control group, contain each two students who received mainly an equal evaluation ('E') and two students who received contrary evaluations. Therefore, the hypothesis that playing with the vowel 'u' will result in a darker tone color in the high register of the saxophone, could not be confirmed with this experiment.

5.1.3 Results on parameter 2.B: tone color in the medium and low register

Table 14. Results of the experiment on parameter 2.B.: tone color in the medium and low register.

Q2.B – Tone color in medium/low register									
Control Group					Experimental Group				
Student 1	B	E	B	E	Student 2	E	E	E	E
Student 4	D	B	E	VB	Student 3	E	B	E	B
Student 5	B	E	E	E	Student 6	D	E	E	E
Student 7	E	E	B	E	Student 8	B	E	E	E
	Jury 1	Jury 2	Jury 3	Jury 4		Jury 1	Jury 2	Jury 3	Jury 4
VD – Very dark tone color D – Dark tone color E – Equal B – Bright tone color VB – Very bright tone color									

Objective of the vocalization exercises related to the tone color in the medium and low register: to develop a brighter tone color in the medium and low register by imitating the vowel ‘i’ as in the word ‘she’. The reason to do so is that tone color in the medium and low register of the saxophone often sounds flat with many low frequencies.

Expected results: students of the experimental group will play with a brighter tone color in the medium and low register in comparison to students of the control group.

The evaluation of jury member 1 does not indicate that the vocalization exercises did result in a brighter tone color in the medium and low register of the students of the experimental group. According to jury member 1 only student 8 played with a brighter tone color in the medium and low register. The evaluation of jury member 2 reveals that most of the students of both the experimental and the control group performed equally in terms of the tone color in the medium and low register. Both groups contain one student who performed with a brighter tone color in the medium and low register according to jury member 2. Jury member 3 indicates that all of the students of the experimental group performed equally in terms of tone color. However, two of the four students of the control group performed with a brighter tone color in the medium and low register according to the evaluation of jury member 3. According to the evaluation of jury member 4 there is almost no difference in terms of tone color in the medium and low register between the students of the experimental and the control group. Jury member 4 evaluated that almost all of the students of both groups performed equally in terms of tone color. One of the students of the control group performed with a very bright tone color, in comparison to one of the students of the experimental group who performed with a brighter tone color.

When comparing the results of the students of the experimental group, I analyze that the majority of students (student 2, 6 and 8) received the evaluation that their performances

remained mainly equal in terms of tone color in the medium and low register. Student 3 was twice evaluated as playing with an equal tone color and twice as playing with a bright tone color in the medium and low register.

Students of the control group received slightly different evaluations. Two students of the control group (student 5 and 7) were mainly evaluated as playing with an equal tone color. Student 1 received the same evaluation as student 3: twice bright and twice equal. Student 4 was evaluated in a contrary manner by the jury members namely as playing with a dark, equal and bright tone color, but with a small majority on playing with a bright tone color.

The results of the experiment on parameter 2.B. do not confirm the hypothesis that playing with the vowel 'i' results in a brighter tone color in the medium and low register of the saxophone. Most of the students of the experimental control group performed equally in terms of tone color in the medium and low register. The tone color in the medium and low register of the students of the control group was evaluated slightly more times as being bright in comparison to the students of the experimental group.

5.1.4 Results on parameter 2.C: use of tone colors

Table 15. Results of the experiment on parameter 2.C.: use of tone colors.

Q2.C – Use of tone colors									
Control Group					Experimental Group				
Student 1	D	I	E	I	Student 2	E	I	E	E
Student 4	I	SI	D	E	Student 3	I	I	E	E
Student 5	D	MI	I	E	Student 6	E	E	I	I
Student 7	E	E	E	I	Student 8	E	SI	E	I
	Jury 1	Jury 2	Jury 3	Jury 4		Jury 1	Jury 2	Jury 3	Jury 4
SD – Significant Decline D – Decline E – Equal I – Improvement SI – Significant Improvement MI – Major Improvement									

Objective of the vocalization exercises related to the use of tone colors: to develop the ability to play with a bigger variety of tone colors by singing and playing with different vowels.

Expected results: students of the experimental group will improve their ability of playing with a bigger variety of tone colors throughout their performance, in comparison to students of the control group.

According to the evaluation of jury member 1 most of the students (three) of the experimental group performed equally on 'use of tone colors', while one student improved. In addition, two students of the control group declined in terms of use of tone color, one performed equally and one student improved. Jury member 2 indicates that most of the students, both of the

control and the experimental group were able to play with a bigger variety of tone colors. However, the students of the control group seem to have improved even more in terms of tone color in comparison to the students of the experimental group. The evaluation of jury member 3 indicates that most students of the experimental group performed equally on 'use of tone colors' (three students), while one student improved. This is a slightly better evaluation in comparison to the students of the control group: two students performed equally, one student improved and one student declined. Jury member 4 does not indicate any differences between the performances of the students of the control and the experimental group. Both groups contain two students who performed equally and two students who improved.

According to the evaluation of half of the jury members, the majority of students of the control group (student 3, 6 and 8) were able to improve and perform with a bigger variety of tone colors. The same students were also evaluated as performing equally by the other half of the jury members. Most of the jury members evaluated that student 2 remained equally in the use of tone colors.

Three students of the control group (student 1, 4 and 5) received contrary evaluations by the jury members. For example: student 5 revealed a major improvement and was able to play with a much bigger variety of tone colors according to the evaluation of jury member 2, but jury member 1 evaluated that student 5 declined in the use of tone colors. Student 1, 4 and 5 improved according to half of the jury members, but declined or performed equally according to the other half of the jury members. Student 7 performed mainly equal according to the majority of jury members.

When comparing evaluations of the control and the experimental group, I notice that students of the experimental group improved or remained equally in their ability to play with a bigger variety of tone colors, while the control group revealed both a slight decline as major improvement. The evaluation of the experimental group revealed more similar results, but the results of the control group were often contrary.

The results of the experiment on the use of tone colors tend to confirm the hypothesis that singing and playing with vowels will improve the ability of the students to play with a bigger variety of tone colors. Moreover, the results definitely confirm that singing and playing with vowels is not negative in order to develop the ability to play with a bigger variety of tone colors. Although the control group also improved in their use of tone colors, the results of the experimental group were much more stable in comparison to the contrary results of the control group.

5.1.5 Results on parameter 3: use of dynamics

Table 16. Results of the experiment on parameter 3: use of dynamics.

Q3 – Use of dynamics									
Control Group					Experimental Group				
Student 1	I	I	SI	I	Student 2	I	I	E	D
Student 4	SI	I	I	E	Student 3	I	E	I	E
Student 5	E	I	E	E	Student 6	I	E	I	D
Student 7	I	E	I	E	Student 8	I	E	E	I
	Jury 1	Jury 2	Jury 3	Jury 4		Jury 1	Jury 2	Jury 3	Jury 4
SD – Significant Decline D – Decline E – Equal I – Improvement SI – Significant Improvement									

Objective of the vocalization exercises related to the use of dynamics: to develop the ability to play with a bigger variety of dynamics by singing.

Expected results: students of the experimental group will improve their capacity to play with dynamics in comparison to students of the control group.

According to jury member 1 all of the students of the experimental group improved in their use of dynamics. The same jury member evaluates that most students of the control group also improved in their use of dynamics (two students improved, one student improved significantly), but that one student performed equally. Jury member 2 reveals a very different evaluation in comparison to jury member 1. According to jury member 2, most of the students of the control group (three students) improved in their use of dynamics, while most students of the experimental group (three students) performed equally. The evaluation of jury member 3 also indicates that most students of the control group improved in their use of dynamics: two students improved and one student improved significantly. The results of the students of the experimental group indicate that two students improved and two students performed equally. Although one student of the experimental group improved according to jury member 4, there was one student who performed equally and two students who even declined in terms of use of dynamics. According to jury member 4 most students (three) of the control group performed equally, while one student improved. Only jury member 1 indicated that all of the students of the experimental group improved in their use of dynamics. Jury member 2, 3 and 4 noticed some improvement in the use of dynamics of the students of the experimental group. However, the same jury members noticed a bigger improvement in the use of dynamics of the students of the control group.

When comparing the results of the students of the experimental group, I notice that all of the students improved in their use of dynamics according to half of the jury members. Two students (student 3 and 8) performed equally and two students (student 2 and 6) declined in their use of dynamics according to the other half of the jury members.

When comparing the results of the experimental with the control group, I notice that the students of the control group revealed a larger improvement in terms of their ability of performing with a bigger variety of dynamics. Student 1 and 4 improved or significantly improved in their use of dynamics. Student 5 and 7 improved according to half of the jury members and performed equally according to the other half of jury members. This reveals that the hypothesis that singing will help students to play with a bigger variety of dynamics, cannot be confirmed with the results of this experiment.

5.1.6 Results on parameter 4: use of articulation

Table 17. Results of the experiment on parameter 4: use of articulation.

Q4 – Use of articulation									
Control Group					Experimental Group				
Student 1	D	-	E	E	Student 2	I	D	E	I
Student 4	SI	I	E	I	Student 3	E	I	I	I
Student 5	D	I	E	E	Student 6	I	I	E	I
Student 7	E	D	E	I	Student 8	SI	E	E	E
	Jury 1	Jury 2	Jury 3	Jury 4		Jury 1	Jury 2	Jury 3	Jury 4
SD – Significant Decline D – Decline E – Equal I – Improvement SI – Significant Improvement									

Objective of the vocalization exercises related to the use of articulation: to sing and play with the consonant 't' in order to perform with a more clear articulation on the saxophone.

Expected results: students of the experimental group will improve their ability to play with a more clear articulation in comparison to students of the control group.

According to jury member 1 most of the students of the experimental group improved in terms of performing with a clear articulation: two students improved, one improved significantly and one student performed equally. The evaluation of the students of the control group reveals that two students declined, one student performed equally and one student improved significantly. The evaluation of jury member 2 reveals that the results between the experimental and the control group are comparable: two students improved and one declined. Jury member 3 notices little difference in the use of articulation of the students of both the experimental as the control group. However, one student of the experimental group improved in terms of performing with a clear articulation according to jury member 3. Jury member 4 denotes that three students of the experimental group improved on performing with a clear articulation and that one student performed equally. In comparison to the control group I notice that slightly more students of the experimental group improved in terms of playing with a clear articulation according to jury member 4.

When comparing the results of the students of the experimental group, I notice that most of the students were able to improve their ability of performing with a more clear articulation. Two students (student 3 and 6) improved according to three jury members. Student 2 improved according to half of the jury members, but declined according to jury member 2 and performed equally according to jury member 3. Student 8 performed equally according to most of the jury members, but jury member 1 evaluated that student 8 improved significantly in the use of articulation.

When comparing the results of the students of the control group, I analyze that most of the students (student 1, 5 and 7) performed equally according to half of the jury members or declined according to one of the jury members. In addition, student 5 and 7 improved according to one jury member. Student 4 revealed improvement or significant improvement according to the majority (three) of the jury members.

The results of the experiment on performing with a clear articulation confirm the hypothesis that singing with the consonant 't' will result in a clearer articulation in the performance of students of the 3rd and 4th grade. Although there was improvement in the use of articulation of the students of the control group, the students of the experimental group improved more according to the evaluation of the jury members.

5.2 Discussion

In chapter 2 I defined the main question of this research:

Does vocalizing improve (1.) the tone quality, (2.) the articulation and (3.) the use of dynamics of third and fourth grade saxophone students?

I divided this main question into three sub questions that I wanted to answer by executing the experiment (see chapter 4). In the following section I will answer these three questions based on the results of the experiment (see §5.1). The questions are divided per research parameter.

1. Are vowels useful as tools to improve the tone quality of third and fourth grade saxophone students?

5.2.1 Air pressure

Based on the experiment, I conclude that the vowel 'i' (as in the word 'she') is useful in order to improve the direction and velocity of the air stream that enters the saxophone. Playing with consistent air pressure will directly influence the tone quality of the saxophonist in a positive manner. Results of the experiment, based on the evaluation of four jury members, indicate that students of the experimental group improved in terms of air pressure. Jury members

evaluated that students of the experimental group improved by playing with a more consistent air flow, while students of the control group performed equally and didn't improve nor decline.

The results of the experiment are in line with Liebman (1994) who writes that the tongue position has a major influence on the direction and velocity of the airstream before it enters the saxophone mouthpiece. According to Liebman (1994) the so-called 'middle position' of the tongue will result in maximum direction and velocity of air. Also saxophonist Fernando Ramos proposes a not too open position of the tongue as in the syllable 'she'.

5.2.2 Tone color in the high register

The vowel 'u' (as in the word 'you'), does not have a significant influence on the darkness of the tone quality in the high register of third and fourth grade saxophone students. However, with the results of the evaluation I also cannot conclude if the vowel 'u' results in a brighter tone color in the high register of the saxophone.

The results are not in line with results of my experiment of 2013 (Geest). During this experiment the majority of superior saxophone students indicated the vowel 'u' as their favorite vowel. The superior students commented that the vowel 'u' gave a warm, full and dark saxophone timbre and a projected sound.

It is possible that the experiment did not confirm the hypothesis because the jury members interpret the tone color of the same student in very different manners. This might be a result of a different interpretation of the words bright and dark tone color of the jury members. A second explanation might be that students of the third and fourth grade have more difficulties in altering the tone color in the high register in comparison to superior saxophone students.

5.2.3 Tone color in the medium and low register

Based on the experiment, the vowel 'i' (as in the word 'she'), does not have a significant influence on the brightness of the tone quality in the medium and low register of third and fourth grade saxophone students. Most students of both the experimental and the control group, did not alter their tone color in the medium and low register and were evaluated equally on both performances by the jury members. Of notice is that the control group scored slightly higher in terms of playing with a brighter sound in the medium and low register than the experimental group. Therefore I conclude that the vowel exercises with 'i' do not contribute to the ability of performing with a brighter tone color in the medium and low register of the saxophone.

These results are not in line with my own expectations and experience on playing with the vowel 'i'. As the vowel 'i' seems to be useful in order to play with maximum direction and velocity of air (Liebman, 1994) and implies a closed tongue position in the front part of the mouth, I expected the vowel to result into a projected and very compact sound, especially in the

medium and low register of the saxophone. However, results of the experiment do not confirm these expectations.

5.2.4 Use of tone colors

Singing and playing with vowels tends to improve the ability of playing the saxophone with a variety of tonal colors. Results confirm that singing and playing with vowels is not negative in order to develop the ability to play with a bigger variety of tone colors. Although the control group also improved in their use of tone colors, the results of the experimental group were much more stable in comparison to the contrary results of the control group.

These results are in line with my experiment of 2013 (Geest). According to the experts' evaluation, the difference in the evaluation prior to and after the exercises was non-significant (Geest, 2013). However, the results of the participants' questionnaires indicated that the totality of participants of the 2013 experiment referred sound differences each time they changed to a different vowel. Furthermore, the majority of the participants pointed that the exercises made them more aware of timbre possibilities and helped them to create a clear idea about which saxophone timbre to apply in various musical contexts (Geest, 2013).

The results of the experiment are also in line with scientists who do not always agree about the effect of the vocal tract to the timbre (see §1.3). According to Wolfe *et al.* (2003) a possible reason for these doubts is that it is difficult to explain the effect of the vocal tract to the sound, because the acoustic currents on either side of the reed most of the time aren't equal; the bore of most instruments is narrow and has therefore high resonances in comparison to the weaker resonances of the vocal tract. According to Wolfe saxophonists tune the vocal tract to produce the altissimo register, but *in the normal range of the instrument, below about 700 Hz. there is no simple relation between the frequencies of the note played and the tract resonance* (Wolfe, Garnier, & Smith, 2010, p. 14). In a similar research, Scavone *et al.* (2008) defend that tongue movement by saxophone players, results in vocal-tract manipulation which can be used to produce subtle timbre variations throughout the playing range of the saxophone. However, the vocal-tract influence becomes significant in the high and altissimo register of the saxophone (Scavone, Lefebvre, & da Silva, 2008). According to Scavone *et al.* (2008) saxophone players can produce subtle timbre variations throughout the playing range of the saxophone, although not as significant as in comparison to the high and altissimo register.

2. Are consonants useful as tools to improve the saxophone articulation of third and fourth grade saxophone students?

5.2.5 Use of articulation

Based on the results of the experiment, singing and playing with the consonant 't' (as in the word 'two') is beneficial for third and fourth grade saxophone students in order to play with

a more clear articulation. Although there was an improvement in the use of articulation of the students of the control group, the students of the experimental group improved more according to the evaluation of the jury members. In addition, students of the control group more often maintained equally or declined in terms of articulation according to the evaluation of the jury members.

These results are in line with literature of Liebman and Quantz (Liebman, 1994; Quantz, 2001). Liebman proposes to use the consonant 't' in order to play a light staccato and the syllable 'the' in order to play tenuto (Liebman, 1994). Quantz uses a similar approach with several syllable examples such as 'ti' and 'di'. According to the author, the syllable 'ti' should be used for short, equal, lively and quick notes, while the contrasting syllable 'di' "must be used in slow melodies (Quantz, 2001, p. 71 – 72).

The results of the experiment confirmed my own expectation in relation to the consonant 't'. Because of the level of the saxophone students (3rd and 4th grade) I choose to select the consonant 't' for the vocalization exercises, even though the melody of the etude of Guy Lacour (1989, p. 14) is slow and melodic. In my experience, the consonant 't' would give more clear results in terms of articulation in comparison to 'd' for students of the third and fourth grade. From my teaching experience students of this level do not exaggerate as much as superior saxophone students, and therefore I expect the consonant 't' to give clearer articulation results in comparison to the consonant 'd'.

3. Does singing help third and fourth grade students to play with a larger dynamic range?

5.2.6 Use of dynamics

Results of the experiment reveal that singing is not necessarily beneficial in order to develop the ability of playing with a bigger dynamical range. When comparing the results of the experimental with the control group, I noticed that the students of the control group revealed a larger improvement in terms of their ability of performing with a bigger variety of dynamics. It seems that on a short term, singing does not benefit the ability of playing with a larger dynamical range for saxophone students of the third and fourth grade.

These results are not in line with Wolbers (2002) who writes that singing will help students to naturally develop dynamics. However, the experiment investigated results of singing and playing with vowels on a short-term. Wolbers suggests that students should sing regularly in order to improve their use of dynamics and their performance in general (Wolbers, 2002) but doesn't indicate if results will be noticed on a short or long term.

Conclusion

In this thesis, my objective was to discover if vocalizing improves the (i) tone quality, (ii) articulation and (iii) use of dynamics of third and fourth grade saxophone students.

First I wrote about the existing literature on the subject. I came to the conclusion that singing or vocalizing is essential for the musical development of children (Gordon, 1999). Moreover, investigators as well as musicians and teachers write about the necessity of including singing or vocalization exercises in instrumental class in order to develop the inner ear and for students to imagine the music before they play it (Edlund, 1963; Ioan, 2007; Lee, 1996; Robinson, 1996; Scavone, Lefebvre, & da Silva, 2008; Wolbers, 2002). Singing in instrumental class also helps students to solve intonation difficulties, to develop a consistent sense of tonality (Robinson, 1996) and to naturally develop phrasing, the use of dynamics and breathing points (Wolbers, 2002). Ioan (2007) and Rascher (1994) underline that every music student should develop the inner listening as much as possible because without a clear imagination of the music it will be harder to reproduce it. In order to develop the wind instrument timbre and articulation, several musicians and teachers propose the use of vowels and consonants in vocalization exercises (Ioan, 2007; Liebman, 1994; Quantz, 2001). Liebman (1994) proposes the use of the vowel 'e' as in 'eat' in order to create a maximum velocity of air and minimum waste which will benefit the tone quality of the saxophone. In addition, Liebman (1994) and Quantz (2001) propose the use of several consonants such as 't' as in 'tea' in order to develop a staccato articulation. Although many wind instrument players notice the impact of vowels to the timbre (Berio, 1966; Ioan, 2007; Liebman, 1994; Quantz, 2001) scientists do not always agree on the effect of the vocal tract to the timbre of wind instrument players (Wolfe, Tarnopolsky, Fletcher, Hollenberg, & Smith, 2003). Reasons therefore are that (i) it's difficult to measure specific aspects of the vocal tract and (ii) the acoustic currents on either side of the reed most of the time aren't equal (Wolfe, Tarnopolsky, Fletcher, Hollenberg, & Smith, 2003). In the specific case of the saxophone, Scavone *et al.* (2008) state that tongue movement results in vocal-tract manipulation which can be used to produce subtle timbre variations throughout the playing range of the saxophone, but vocal-tract influence only becomes significant in the high and altissimo register of the saxophone.

In Chapter 2 I denoted that many of the sound emission and musical problems of my saxophone students seem to have their origin in a general lack of musical imagination. I believe that it is essential for music teachers to create methods in order to help students to create the ability of imagining the music they want to play, in their minds. As most of the existing information and developed exercises focus on more advanced or superior saxophone students (Liebman, 1994; Rascher, 1994), I felt the necessity to develop more simple exercises for beginning and young saxophone students. I raised the hypothesis that vocalizing with syllables

improves (1.) the tone quality, (2.) the articulation and (3.) the use of dynamics of third and fourth grade saxophone students. In order to test this hypothesis I set formulated the following objectives:

1. To deepen my knowledge about vowels and consonants.
2. To sing and play with vowels and to discover if vowels are useful as tools to improve my own tone quality on the saxophone.
3. To sing and play with consonants and to discover if consonants are useful as tools to improve my articulation.
4. To develop two vocalization exercises for third and fourth grade students.
5. To set up an experiment and to discover if these exercises help third and fourth grade students to improve their tone quality, articulation and the use of dynamics.

In Chapter 3 I described the vocalization approach that I adopted for myself, based on the existing literature, my study of the International Phonetic Alphabet (IPA, 1999) and lessons with my saxophone teacher Fernando Ramos between 2011 and 2013. I described the basic linguistic terms and the parallel between linguistic and musical terms. I wrote about the importance of the International Phonetic Alphabet (IPA, 1999) in order to deepen my knowledge on vowels and consonants. Further in chapter 3, I described the tongue position of the four extreme vowels in the mouth and the expected sound results in shaping the saxophone timbre. In addition, in §3.3.1 I described the experiences of colleague saxophonists on singing and playing with vowels based on the experiment I developed in 2013 (Geest, 2013). In §3.4 I described the place and manner of articulation of consonants and came to the conclusion that (i) consonants help discovering and improving a variety of articulations on the saxophone and (ii) consonants are a useful support to develop extended techniques on the saxophone. Based on the existing literature and my personal experience I denoted that the consonants 'd' and 't' were directly applicable to the saxophone articulation because their place and manner of articulation stand very close to the embouchure of a saxophone. Most of the other consonants, examples are 'n' and 'h', are not-directly suitable as modes of saxophone articulation. However, some of these consonants can be useful as sound references, which can be imitated on the saxophone to discover different articulations. In §3.5.2 I gave examples of four consonants that can be useful in order to develop extended saxophone technics. Finally, in §3.5.3 I describe experiences of colleague saxophonists on singing and playing with consonants based on the experiment I developed in 2013 (Geest, 2013).

In Chapter 4 I described the experiment protocol. First, I set out a pilot study with two of my saxophone students. I selected an etude of Guy Lacour (1989) for both of my students and developed a vocalization exercise. In addition, I selected syllables that in my experience would fit into the style of the etude and would give the best results in terms of air pressure, tone quality and use of articulation and dynamics and wrote them above the notes in the sheet music. After my students were able to easily play the selected etude (without syllable indications) I marked the date of the experiment. I developed a questionnaire and asked fellow colleagues to evaluate

the performances of student M. by filling in the questionnaire. Afterwards, I worked for more or less 30 minutes with the student on the vocalization exercises and the etude but this time with the syllable indications. Finally, student M. performed the etude with the syllable indications in front of the jury and the jury evaluated the student by filling in a second questionnaire. The same process was repeated with student J. During the process I decided to develop a second vocalization exercise as I felt that it was necessary to create a connection between the first vocalization exercise and the Guy Lacour etude (1989). Based on the results of the questionnaires I concluded that the vocalization exercises were helpful in order to develop the air pressure, the tone quality and the use of dynamics and articulation. Based on the feedback I received of my colleagues, I rephrased some of the questions of the questionnaire.

Afterwards I prepared the research experiment with the help of my internship coordinator João Figueredo at the *Conservatório de Aveiro*. João selected a group of eight saxophone students of the third and fourth grade. I chose to apply a convenience sample procedure given the accessibility and proximity of the participants. All of them received etude nº 18 of Guy Lacour (1989, p. 14) and studied the etude for a period of two months. In addition, João and three other teachers of the *Conservatório de Aveiro* agreed in joining the experiment by evaluating the students on the 21st of April of 2015. The jury existed of three saxophone teachers and one clarinet teacher. During the experiment, all of the students performed in front of the jury members and after each performance the jury members filled in a questionnaire. Afterwards, I divided the students into two groups: a control group and an experimental group. I asked the control group to study etude nº 18 (1989, p. 14) together and to help each other to improve their performances. At the same time I worked with the experimental group on the vocalization exercises and etude nº 18 (Lacour, 1989, p. 14) with syllable indications. After 40 minutes both groups performed again in front of the jury and the jury evaluated all of the students by filling in a second questionnaire.

Based on the evaluations of the jury members I described the results in §5.1. Further, in §5.2 I related the outcome of the experiment to the existing literature on the subject. Results on air pressure revealed that playing with the vowel 'i' as in 'me' is useful in order to improve the direction and velocity of the air stream that enters the saxophone. This will directly improve the tone quality of the saxophonist in a positive manner. These results are in line with Liebman (1994) who writes that the so-called 'middle position' of the tongue (as in 'me') will result in maximum direction and velocity of air. Also saxophonist Fernando Ramos proposes a not too open position of the tongue as in the syllable 'she'. The outcome of the experiment on the development of the tone color in the high register showed that the vowel 'u' (as in 'you') does not have a significant influence on the darkness of the tone quality in the high register of the third and fourth grade saxophone students. Of notice is that jury members interpreted the tone color of the same students in very different manners. Results on this parameter are not in line with results of my 2013 experiment (Geest, 2013). During this experiment the majority of superior saxophone students indicated the vowel 'u' (as in 'you') as their favorite vowel and

commented that the vowel resulted into a warm, full and dark saxophone timbre and projected sound. Also the vowel 'i' (as in 'me') does not have an influence on the brightness of the tone quality in the medium and low register of the saxophone of third and fourth grade saxophone students. Even though most of the totality of students performed equally during both performances, students of the control group scored slightly higher in terms of performing with a brighter tone color in the medium and low register in comparison to the experimental group. These results are not in line with my own expectations and experience on playing with the vowel 'i' (as in 'me'). As the vowel is useful in order to play with maximum velocity and direction of air (Liebman, 1994), I expected the vowel to result in a projected and very compact sound, especially in the medium and low register of the saxophone. The outcome of the experiment on the use of tone colors confirms that singing and playing with vowels is not negative in order to develop the ability of playing with a bigger variety of tonal colors. In other words: vocalizing tends to improve the ability of playing with a bigger variety of tonal colors but the outcome of the experiment was not significant in order to confirm this. These results are in line with my experiment of 2013 (Geest). According to the experts' evaluation, the difference in the evaluation prior to and after the exercises was non-significant. However, the totality of participants referred sound differences each time they changed to a different vowel and the majority pointed that the exercises made them more aware of timbre possibilities and helped them to create a clear idea about which saxophone timbre to apply in various musical contexts (Geest, 2013). Results of the experiment on tone color are also in line with Scavone *et al.* (2008) who state that saxophone players can produce subtle timbre variations throughout the playing range, although not as significant as in the altissimo register. Results of the experiment on the use of articulation indicate that the use of the consonant 't' (as in 'two') is beneficial for third and fourth grade students in order to play with a more clear articulation. These results are in line with literature written by Liebman (1994) and Quantz (2001) and confirm my own expectations. Finally, the outcome of the experiment indicates that singing is not necessarily beneficial in order to develop the ability of player with a larger dynamical range. These results are not in line with Wolbers (2002) who denotes that singing will help students to naturally develop the ability of developing their phrasing, breathing points and use of dynamics.

This leads me back to the main question of the research:

Does vocalizing improve (1.) the tone quality, (2.) the articulation and (3.) the use of dynamics of third and fourth grade saxophone students?

1.) Vocalizing and tone quality

Vocalizing is beneficial for saxophone students of the third and fourth grade in order to (i) develop the ability to improve the direction and velocity of the air stream (with the vowel 'i' as in 'me') and seems to be beneficial in order to (ii) discover and play with a bigger variety of

tonal colors (with the vowels 'i' 'me' and 'u' as in 'you'). Both abilities are essential in order to improve the tone quality of the saxophone.

2.) Vocalizing and articulation

Vocalizing with the consonant 't' as in the word 'two' is beneficial for saxophone students of the third and fourth grade in order to play with a clearer saxophone articulation.

3.) Vocalizing and dynamics

Vocalizing does not have an influence on the use of dynamics of saxophone students of the third and fourth grade on a short term.

Implications for further research

In my opinion, it is necessary that music teachers keep developing methods in order to help students to create the ability of imagining the music they want to play, in their minds. With this research, I tried to develop such a method. However, I believe that the development of many more methods are necessary especially for beginning music students. In addition, I believe that whenever a student can imagine the music he or she wants to play, the actual execution will be not only more accurate, as well as more musical. This approach will be more efficient in comparison to only focusing on instructing the student to play the right notes and to play with the written musical indications. Music students need to learn how to think independently and to gain maturity in order to apply what they learned in future circumstances.

In addition, it is necessary to test the effect of the vocalization exercises that I developed, on a long term, for example during a case study.

Also, it would be interesting to test the effect of the vocalization exercises with students of other wind instruments such as the clarinet.

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Appendixes

Appendix 1 – Etude N° 5 by Guy Lacour (1989, p. 4).

4

5

Allegretto ♩ = 112

mf

p

f

p

mf

rall.

Appendix 2 – Etude N° 18 by Guy Lacour (1989, p. 14).

14

18

T° di Valse ♩ = 138

mf *p* *mf* *f* *p* *f* *mf* *f* *p* *mf* *f* *p* *mf*

Appendix 3 - Questionnaire 1.

Thank you for participating in my research about vocalization in saxophone class!

In this research, I investigate the possible role of syllables to the performance of saxophone students. More specifically, I investigate if singing and playing with syllables affects the (1.) tone quality and the use of (2.) dynamics and (3.) articulation.

As a saxophone teacher of mainly young students, I often see my students struggling with the development of a stable saxophone sound. Several researchers, especially saxophonists and flutists, show that vocalizing has positive effects on the development of sound imagination and sound quality (Liebman, 1994; Rascher, 1994; Quantz, 2001; Ioan, 2007).

I developed two vocalization exercises designed to improve the performance of Etude N° 18 by Guy Lacour. Today we investigate if the vocalization exercises have any influence on the student's performances on a short term. I would like to ask you to listen twice to each student and to evaluate his or her performance by filling in a questionnaire.

Evaluation 1

Student:

.....

Level:

.....

Please listen to the student and answer the following questions:

- 1.** Describe the level of air pressure of the student by surrounding one of the following numbers:

1 – 2 – 3 – 4 – 5

1 = no air pressure
 2 = poor air pressure
 3 = just enough air pressure
 4 = consistent air pressure
 5 = very consistent air pressure

- 2.A.** Describe the tone color of the student, in the high register, by surrounding one of the following numbers:

1 – 2 – 3 – 4 – 5

1 = very dark tone color
 2 = dark tone color
 3 = no specific tone color
 4 = bright tone color
 5 = very bright tone color

- 2.B.** Describe the tone color of the student, in the medium/low register, by surrounding one of the following numbers:

1 – 2 – 3 – 4 – 5

1 = very dark tone color
 2 = dark tone color
 3 = no specific tone color
 4 = bright tone color
 5 = very bright tone color

- 2.C.** Describe the use of tone colors (i.e. to play with brighter and darker tone colors) of the student by surrounding one of the following numbers:

1 – 2 – 3 – 4 – 5

1 = no use of tone colors
2 = poor use of tone colors
3 = minimal use of tone colors
4 = rich in use of tone colors
5 = very rich in use of tone colors

- 3.** Describe the use of dynamics of the student by surrounding one of the following numbers:

1 – 2 – 3 – 4 – 5

1 = no dynamics
2 = poor dynamics
3 = minimal use of dynamics
4 = rich dynamics
5 = very rich dynamics

- 4.** Describe the use of articulation of the student by surrounding one of the following numbers:

1 – 2 – 3 – 4 – 5

1 = no articulation
2 = unclear articulation
3 = minimal use of articulation
4 = clear articulation
5 = very clear articulation

Thank you!

Appendix 4 - Questionnaire 2.

Evaluation 2

Student:

.....

Level:

.....

Please listen to the student and answer the following questions:

- 1.** Describe the level of air pressure of the student by surrounding one of the following numbers:

1 – 2 – 3 – 4 – 5

1 = no air pressure
 2 = poor air pressure
 3 = just enough air pressure
 4 = consistent air pressure
 5 = very consistent air pressure

- 2.A.** Describe the tone color of the student, in the high register, by surrounding one of the following numbers:

1 – 2 – 3 – 4 – 5

1 = very dark tone color
 2 = dark tone color
 3 = no specific tone color
 4 = bright tone color
 5 = very bright tone color

- 2.B.** Describe the tone color of the student, in the medium/low register, by surrounding one of the following numbers:

1 – 2 – 3 – 4 – 5

1 = very dark tone color
 2 = dark tone color
 3 = no specific tone color
 4 = bright tone color
 5 = very bright tone color

- 2.C.** Describe the use of tone colors (i.e. to play with brighter and darker tone colors) of the student by surrounding one of the following numbers:

1 – 2 – 3 – 4 – 5

1 = no use of tone colors
2 = poor use of tone colors
3 = minimal use of tone colors
4 = rich in use of tone colors
5 = very rich in use of tone colors

- 3.** Describe the use of dynamics of the student by surrounding one of the following numbers:

1 – 2 – 3 – 4 – 5

1 = no dynamics
2 = poor dynamics
3 = minimal use of dynamics
4 = rich dynamics
5 = very rich dynamics

- 4.** Describe the use of articulation of the student by surrounding one of the following numbers:

1 – 2 – 3 – 4 – 5

1 = no articulation
2 = unclear articulation
3 = minimal use of articulation
4 = clear articulation
5 = very clear articulation

5.A. You have listened twice to the student. Please surround which of the performances you prefer:

I prefer the 1st / 2nd performance.

5.B Please describe why you prefer the 1st or 2nd performance?

.....
.....

.....
.....


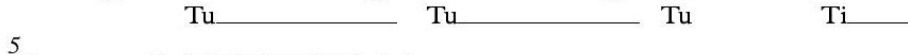
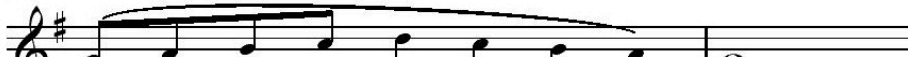
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Thank you very much for your time and participation!

- Alto Saxophone
- 
- Tu Tu Tu Ti
- 5
- Alto Sax.
- 
- Ti Ti
- 7
- Alto Sax.
- 
- Tu Ti Ti

Alto Saxophone

Tu_ Tu_ Tu Ti_ Ti_ Ti Tu_ Ti_

5

Alto Sax.

Tu Tu_ Tu Ti_ Ti Tu

Alto Sax.

Tu_ Tu_ Tu_ i_ Ti_

Alto Sax.

Tu_ Ti_ Tu_ Ti_ Ti_ Ti_