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THE VOICE CHARACTERISTICS OF AN AUTONOMY SUPPORTIVE AND CONTROLLING TEACHING STYLE

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The Voice Characteristics of an Autonomy Supportive and Controlling Teaching Style

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June 2021

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Curriculum and Instruction.

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ABSTRACT

The Voice Characteristics of an Autonomy-Supportive and Controlling Teaching Style

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M.A. in Curriculum and Instruction

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The study investigated the voice characteristics of an autonomy-supportive and controlling teaching style. Based on the literature describing the autonomy-supportive and controlling motivating style, two texts were prepared to be used by teachers to introduce an assignment to their students. The one text included phrases that correspond to autonomy-supportive teaching (i.e., autonomy-supportive text), and the other text included phrases that correspond to controlling teaching (i.e., controlling text). Voices of eight Turkish high school teachers in Ankara were recorded while they were reading the two texts. Then, the voice recordings were analysed.

A voice analysis performed through Praat software identified the external characteristics of teachers' voice (i.e., pitch, amplitude, energy, power and speech rate) that correspond to the autonomy-supportive and controlling motivating style. The Wilcoxon-signed rank test was performed to identify differences in voice characteristics of the two different instructions.

Results of the 16 recordings showed that, in 11 out of the 14 sentences, the speech rate of the controlling teaching style was faster. Contrary to my expectations, only one controlling sentence was delivered with a higher-pitched voice. The same sentence was delivered less softly, in a more forceful and "stern" way in the controlling instructions as I expected. A supplementary analysis, in which the recordings of a less expressive voice were excluded, showed more differences in the voice characteristics between the autonomy-supportive and the controlling motivating style. The findings are discussed in terms of their applications in supporting instruction as well as the teacher pre-service and in-service programs.

Keywords: amplitude, autonomy-supportive teaching, controlling teaching, fundamental frequency, loudness, motivational prosody, pitch, speech rate, the energy level of the voice, voice characteristics

ÖZET

Özerkliği Destekleyici ve Engelleyici Öğretim Yaklaşımlarını Kullanan

Öğretmenlerin Ses Özellikleri

Gülcehan Ceyhan Erken

Yüksek Lisans, Eğitim Programları ve Öğretim

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Bu çalışma, özerkliği destekleyici ve engelleyici öğretim yaklaşımlarını kullanan öğretmenlerin bu öğretim yaklaşımlarını kullanırken sahip oldukları akustik ses özelliklerini araştırmaktadır. Öğretmenlerin öğrencilerine bir ödevi tanıtırken kullanmaları için özerklik destekleyici ve engelleyici öğretim yaklaşımlarını inceleyen alanyazına dayalı olarak iki Türkçe metin hazırlanmıştır. Bir metin özerkliği destekleyici öğretime karşılık gelen ifadeler içerirken diğer metin özerkliği engelleyici öğretime karşılık gelen ifadeleri içermektedir. Ankara'daki bir özel lisede çalışan, farklı branşlarda öğretmenler olan 8 Türk katılımcının sesleri bu iki metni okurken kaydedilmiş ve ardından ses kayıtları Praat yazılımıyla analiz edilmiştir. Praat yazılımı aracılığıyla gerçekleştirilen ses analizi, özerkliği destekleyici ve engelleyici öğretim yaklaşımlarına karşılık gelen öğretmen sesinin akustik özelliklerini (frekans ya da tını, gürlük, enerji, güç ve konuşma hızı) belirlemiştir. İki farklı öğretim yaklaşımının ses özelliklerindeki farklılıklarını belirlemek için Wilcoxon Signed Rank testi uygulanmıştır.
8 öğretmenden alınan 16 ses kaydının analiz sonuçlarına göre, 14 cümleden 11 tanesinde öğretmenler özerkliği engelleyici öğretim yaklaşımını kullanırken daha hızlı konuşmuştur. Beklentimizin aksine, özerkliği engelleyici öğretim yaklaşımının hâkim olduğu bir cümle daha yüksek tınılı söylenmiştir. Bunun yanı sıra, aynı cümle daha güçlü ve “sert” bir şekilde söylenmiş, beklentilerimizi desteklemiştir. Daha ifadesiz olan ses kayıtlarının hariç tutulduğu tamamlayıcı bir analiz sonucu, daha fazla ses özelliğinde farklılık ortaya çıkmıştır. Bulgular, eğitim uygulamalarını destekleyecek kullanımlar açısından tartışılmıştır.

Anahtar kelimeler: frekans, gürlük, konuşma hızı, motivasyonel prozodi, özerkliği destekleyici öğretim yaklaşımı, özerkliği engelleyici öğretim yaklaşımı, ses özellikleri, ses yüksekliği, sesin enerji düzeyi, tını

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CHAPTER 1: INTRODUCTION

Introduction

My teachers had a crucial role in my life. I remember my kindergarten teacher; she was my very first teacher and I learned a lot from her. My parents considered her a very positive and sympathetic person. They were always telling me that I am so lucky to have such a successful and lovely teacher. She was always optimistic. She was smiling all the time. She was also physically close to me. She used to caress my head and compliment me about my beautiful hair. However, I was not feeling very positive about her. I was feeling that she was not sincere and warm. I was being irritated by her proximity and her words. When I was failing in a task or when I could not finish a task until the deadline, she was saying "you are such a successful girl". It seemed to be no problem when I told this to my parents because there was nothing wrong with her wording. However, the way that she was saying this phrase, the mimics of her and the voice of her were irritating. I was not feeling successful when she said to me so, but the opposite; I was feeling terrible and thinking that she did not like my painting or drawing. This made me feel that I am bad at anything, and can never succeed. However, I could not explain to my parents (and myself) the reason why I was feeling this way. Years later, when I was looking at drawings, paintings, hand crafts of my kindergarten years, I remembered the way she was talking to me. Then, I realized that she used to be sarcastic. She was using her voice and her facial expressions to mean the opposite of what she was saying. I realized that the voice tone can mean a lot as a means of communication. In the present study, therefore, I investigated teachers' motivating style through their voice tone.

Background

According to self-determination theory (SDT; Ryan & Deci, 2017), there are three basic innate psychological needs: autonomy, competence and relatedness. The need for autonomy stands for people's need to act with free will. In other words, it refers to people's sense of being initiators of their behaviours; self-governing their actions (Deci & Ryan, 1987; Gillet et al., 2012). Need for competence refers to feeling effective and capable in interactions with the environment. Lastly, the need for relatedness refers to feeling connected and involved in relationships with others, in other words, it can be defined as a sense of belongingness (Ryan & Deci, 2000).

When basic psychological needs are satisfied, it enhances psychological well-being, integrity and growth. When basic psychological needs are frustrated, the consequences may be harmful to the individual's cognitive and affective well-being. Need satisfaction has been related to people's quality of motivation (Deci & Ryan, 2017; Reeve, 2016), regulation of behaviour and social relationships (Deci & Ryan, 2017), self-efficacy (Skinner, 1995; Skinner et al., 2008), and hence optimal functioning in every aspect of life throughout one's life.

According to research in the educational context, when students' psychological needs are satisfied by the teacher, they develop a good quality of motivation such as being engaged in school activities out of interest. They may also develop personal important reasons to be engaged. For example, they might do their homework because they enjoy it or because they find it satisfying. Another reason may be because they find the homework relevant to their personal goals. This good quality of motivation labeled as autonomous motivation enhances creativity (Koestner et al., 1984), increases conceptual understanding (Benware & Deci, 1984), enhances enthusiasm towards learning (Reeve, 2016), enhances greater emotional

engagement (Kaap-Deeder et al., 2016; Reeve et al., 2004), and support well-being (Black & Deci, 2000). Students become proactive and cooperative and hence meaningful learning occurs (Deci & Ryan, 1987; Reeve, 2006, 2016; Ryan & Deci, 2000; Skinner & Belmont, 1993).

According to research in educational settings, when basic psychological needs are thwarted, it causes students to not attend to the learning activity; they may feel bored, anxious and unhappy during learning sessions (De Meyer et al., 2014). Even when students do attend their lessons they are motivated by external pressure (Ryan & Deci, 2000). For instance, they do their homework to get a reward such as chocolate, to avoid a punishment or to avoid feeling guilty. This poor quality of motivation is labeled controlled motivation and prevents students' effective engagement in the learning process while it also diminishes their performance. (Reeve, 2006).

According to self-determination theory, teachers' motivating style can be considered along a continuum that ranges from being highly need-thwarting to being highly need-supportive (Deci et al., 1981).

Autonomy-thwarting or controlling teachers tell students what to do and what not to do and put external motivational resources on their students such as rewards and punishments. More specifically, they criticize their students with pressuring statements and are negative toward them (e.g., "Hey, stop! No, you should not be doing it" or "You cannot do it"). They provide answers directly, give commands and directives (e.g., "Put it there."). They convey rigid and pressuring messages (e.g., "Work faster, you should've been done by now.") (Reeve, 2006). Teacher talk and monopolization of teaching materials are dominant when teachers are autonomy-thwarting. (De Meyer et al., 2014; Reeve & Jang, 2006). Teachers who are careless

of their students thwarts their need for relatedness, they come to class, teach and leave; they do not engage with their students. Teachers who communicate their expectations in a confusing way or giving contradictory statements or teachers who do not respond to students' questions in the process of learning thwart students' need for competence (Jang et al., 2010).

Autonomy-supportive teachers, on the other hand, encourage their students to develop coherence between classroom activities and students' own interests, choices, values and goals (i.e., inner motivational resources; Reeve, 2016). More specifically, they ask students what they want to do; they provide choices and flexibility. They provide rationale about the usefulness of what they are doing. They offer hints and encouragements for students to make a choice or initiate an action. (De Meyer et al., 2014; Núñez & León, 2015; Reeve & Jang, 2006).

Teachers can support students' need for relatedness by being interested in their students; this involves caring about them, spending time with them and listening to them. For instance, asking how they are doing at the beginning of the class help to enhance students' sense of relatedness. (Skinner & Belmont, 1993). Students' need for competence can be enhanced by providing in detail their expectations and how to achieve them. Teachers reflect these qualities when they give clear instructions, offer a sequence of actions to guide students and give feedback to help improve students' progress (Jang et al., 2010).

During teacher-student interactions, nonverbal communication has as much great impact on students as the verbal communication (Mehrabian & Ferris, 1967). According to Hall et al. (2019), nonverbal communication can be defined as facial expressions, voice diminished from its linguistic content, body posture, touch, interpersonal space; anything minus words. Hence, the voice characteristics of the

teacher is one of the important components of teacher-student nonverbal communication.

Prosody is defined as speech qualities related to speakers' emotional state, intentions and form of the utterance varies in terms of conveying autonomy-supportive or controlling meaning (Weinstein et al., 2018). It provides important clues about how the speaker feels and what the speaker means exactly. For example, a speaker whose words are "What an amazing day!" may want to mean the exact meaning of the words if s/he told the sentence with a cheerful and an energetic voice or the exact opposite if s/he told the sentence with a stable and sad voice. The difference of the meaning with the same exact words is associated with the tone of voice; intonation of the sentence, stresses on the words and the rhythm of the sentence.

The human voice has a number of characteristics, including frequency, timbre and amplitude. Frequency is the number of times vibrations occur for a specified unit of time (usually, per second). The frequency of phonation is the number of times the vocal folds vibrate per second and is the acoustic equivalent to pitch. Its unit is Hertz or Hz for short (Berg & Stork, 2005).

The loudness of the voice can be determined by its amplitude. It is the strength of a signal. In other words, it is the volume of the voice and its unit is the decibel (dB) (Berg & Stork, 2005).

Timbre is the feature which allows us to distinguish different people's voices at the same frequency and amplitude. It makes the voice unique to its owner by the differences among various waves. In other words, it is the voice quality (Berg & Stork, 2005).

Recent studies showed that voice and speech analysis can provide important

information for different purposes. Dasgupta (2017) investigated how can emotions be detected through voice and speech analysis and presented an algorithmic approach to detect normal, angry and panicked emotional states. Schirmer et al. (2019) found that vocal characteristics (e.g., frequency, speech rate) can affect people's trustworthiness. In another study, women assessed men's age, weight and height through their voice characteristics (Bruckert et al., 2006). Almeida et al. (2019) detected Parkinson's disease by processing voice signals and phonation. Is it also possible to detect teachers' motivating styles through voice analysis?

Problem

Teachers' style during classroom instruction influences their students in terms of motivation towards learning, their engagement with subject areas and assignments, their exam scores, their emotions, and subsequently their overall performance (Amoura et al., 2015; Khandaghi & Farasat, 2011; Wilde, 2014). A number of studies have investigated various ways teachers motivate students. In these studies, teacher motivating style is assessed through teachers' self-reports (Deci et al., 1981; Reeve et al., 1999), student ratings (Black et al., 2000; Williams & Deci, 1996), or observations (De Meyer et al., 2014) and observers' ratings (Reeve et al., 2004). Therefore, data is collected through instruments, such as questionnaires, that rely on the participants' opinions and actions. Often times, respondents' viewpoints (such as teacher favouritism or faulty memory) could bias the results (Fraenkel & Wallen, 2008). Even external observers may be influenced by misinterpretations of actions and behaviours. Therefore, since it is possible to have biased results in studies of teacher motivating style, there is a need for more objective measures of teachers' motivating style. One source for a more neutral assessment of teachers' motivating style could be their voice characteristics. A

seminal study by Mehrabian and Ferris (1967) showed that 38% of the communication in a social interaction is affected by voice tone. Hence, it is possible to assume that, by recording teacher voice, a more objective assessment of teachers' motivating style can be achieved.

The human voice has external characteristics such as loudness, timbre, tone and frequency. Those characteristics can be recorded and values associated with these characteristics can be found by using computer software. In particular, the technology can also use algorithms to process voice and speech patterns. The analysis of voice characteristics has been extensively used to determine human emotions (Dasgupta, 2017). To be able to analyse speech, paralinguistics is used as a tool, along with content analysis, of what people say, mean and do. Paralinguistics might be considered as nonverbal communication, it may convey emotion, may modify meaning, might be delivered consciously or unconsciously (Hall et al., 2019). For example, tone of voice, pauses between words, sounds made between words, throat-clearing are among the paralinguistic features that may occur in communication. Can we also use teachers' vocal paralinguistic features to detect their motivating style?

Purpose

The purpose of this research was to identify the characteristics of Turkish teachers' voices while giving instructions that correspond to teachers' autonomy-supportive versus controlling motivating style. I believe that teachers' autonomy support and pressuring attitude can be particularly expressed in their voice tone as they imply trust and domination, respectfully.

Research Question

To what extent are Turkish teachers' specific voice characteristics of autonomy supportive motivating style different from their voice characteristics of controlling motivating style?

Significance

This is the first study aiming at identifying the voice characteristics of Turkish teachers' motivating style as far as known by me and the literature review covered for this study. By identifying what are the paralinguistic characteristics of Turkish teachers' autonomy-supportive versus controlling motivating style, a new measure (i.e., voice characteristics) can be provided to more objectively assess teachers' motivating style. Voice recordings can provide continuous data during teachers' talk in the class and can be used in a real-classroom during lessons to capture teachers' actual motivating style. Moreover, continuous data from teachers' voice recordings can be paired with students' corresponding feelings, motivation and engagement scores during the lecture which can be assessed through real-time surveys completed by the students (i.e., experiential sampling) or through collecting physiological data (e.g., students' heart rate). This way we will be able to study the covariation of teacher motivating style and student motivational state. Although scholars in the SDT have conducted extensive research on teachers' motivating style, until now they have not explored the role of voice characteristics in forming a particular motivating style. Therefore, this study also contributes to the Self-Determination Theory literature by providing a strategy to further understand teachers' motivating styles.

Definitions of Key Terms

Autonomy-supportive motivating style: It is the instructional effort to provide students with a classroom environment and a teacher-student relationship that can support their students' need for autonomy. Autonomy support is the interpersonal sentiment and behaviour the teacher provides during instruction first to identify, then to vitalize and nurture, and eventually to develop, strengthen, and grow students' inner motivational resources. (Reeve, 2016).

Autonomy-thwarting (controlling) motivating style: It is the interpersonal sentiment and behaviour of the teacher during instruction that pressure students to think, feel or behave in a teacher-prescribed way (Reeve, 2009).

Voice characteristics: Characteristics that compose the voice including:

Fundamental frequency (F0, perceived as pitch): It is the rate of repetition of a regular event. The number of cycles of a wave, or some other oscillation or vibration, per second are expressed in hertz (cycles per second). In other words, "how low or high a voice is perceived" (Weinstein et al., 2018, p. 903).

Amplitude (perceived as vocal intensity): The greatest distance that a wave, especially a sound or radio wave, vibrates (= moves up and down). A larger amplitude means a louder voice. In other words, "how loud a sound is perceived" (Weinstein et al., 2018 p. 903).

The energy level of the voice: It is a potential indicator of voice quality. In this study it was examined in different frequency bands and in this context, it can be defined as the relative energy in the frequency spectrum from the low-frequency region to the high-frequency region. It might be an indicator of a stern voice if it has a higher concentration in higher-frequency bands (Guzman et al., 2013; Scherer, 2003).

Speech rate: It is basically the speed at which a person speaks. In other words, “how fast an utterance is produced” (Weinstein et al., 2018, p. 903).

Voice quality (Timbre): The quality of sound that is produced by a particular voice or musical instrument. The unique shape of the voice is obtained when all characteristics of the voice are added together. In the context of voice, it is an indicator of whether the voice is rough, harsh, soft or whispery. It is linked to the amount of energy present within certain frequency bands (Banse & Scherer, 1996; Weinstein et al., 2018).

CHAPTER 2: REVIEW OF RELATED LITERATURE

Introduction

All teachers have their own styles for communicating, instructing, introducing homework and teaching students. Communication has different components. People use, apart from the oral speech, their body language, facial expressions, and their voice while talking (consciously or unconsciously) to be more effective. Each individual's characteristics of talking are unique and therefore, each teacher's talking style is specific.

This study focused on teachers' voice characteristics while they are giving instructions. While introducing homework or exam, teachers may have different attitudes towards their students. Teachers can encourage students for an exam by saying "I am sure you will be successful in this exam." However, this statement may have a different effect on students depending on whether it is said with an enthusiastic and energetic voice or if it is conveyed in a manner that is sarcastic and careless. With their voices, teachers can seek to emphasize and promote what they say in a positive or a negative way. Furthermore, it is possible that even though teachers are saying one thing, they are meaning another. Hence, the voice may give clues about the teachers' communication style.

In this study, the aim was to seek clues from teachers' voices that help to identify communication styles of teachers (i.e., need-supportive teaching, need-thwarting teaching). Often researchers try to gain insights into educators' teaching style by observations or scales; these instruments, however, are inadequate for measuring tonal differences. Therefore, the current study recorded teachers' voices while giving instructions to their students in an autonomy-supportive or controlling

style and used technical devices to measure tonal characteristics (e.g., loudness) of the voices. Subsequently, this study investigated teachers' voice characteristics in certain teaching styles (i.e., being autonomy-supportive vs. controlling) to find out whether voice differences can be identified.

Autonomy-Supportive Versus Controlling (Need-Thwarting) Teaching

In the context of education, Reeve (2009) defined autonomy-support as the interpersonal conception and behavior of teachers which provide explanatory rationales, depend on non-controlling language, display patience towards students, allow them to work at their own pace, acknowledge and accept expressions of negative feelings, nurture and develop students' inner motivational resources. Reeve (2015) described autonomy-supportive teaching as providing a positive psychological environment for learning to occur by teachers who display an understanding of students' feelings and interests. In contrast, using a demanding language, putting pressure on students' behaviors, forcing meaningless and uninteresting activities, neglecting to provide explanatory rationales, showing impatience, neglecting students' feelings and emotions, intervening in their workplace, uttering assignments and commands, being unaware of students' needs, wishes, goals, preferences thwart students' autonomy (Deci & Ryan, 2000; Reeve et al., 2006; Soenens et al., 2012).

More specifically, to identify teachers' attitudes that indicate autonomy support, Reeve et al. (1999) assigned preservice teachers into the role of either a teacher or a student. The teachers' role was to instruct students to solve a puzzle, while the students' role was to develop strategies to solve it and to derive solutions. The instruction period lasted for 10 minutes and it was recorded by a camera. The analysis of the records showed that autonomy-supportive teachers compared to

relatively controlling teachers listened to students more, resisted to give solutions to the puzzle, used fewer directives, asked more questions about what the students wanted to do, responded more to questions of students, encouraged students to work their own way, used more perspective-taking statement, and used more praises. The teachers who supported autonomy created a more student-centered learning environment and encouraged the students more to be initiators of their own behaviors.

In a similar study, Reeve and Jang (2006) classified the instructional behaviors of 72 pairs of same-sex preservice teachers. In these pairs, similar to Reeve et al. (1999), one had the role of the teacher and the other had the role of the student during a 10 minutes instructional event related to a puzzle solution. Reeve and Jang (2006) hypothesized that 21 teaching behaviors will be exhibited during these teaching events; 11 autonomy-supportive and 10 controlling behaviors. The hypothesized autonomy-supportive behaviors included long time of listening to the students, asking what students want, providing time which allows students to work in their own way, long time of student talking, seating arrangements close to learning materials, providing rationales, using praise as informational feedback, offering encouragements, offering hints, being responsive to student-generated questions and communicating perspective-taking statements. While the hypothesized controlling instructional behaviors included long time of teacher talking, long time of holding/monopolizing learning materials, exhibiting solutions/answers, uttering solutions/answers, uttering directives/commands, making should/got to statements, asking controlling questions, giving deadline statements, using praise as a contingent reward and criticizing.

The teaching events were recorded and students (those teachers that had a student role) assessed their perceived autonomy support after the learning-teaching event. Two trained raters independently scored each behavior. According to the results of the study, 8 out of the 11 autonomy-supportive teaching behaviors positively and significantly related to students' perceived autonomy support, whereas from the 10 controlling teaching behaviors 6 were negatively and significantly related to students' perceived autonomy support. The 6 controlling behaviors were, long time of holding/monopolizing learning materials, exhibiting solutions/answers, uttering solutions/answers, uttering directives/commands, making should/got to statements, asking controlling questions. Moreover, regarding the autonomy-supportive behaviors three contributed unique variance in explaining students perceived autonomy support, which are offering encouragement, time allowing the student to work in own way and time student talking. Likewise, two of the controlling behaviors predicted significantly and negatively students perceived autonomy support. Namely, asking controlling questions and making should/got to statements.

In a similar vein, Assor et al. (2002) investigated whether students could differentiate teachers' behaviors as autonomy-supportive and controlling. Approximately 850 students from grades 3 to 8 participated in the study. Teachers' autonomy support was assessed by 34 items combined from different scales. The scales consisted of three types of autonomy-enhancing teacher behaviors. The first of them was fostering relevance; explaining the learning tasks to students by supporting their self-determined interests, goals and values while being attentive and considerate of their feelings and thoughts (e.g., "Teacher explains why it is important to study certain subjects in school"). The second autonomy-supportive behavior was

providing choice and opportunities for students to choose learning tasks based on their interests and purposes (e.g., “Teacher allows me to choose how to do my work in the classroom). The third behavior was allowing criticism and encouraging independent thinking, allowing students to express their dissatisfaction with tasks and being open to re-designing the task (e.g., Teacher allows us to talk about things that we ding unacceptable in school”). The scales also consisted of three types of controlling behaviors. The first of them was suppressing criticism and independent opinions, undermining students’ need for self-guidance and self-expression (e.g., “Teacher is not willing to acknowledge her mistakes”). The second controlling behavior was interrupting students’ actions (e.g., Teacher interrupts me in the middle of activities which interests me”). The last controlling behavior that they described was forcing meaningless and uninteresting activities (e.g., Teacher forces me to prepare uninteresting homework). Assor et al. (2002) found that students can also differentiate these behaviors. Moreover, they suggested that giving students freedom of choice was not always the best way to support students’ need for autonomy because students might not have any clear personal goals or interests. However, to help students develop such interests and goals, explaining the relevance of school work for students was a more important component of autonomy-support. Also, teachers should not suppress students’ criticism and independent thoughts to provide more suitable conditions for learning.

Similarly, Stefanou et al. (2004) distinguished three ways through which teachers can support students’ autonomy. The first way refers to procedural support which can be manifested by sharing procedural decision-making responsibilities. For example, letting students to choose the way to present their ideas, to choose materials for their own learning, and discuss their desires. The second way refers to

organizational support which can be manifested by giving students the opportunities to take part in the organization of the learning environment and learning tasks. For example, encouraging students to choose their group members, their seats and deadlines for their assignments, and to participate in deciding and implementing classroom rules. The third way refers to cognitive autonomy support which can be manifested by teachers who create conditions for students to pursue their own academic goals. For example, when teachers ask students to generate their own paths to solve a task, give them informational feedback, encourage them to be problem-solvers in creative ways students' autonomy is supported cognitively.

Based on these operational definitions, four lessons were observed. Stefanou et al. (2004) found that statements such as "Write this on the sheet, remember this for the quiz, memorize this solution pattern" are instructional controlling directives. On the other hand, statements like "Using your errors to learn might be a good idea, give me a different way you would approach this problem, explain your way of thinking to your classmates" are instructional approaches that support students' autonomy.

Giving a meaningful rationale for the requested behavior, explaining why a rule exists or why an uninteresting activity deserves the attention of students are autonomy-supportive behaviors of teachers. Likewise, providing choices, asking students what they want to include to the lesson plan are autonomy-supportive approaches according to Mih and Mih (2013). Overall, autonomy support is pertinent to find ways to support and increase students' inner endorsement of their classroom activity (Reeve, 2009; Reeve et al., 2004).

Benefits of Autonomy-Support

Teaching styles have been investigated in previous research as they have many important effects on students' outcomes. There is evidence that perceived autonomy support enhances students' engagement (Cheon et al., 2019) and optimal learning (Deci et al., 2000; Su & Reeve, 2011), active-voluntary behavior in the classroom (Vansteenkiste et al., 2005), preference for optimal challenge, greater persistence in tasks and higher academic achievement (Black & Deci, 2000; Reeve et al., 2004; Reeve, 2009; Vansteenkiste et al., 2004). Assor et al. (2002) found that clarifying the relevance of the learning activities for students' goals predicts students' emotional, cognitive and behavioral engagement. Likewise, Reeve et al. (2002) investigated the effects of explaining the rationale in a controlling and autonomy-supportive way. They found that autonomy-supportive communication motivates students even if the activity is not interesting. Vansteenkiste et al. (2012) found that when students' autonomy was supported, students had fewer behavioral problems both within and outside the school (i.e., less skipping classes and less drug use), managed their time more successfully, had more concentration and persistence and experienced lower test anxiety compared to when their autonomy was not supported. Moreover, research has shown that autonomy-support enhances students' well-being (Black et al., 2000; Levesque et al., 2004) and creativity (Amabile, 1985; Koestner et al., 1984).

On the other hand, controlling teaching style is related to students' maladaptive behaviors (Haerens et al., 2015; Ryan et al., 2017). Students display lower academic performance, feelings of guilt and shame (Soenens et al., 2012) and disengagement (Berghe et al., 2015; Jang et al., 2016). They also engage in aggressive and deviant behavior (Vansteenkiste et al., 2012). Assor et al. (2005)

showed that controlling teaching behavior leads to poor motivation and engagement, and negative emotions such as anger and anxiety. Haerens et al. (2015) found that when students reported that their teacher was controlling, they also reported that they felt more pressure, they thought their teacher dislikes them, they considered the lesson as a waste of time and hence they were present in the lesson only to meet pressuring demands of the lesson and the teacher. Vansteenkiste et al. (2005) found that controlling teaching behavior was associated with passive-avoidant behavior in class, higher drop-out rates and ill-being.

Methods of Assessing Teachers' Motivating Styles

In educational research, different methods have been used to assess teachers' autonomy support. In some studies, autonomy-supportive teaching has been assessed through students' reports while in other studies it has been assessed through observations, or teachers' reports (i.e., self-reports).

Student Reports

Students report their teachers' autonomy support usually through questionnaires. In the study conducted by Reeve and Jang (2006) students reported their perceived autonomy support by the nine-item Perceived Self-Determination (PSD) scale. Three items assess an internal locus of causality, three items assess autonomy and the last three items assess perceived choice over one's actions. Some example items of these questionnaires are the following: "While puzzle solving, I felt I was doing what I wanted to be doing", "While puzzle solving, I felt free", "Throughout puzzle solving, I had choices about what I would do next". Similarly, Hofferber et al. (2016) used a modified version of the PSD questionnaire with 10 items to assess perceived autonomy of students. Some example items of this questionnaire are the following: "I study my biology lessons, because I will get a bad

grade if I don't", "I feel that I have everything in control", "In this lesson, I was pursuing my own goals, goals that were important to me."

In the work of Shen et al. (2009) and Cheon and Moon (2010), students' perceptions of teacher autonomy-support were assessed by the six-item Learning Climate Questionnaire (LCQ; Williams & Deci, 1996) and the same was true for the study of Zhang et al. (2018) and Reeve et al. (2020). Chatzisarantis and Hagger (2009) assessed ten high school PE teachers' motivating styles by using an adapted version of LCQ. Some example items of LCQ are the following: "I feel that my instructor provides me choices and options", "My instructor conveyed confidence in my ability to do well in the course", "My instructor tries to understand how I see things before suggesting a new way to do things".

In the research of Bennett et al. (2017) teaching style was measured by a subscale from The Teacher as Social Context (TASC) scale (Belmont et al., 1988). In this scale, autonomy support is assessed with 12 items that correspond to controlling behavior (reverse-scored items; e.g., "My teacher often criticized me on how I do the things during class"), respect toward the students (e.g., "My teacher listens to my ideas"), provision of choice (e.g., "My teacher gave me a lot of choice about how to deal with the exercises") and relevance (e.g., "My teacher talks about how I can use the things we learn in school"). TASC has been used in many other studies (e.g., see Aelterman et al., 2014; Ahn et al., 2018; Berghe et al., 2015; Haerens et al., 2013; Haerens et al., 2015; Soenens et al., 2012).

Mih and Mih (2013) assessed autonomy-supportive teaching style using the 18-item four-point scale of Assor et al. (2002). This scale includes three subscales of providing choice (e.g., "The teacher encourages me to work in my own way"), fostering understanding and interest (e.g., "The teacher explains why it is important

to study certain subjects in school”) and allowing criticism and encouraging independent thinking (e.g., “The teacher allows us to talk about things that we find unacceptable in school”).

Observation

Turner et al. (2002) observed for five days nine math classrooms which were also audiotaped. The naturalistic verbatim data were analyzed in terms of being supportive or non-supportive for students’ learning. Teachers’ supportive discourse was categorized into supportive instructional discourse (including negotiating meaning and transferring responsibility), supportive organizational discourse (e.g., giving directions or using linking expressions between activities), and supportive motivational discourse (i.e., focus on learning, eliciting positive emotions and supporting collaboration).

Haerens et al. (2013) videotaped physical education classes of 74 teachers. They observed 21 possible need-supportive behaviors. Some example behaviors for teachers’ motivating style are the following: “Teacher is enthusiastic and eager”, “Teacher provides variation between or within exercises”, “Teacher addresses pupils by their first name when the opportunity occurs”, “Teacher gives pupils the opportunity to practice independently and to solve problems on their own, without interfering”. Similarly, Aelterman et al. (2014) videotaped physical education classes while teachers were teaching ball games. They used a selection of 13 items from the observation scheme developed by Haerens et al. (2013). Five autonomy-supportive (e.g., “The teacher offers choice to all the students”) and eight structuring (e.g., The teacher gives an overview of the content and structure of lesson”) strategies were rated.

Jiang et al. (2019) videotaped four lessons to analyze teachers' autonomy-supportive and controlling behaviors. They developed coding schemas for autonomy-supportive behaviors (e.g., providing explanatory rationales, acknowledging negative effects, using non-controlling language) and controlling behaviors (e.g., relying on outer resources, rejecting negative effect, using controlling language).

Self-Reports

Reeve (1998) used self-reports of the extent to which teachers perceived themselves as being autonomy-supportive toward their students. Teachers reported their autonomy support through the Problems in School questionnaire (Deci et al., 1981). This questionnaire includes eight brief vignettes describing the teacher's behavioral options when students face problems of motivation. An example of a vignette: "Jim has not been participating during the reading group and has not been completing assignments. The most appropriate thing for Jim's teacher to do is: …" The behavioral options categorized to four ways: a teacher might approach the problem in a highly controlling way (e.g., "Make him stay after school until the day's assignments are done."), in a moderately controlling way (e.g., "She should impress upon him the importance of finishing his assignments since he needs to learn this material for his own good."), in a moderately autonomy-supportive way (e.g., Let him see how he compares with the other children in terms of his assignments and encourage him to catch up with the others.") or in a highly autonomy-supportive way (e.g., "Let him know that he does not have to finish all of his work now and see if she can help him work out the cause of the lessness.").

Aelterman et al. (2019) developed another vignette-based instrument to measure teachers' teaching style called Situations-in-School (SIS). It consists of 12

vignettes of situations differing in the timing of the event, type of event (i.e., problematic situation needs intervention “At a difficult point in the lesson students begin to complain. In response you…”, non-problematic situation but the teacher needs to be proactive “You are thinking about classroom roles. So, you …”), and content (i.e., vignettes involving the provision of learning content “It is time for students to practice what they have learned. You …”, introduction or monitoring of guidelines or a code of conduct “A couple of students have been rude and disruptive. To cope, you…”). For each of the vignette (e.g., “You are preparing a class, your priority is…”), four different teaching behavior options were given; autonomy-supportive (e.g., “to give students enough freedom to participate and offer suggestions during class”), controlling (e.g., “to insist that students pay attention; you do not tolerate any exceptions or excuses”), structuring (e.g., “to ensure that your lesson is clear and complete”) and chaotic (e.g., “to not invest too much time in preparation. Things will turn smoothly”). Cheon et al. (2019) and Vermote et al. (2020) assessed teachers’ motivating style by the Situations in School (SIS) questionnaire (Aelterman et al., 2019).

Aelterman et al. (2019) also used some other self-report measures to assess teachers’ motivating style. They used Teacher as Social Context Questionnaire – Teacher version (TASCQ; Belmont et al., 1988) to measure teachers’ provision of autonomy support (12 items; e.g., “I try to give a lot of choices about how to do the exercise to my student”), structure (15 items, e.g., “I talk with my students about my expectations for them”) and involvement (14 items; e.g., “I find it easy to like my students”). They also used the 7-item Psychologically Controlling Teacher Questionnaire (PCT; Soenens et al., 2012) to measure controlling teaching (e.g., “I’m less friendly to my students if they do not see things in my way”). Lastly,

Aelterman et al. (2019) used the 20-item Teaching Rating Scale (TRS; Reeve et al., 2004) to measure autonomy-support (5 items; e.g., “I explain to students the reasons for procedures and requests”), structure (5 items, e.g., “I communicate clear expectations”) and control (5 items; “I insist that students have to do what they have to do”) but low for chaos (5 items; “I expect that students solve their problems by themselves”).

Similarly, Vermote et al. (2020) used some other self-report tools along with SIS. They also used PCT (Soenens et al., 2012), TASCQ (Belmont et al., 1988) as Aelterman et al. (2019). Additionally, they used School Experiences Questionnaire (Patall et al., 2013) to measure choice provision (e.g., “I encourage students to work in their own way”), offering a rationale, (e.g., “I explain to my students how what they learn may be important”), taking students’ perspective (e.g., “I am accepting when students express that course material is hard) and showing consideration for students’ interests and opinions (e.g., “I work the students’ interests into my lessons.”).

Method of Assessing Objectively Motivational States Through Facial Expressions

In the framework of SDT, teachers’ motivating styles have been assessed only through students’, observers’ and teachers’ reports. However, students’ motivational state has been also assessed through more objective measures such as facial expressions. For example, Reeve (1993) studied 16 different facial displays and two psychophysiological responses to validate them as showing individuals' motivational state by being related to the interest of 26 participants toward a film. Two independent raters coded and scored facial behaviors when participants were watching a film. Eye blinks, eyes closed, lips part, mouth stretch, smiles, head turn

were some of the facial expressions that were measured. Reeve (1993) also measured autonomic response; he recorded skin resistance and heart rate. After the film, participants were asked to fill a questionnaire which assessed interest and enjoyment. Eyes closed, number of eye glances, duration of eye glances, lips part, yawns, head turns, head tilt found to be correlated with interest and enjoyment. The other measures were found not to be related to participants' interest and enjoyment.

Reeve and Nix (1997) also investigated the facial displays of 60 students which were videotaped while trying to solve a SOMA puzzle (in SOMA puzzle, there are seven unique pieces composed of all the irregular face-joined cubes. The aim of the puzzle is to organize these pieces into a solid cube). After the SOMA puzzle, the students reported their perceived self-determination. The researchers analyzed the students' expressions to gain insights into student self-determination (i.e., to what extent students feel competent and interested in the task at hand). Specifically, they focused on how students made eye contact, how frequently they closed their eyes and how their lips moved. Besides, they measured students' eyeball exposure (visibility of the iris' outermost outline). Then, two raters scored four facial displays in terms of the frequency of occurrence or a duration length. Then, they correlated the measured facial expressions with the students' self-reported perceived self-determination. They found that eye contact correlated with self-reported interest and perceived self-determination, and eyes closure correlated with competence. Other measures such as eyeball exposure and lips parted did not correlate with students' perception of self-determination.

This study shows that students' motivational states can be measured through more objective measures such as facial expressions. Are there objective measures of assessing teacher autonomy-supportive motivating style? Perhaps, autonomy-

supportive or controlling teaching can be also expressed through facial expressions, postures or voice characteristics. Indeed, research has shown that “prosody”, speech qualities related to speakers’ emotional state, intentions and form of the utterance, varies in terms of conveying autonomy-supportive or controlling meaning (Weinstein et al., 2018). Therefore, voice characteristics could be an appropriate objective measure of teaching style.

Motivational Prosody

Weinstein et al. (2018) conducted a series of studies to explore whether statements with autonomy-supportive and controlling meaning can be differentiated by the voice characteristics of the speakers. In their study, they used three main voice characteristics; pitch, amplitude and speech rate. Moreover, they examined the distribution of energy in different energy bands, so they measured the energy level of voice as well. In their preliminary study, one hundred adult participants, who were untrained speakers, were randomly assigned to an autonomy-supportive or controlling condition. The conditions were determined by the motivational content of some sentences that the participants would read. Participants were instructed to read a number of sentences out loud as they really mean them. They were also instructed to read the sentences in a loud and expressive voice and pronounce them clearly. The sentences were presented one by one and the participants were reading four times each of them while their voice was recording. For validation, an independent sample of students listened to the recordings and reported the extent to which the controlling sentences were not pressuring at all or very pressuring and the extent to which the autonomy-supportive sentences did not support choice or supported choice very much. The results should that the controlling sentences were indeed perceived as more pressuring than the autonomy-supportive sentences. Then, two independent

researchers, who were blind to the purpose of the study, measured the pitch, intensity (mean, minimum, maximum and range) and speech rate of the collected audio files by using Praat software. The findings of this preliminary study showed that autonomy-supportive sentences were said with a lower pitch, less loud voice and less energy (it means with a softer way) than controlling sentences. Also, there were no significant differences in speech rate, although autonomy-supportive sentences were read out loud more slowly.

In study of Weinstein et al. (2018), 15 trained actors who know how to use their voice were asked to read identical sentences with a specific motivational context. For example, they were instructed to talk to their daughter who did poorly in school either by scolding her (controlling case) or by understanding her (autonomy-supportive case). They expected that actors would reveal more evident differences between the two sentence types. As in the preliminary study, 90 students rated the sentences in terms of supporting choice or being pressuring. The findings indicate that the autonomy-supportive cases were expressed with a higher voice pitch, lower loudness, lower energy and slower pace than the controlling cases. It seems that autonomy-supportive and controlling motivating styles are spoken with distinct tones of voice (Weinstein et al., 2018).

In a similar study Paulmann et al. (2018) investigated acoustic features to define motivational speech. They hypothesized that controlling and autonomy-supportive speech would differentiate in pitch, intensity and speech rate. Participants were native speakers of Dutch and they were from a Belgian primary school. One hundred twenty-four parent-child interactions were videotaped while completing a puzzle together. Then, they converted videos into audio files and analyzed the interactions acoustically using Praat. They performed the analysis in the whole

sentences, the phrases and every single word for which they measured the mean pitch (in Hz), the mean intensity (in dB), the range of pitch, the range of intensity and the speech rate. They found that intensity (i.e., loudness) and speech rate differed significantly. Controlling messages were conveyed with a louder voice and a faster rate than autonomy-supportive messages. This study replicated previous findings but extended the findings to a different language (Dutch) and a different situational context (non-scripted materials).

Another study conducted by Weinstein et al. (2019) found that listening to mothers' motivating statements conveyed in an autonomy-supportive way rather than controlling or neutral elicited more positive and less negative emotions and increased closeness among 14-15 years-old adolescents.

Paulmann et al. (2019) conducted a study to know more about the processing of controlling and autonomy-supportive motivational communications. Participants were asked to listen to identical sentences in meaning but differentiated in motivational tone; autonomy-supportive, neutral or controlling. Findings showed that participants detected if the speaker talked in a supportive, pressuring or neutral tone.

Brain Parts Involved in Prosody

Ethofer et al. (2006) investigated the neural structures involved in processing prosody (the intonations of the different kinds of emotions). The functional magnetic resonance imaging (fMRI) method is used on twenty-four right-handed participants (11 men, 13 women) who had no history of neurological injuries and were native speakers of German. The participants listened to German adjectives which were pronounced by the six professional actors (3 men, 3 women) in either happy, neutral or angry intonation. The results showed that the right posterior middle temporal

gyrus and bilateral middle/inferior frontal regions were involved in the procession of prosody. During the evaluation of emotional word content, left temporal pole, left orbitofrontal cortex and left superior frontal gyrus showed a stronger response.

Similarly, Rymarczyk and Grabowska (2007) conducted a study to explore the parts of the brain which are involved in processing prosody. There were two groups of participants; the group of fifty-two participants who had suffered a right hemisphere stroke and the control group of twenty-six participants who had no history of any neurological disease. The texts included both well-formed (i.e., “The water is boiling”) and nonsense sentences. All sentences were read by a male speaker who had no formal voice training but a non-professional theatre performance. The sentences were read with a neutral tone or with one of the following emotions: happy, sad or angry. The results showed that the deficits of the patient group affected their ability to comprehend affective intonation. Therefore, the conclusion that processing of intonation is supported by right-sided brain regions and the right hemisphere is critical for processing prosody is similar to the findings of Ethofer et al. (2006). Furthermore, the study suggested that the biggest impairment was seen in participants who had temporoparietal lesions. Although the effects were found to be less severe the participants who had frontal and subcortical lesions were worse at identifying the prosody.

More specifically, Rymarczyk and Grabowska (2007) found that the frontal lesions decreased the comprehension of happy intonation, subcortical lesions decreased the comprehension of happy and angry intonation and temporoparietal lesions decreased the comprehension of sad intonation. Lastly, they found no statistically significant differences in the comprehension of emotional intonations between men and women. In another study, Karow et al. (2001) examined the ability

of processing prosody, facial emotion expressions and emotional word content in brain-damaged subjects. The participants were with right hemisphere cortical lesions (RC, *n* = 5), left hemisphere cortical lesions (LC, *n* = 5), with right hemisphere cortical lesions that also involved subcortical structures of the basal ganglia (RC-S, *n* = 5), with left hemisphere cortical lesions that also involved subcortical structures of the basal ganglia (LC-S *n* = 5) and normal control group (NC, *n* = 5), total of twenty-five participants. The sentences which were used as stimuli were produced by a female speaker in different emotional states: happy, sad, angry and neutral). The results showed that the "normal" subjects had no difficulty in identifying the correct emotional state. Participants with lesions on both cortical and subcortical structures of the basal ganglia had difficulties. The participants who had LC-S had greater difficulty in processing the affective information of prosody and emotional word content while their ability to process the emotions on facial expressions was not impaired. To conclude, the subjects with both cortical and basal ganglia lesions were impaired on the procession of all affective contents (linguistic, tonal-prosodic, visual-facial expressions).

In another study conducted by Zougkou et al. (2017) found that motivational and neutral language are processed differently. Specifically, listening to pressuring and controlling language cannot be ignored and processed by in-depth mechanisms. Twenty native speakers of English (8 women, 12 men) with no hearing difficulties listened to five types of sentences (autonomy-support expression through prosody and words, control expression through prosody and words, semantically and prosodically neutral, semantically neutral autonomy-support expression through prosody, semantically neutral control expression through prosody). The EEG data was recorded in the process. Event-related potentials (ERPs) showed that the

listeners can distinguish between autonomy-supporting, controlling and neutral language. The participants' brains were more responsive to controlling messages than neutral or autonomy-supportive messages.

Voice Analysis

Facial expression is one example of a nonverbal indicator that can be used to gain insights into perceptions, interest and motivations (see Reeve, 1993; Reeve et al., 1997). Although it involves words, people's voice characteristics can also be considered as nonverbal indicators as facial ones; this is because qualities such as tone and volume are being observed rather than the actual words. There have been studies that have measured voice and speech characteristics and investigated whether they are related to speakers' personal or physical characteristics. These studies suggest that voice characteristics can be a distinctive measure for people's personal communicative style. Schirmer et al. (2019) examined how the voice characteristics of an individual affect the individual's trustworthiness. They recorded 20 Singaporean native English speakers who had acting experience. Participants differed in gender, age and number of years in acting experience. They were given two sentences and asked to produce these sentences while expressing a certain emotional state (i.e., content, happy, proud, afraid, angry and sad) and level of confidence (i.e., bold, timid, doubtful and questioning). Recordings were conducted at a 16 bit / 44.1 kHz sampling rate. Voice recordings were processed off-line using Adobe Audition 2.0. Using the software program Praat they analyzed eight parameters of voice characteristics (e.g., pitch, intensity, volume). Then, the raters listened to the voices and rated their trustworthiness on a 7-point scale that ranged from very untrustworthy to very trustworthy. They found that trustworthy voices

have a faster rate and a lower mean frequency (i.e., pitch) while untrustworthy voices have larger intensity (i.e., louder).

Voice characteristics not only were used to determine the personal characteristics of individuals' but also to determine physical characteristics. Bruckert et al. (2006) used voice parameters to assess individuals' physical characteristics. The purpose of the research was to provide evidence regarding human voice parameters as reliable indicators of an individual's physical features. Vocal attractiveness, age, height and weight of 26 male speakers were assessed by 102 female raters. Voices were recorded in a small, isolated, quiet room using a tape recorder (Sharp MD-MT99H) and a microphone (Sennheiser EMU 4535). Each speaker was asked to repeat the series of five vowels (i.e., a, e, i, o, u) at a constant rate. The authors equalized amplitudes of voices with the Avisoft 4.1 SAS Lab Sound Analysis program. Then, the voice analysis was done by Praat 4.2.07 software. They used mean pitch, temporal variation of pitch, speed of voice and peak of frequencies. Listeners rated the voice pleasantness (by a scale from 0 = not pleasant at all, to 10 = very pleasant), the person's height (by a scale from 1.50 to 2.00 m), weight (by a scale from 50 to 120 kg) and age (by a scale from 15 to 80 years). None of the listeners recognized any speaker.

To test the agreement of listener judgements, Bruckert et al. (2006) used one-way ANOVA and it showed that there was no group effect on listener judgment. They, then, conducted principal component analyses (PCA) for the morphological components and vocal parameters. Three Morphological components were found; body size, body shape and neck. Likewise, three vocal components were found; formant, intonation and pitch component. Regression analysis showed that voices with an increasing pitch were judged as more pleasant than voices with constant or

decreasing pitch. Pearson correlations showed that taller speakers tend to have voices with low-frequency according to this study, however, women were not able to correctly estimate the height. Listeners gave correct estimations of men's ages and weight.

Banse and Scherer (1996) investigated the acoustic profiles in vocal emotion expression. Twelve professional actors, six men and six women, who were native speakers of German were recruited to perform scenarios that involve 14 emotions (i.e., "hot anger, cold anger, panic fear, anxiety, despair, sadness, elation, happiness, interest, boredom, shame, pride, disgust, and contempt"). The scenarios were given to actors three to seven days before recording. The participants were asked to imagine the scenarios vividly and start acting when they felt the intended emotion. The actors were both audiotaped and videotaped while acting. The acoustic parameters fundamental frequency (i.e., perceived pitch), energy and speech rate were analyzed automatically by the Giessen Speech Analysis System. The researchers calculated hierarchical linear multiple regressions. They found out that the fundamental frequency (f0) was highest for emotions of hot anger, panic fear and elation while it was lowest for contempt and boredom. The mean energy of the voice was highest for hot anger, panic fear, elation and despair and lowest for shame and sadness. Low-frequency energy (in 500 Hz and 1000 Hz) was highest for sadness and lowest for hot anger. Speech rate was lowest when the emotion of sadness was present.

These studies show that the human voice can provide important information about both personal and physical characteristics and educational research could get an advantage to investigate instructional approaches through voice characteristics

which cannot be easily manipulated (compared to the responses in surveys) and can be measured in real classroom time.

Voice Analysis in Turkey and Vocal Characteristics of Turkish Language

Kılıç et al. (2004) conducted a study to examine the voice characteristics of the eight vowels in Turkish to find out if there is a difference between the English language and the Turkish language. Turkish vowels were pronounced by 26 healthy native Turkish speakers (all men) who do not smoke and the data compared with the database of the voices belong to native English speakers. Participants' voices were recorded in a quiet room with a unidirectional microphone placed 15 centimeters away from the speakers' mouths. Participants pronounced each vowel for three seconds. All recordings had a 44.1 kHz sampling rate and 16-bit resolution. They compared fundamental frequencies, jitter, shimmer, pitch and amplitude. They found no statistically significant differences among the languages.

Demirhan et al. (2016) conducted similar research on acoustic voice analysis of Turkish speakers. Participants had a "normal voice"; they were not smokers or professional actors and have no physical problems that would affect their voices. Participants are asked to produce the sound of vowels for five seconds. Voices of 83 native Turkish speakers (44 women and 39 men) whose ages between 18 and 32 were recorded in a quiet room with a high-quality microphone. They placed the microphone at a 45° angle and 10 centimeters away from the participants' mouths. All recordings had a 44.1 kHz sampling rate and 16-bit resolution. The data analyzed by using paired t-test on SPSS Statistics version 21.0. They found that the difference between the fundamental frequency and shimmer values for men were statistically lower ($p < .05$) than the values of women.

In another study done by Akmeşe et al. (2012) the acoustic characteristics of Turkish speaking children was investigated. The study was done with the participation of 203 children aged between 4 and 14. The data was collected in a voice laboratory and the microphone was placed in an upright position and 15 centimeters away from the participants' mouths. The analysis was done with the SPSS Statistics version 15.0. They found that the fundamental frequency starts to decrease in boys older than 8 and girls older than 10 years of age. Furthermore, a statistically significant difference of fundamental frequency was found between genders of 13 years old or older children.

Concluding Statement

Many studies within the framework of Self-Determination theory have investigated through which teacher behaviors autonomy-supportive versus controlling teaching is expressed. Many studies also have investigated the correlates of autonomy-supportive or controlling teaching by assessing it through student reports, teacher reports or observations. However, communication includes both verbal and nonverbal elements. Body language, facial expressions, and voice can be categorized under the nonverbal elements which may also be indicative of teachers' teaching style. The current study explored voice characteristics as the elements that could give insights into autonomy-supportive versus controlling teaching style. Based on the study of Weinstein et al. (2018) it is expected that autonomy-supportive teaching speech will be expressed with a higher-pitched, less loud voice, slower speech rate and less voice energy while controlling speech will be expressed with a lower-pitched, more loud voice, faster pace and more voice energy.

The following chapter describes the methods that were used to collect, measure, and analyze the voice characteristics of Turkish teachers while instructing

students in an autonomy-supportive or controlling style. The purpose of the study was to identify whether there are differences in voice characteristics that can be used to measure the teaching style of Turkish teachers.

CHAPTER 3: METHOD

Introduction

The study aimed to investigate teachers' specific voice characteristics while they were introducing an assignment to students in an autonomy-supportive or a controlling motivating style. More specifically, the study aimed to identify possible differences in teacher voice characteristics as a function of their motivating style. This study, therefore, explored the possibility of using teachers' voices while giving instructions to measure their motivating style.

In this chapter, the research design and the context of the study are presented. Moreover, details about the participants and instruments that were used to collect the data are given. Also, the procedure of data collection and data analyses was explained.

Research Design

The research design was quantitative descriptive research for the analysis of the voice characteristics. A quantitative descriptive study primarily intends to describe or explain relationships among variables and uses numbers to provide descriptions of the characteristics of participants (Thomlison, 2011).

This study has a small number of participants and aims to describe "what are" their differing voice characteristics while they are reading texts in autonomy-supportive and controlling teaching contexts. Since the aims of this study include explaining how voice characteristics differ by using their corresponding number values (e.g., loudness in dB, pitch in Hz) in controlling vs. autonomy-supportive teaching styles, it is a quantitative descriptive study.

Context

The study was carried out in a high school affiliated with a private non-profit university which is located in Ankara, Turkey. The school is an IB world school accredited by the Council of International School (CIS). They follow the curricula of the International Baccalaureate Primary Years Programme (IBPYP), International Graduate Certificate Secondary Education (IGCSE), and the International Baccalaureate Diploma Programme (IBDP). The school has approximately 1100 students and 180 teachers working in kindergarten, primary school, middle school and high school. The teachers come from different countries across the world; United States, Canada, U.K., Australia, Spain, Syria, South Africa, Ireland, Spain, Nigeria, Colombian, Russia, Azerbaijan, Kazakhstan and Turkey. Many of them hold a Master's Degree; some also have a Doctorate Degree. Most of the teachers working in this high school have teaching experience of more than 5 years.

Participants

The participants of this research were eight high school teachers (M_{age} = 41 years); one of them was male; seven of them were female. They were native speakers of Turkish and specialized in different subject areas; Turkish Language and Literature, Geography, Biology, Chemistry and Guidance and Counseling departments of the school.

Instrumentation

Based on the literature describing the autonomy-supportive and controlling motivating style, two texts were prepared to be used by the participants to introduce an assignment to their students. The one text included phrases that correspond to autonomy-supportive teaching (i.e., autonomy-supportive text), and the other text included phrases that correspond to controlling teaching (i.e., controlling text). Both

texts included 14 sentences that corresponded to the same information given in different styles. An effort was put forth to keep the length of each sentence as identical as possible, given the syntactic rules of the Turkish language.

A pilot test of the texts included the following steps:

(i) The texts that were initially written in English were given to a native speaker of English to make the sentences sound natural as if a teacher was speaking to students in a real classroom using a daily language. The suggested changes by the native English speaker were taken into consideration to improve the texts.

(ii) The improved texts were sent to Professor Dr. Netta Weinstein from Cardiff University who is an expert in SDT and has carried out a very similar study on voice characteristics of autonomy-supportive and controlling speech in English (Weinstein et al., 2018). The researcher was asked to provide recommendations and feedback on the context of the texts to strengthen the differences between the motivating style cues in the texts and the linguistics. Dr. Weinstein's suggestions were taken into consideration and the texts were finalized in English.

(iii) The tests were translated into Turkish and sent along with the English versions to a native speaker of Turkish who was blind to the study to ensure that the translation was done properly and correctly. The feedback of the native Turkish speaker was taken into consideration and the Turkish translation of the texts was finalized.

(iv) The autonomy-supportive and controlling texts were given to 20 MA students in Curriculum and Instruction blind to the purpose of the study to be assessed in terms of being pressuring (from 1 = "not pressuring at all"

to 5 = “very pressuring) or providing choices (from 1 = “does not support choice” to 5 = “supports choice very much”). The controlling text had been identified indeed as controlling ($M_{pressuring}$ = 4.26, *SD* = 1.37; M_{choice} = 1.26, *SD* = 0.73; $t(18) = 8.36$; $p < .001$) and the autonomy-supportive text had been identified as autonomy-supportive ($M_{pressuring}$ = 2.60, *SD* = 1.64; M_{choice} = 4.00, *SD* = 1.34; $t(19) = -2.67$; $p = .015$).

Autonomy-Supportive Text

This text consisted of 78 words and 643 characters (see Appendix B). In Table 1, the 14 sentences in the text are presented as well as the autonomy-supportive characteristic to which they correspond as they have been presented in Chapter 2.

Table 1

Autonomy-Supportive Text and the Rational From the Literature

Autonomy-Supportive Text	Autonomy-Supportive Characteristics
Today I am going to give you a challenging task to work on it.	Students’ inner motivational resources are vitalized by piquing their curiosity and providing interesting activities (Reeve, 2006; Vansteenkiste et al., 2004). A rational of teacher choice of the task is provided (Reeve et al., 2006; Reeve, 2009)
Remember to also ask yourself: Do I understand what the instructions are telling me?	Self-reliance and self-guidance are encouraged (Reeve et al., 2006)

Table 1 (cont'd)

Autonomy-Supportive Text and the Rational From the Literature

Autonomy-Supportive Text	Autonomy-Supportive Characteristics
The steps you could follow are flexible. Feel free to work "out of the box." You may consider different or alternative strategies.	Choices are provided; flexibility is encouraged; students' voices and preferences are supported (Reeve et al., 2006; Stefanou et al., 2004).
When you feel ready, begin working on the task.	Patience is displayed; students' pace is respected (Assor et al., 2002; Reeve, 2009).
Next Tuesday is the time to turn in your solution. I encourage you to manage your time	Non-pressuring, informational language is used (Reeve et al., 1999; Reeve, 2006).
Just as you know, we could adjust the due date. You might need more time to complete the task.	Students' perspective is taken (Assor et al., 2002; Reeve, 2016); Students' pace is acknowledged; alternatives/choices are provided (Assor et al., 2002; Mih & Mih, 2013).
Remember, I can answer any questions that help you to find the appropriate sources. Enjoy the task!	Help is provided; availability is highlighted; self-reliance and self-guidance are also highlighted (Reeve et al., 2006).

Controlling Text

This text consisted of 84 words and 599 characters (see Appendix C). In Table 2, the 14 sentences of the text are presented as well as the controlling characteristic to which they correspond as they have been presented in Chapter 2.

Table 2

Controlling Text and the Rational From the Literature

Controlling Text	Controlling Characteristics
Today I decided to give you a difficult task to challenge you.	Only teacher's plans are prioritized; teacher does not care for students' needs, wants, goals, priorities, preferences, and emotions (Reeve, 2009)
Listen to me. Read my directions carefully and don't ask me any question that can be answered by them.	Explanatory rationales are not provided; directives are given; teacher's unresponsiveness to student-generated questions is highlighted (Reeve et al., 2006)
Remember what I have taught you in previous lessons to better understand the directions.	Directives are given; self-reliance and self-guidance are discouraged (Reeve, 2006; Reeve, 2009).
The steps you should follow are very specific. Do not stray from what is written. Do not use different or alternative strategies.	Inflexibility is shown; options are not provided; controlling, pressuring language is used (Assor et al., 2005); students are discouraged from using alternative strategies (Reeve, 2009)

Table 2 (cont'd)

Controlling Text and the Rational From the Literature

Controlling Text	Controlling Characteristics
Now, begin working on the task.	Displaying impatience; rushing students to produce the desired behavior (Reeve, 2009)
I set the deadline for next Tuesday to turn in the solution. Do not waste time.	Students' needs and perspectives are neglected; a deadline statement is given (Reeve et al., 2006)
It goes without saying I won't adjust the due date. There is plenty of time to complete the task.	Inflexibility is highlighted; pressuring language is used (Reeve, 2006); choices are not provided (Reeve et al., 2006)
Remember, I will not answer any question that you can answer by searching the appropriate sources. Enjoy the task!	Help is not provided; unavailability of the teacher is highlighted (Reeve et al., 2006; Reeve, 2009)

Data Collection

The ethics committee's approval (see Appendix A) was received from the university. The participants were informed about the study and agreed to participate voluntarily by signing a consent form (see Appendix D). The teachers' identity and contact information were kept confidential. After participants stated that they volunteered to participate in the research, a suitable timeframe and a proper place for the recording were determined. I visited the teachers at the designated time in the

quiet place agreed at their school during their work hours. There was no other sound that interfered with the voice of the participants.

Participants were told to think themselves in one of their classes, which included students who were not very motivated for their assignments and think that they were going to introduce an assignment to this class. They were informed that they were going to read two texts to motivate their students, and their task was to read them as they mean it. The texts were given in random order to the participants to avoid any order effect on their voice characteristics. Before recording the teachers reading the first text, they were provided with the necessary time to familiarize themselves with the context of the text. When they thought they understood the context of the speech and were ready, they were asked to read it out loud expressively and clearly. Also, they were asked to pronounce clearly. Then, their voice was recorded in a high-quality sampling rate (44.1 kHz and 16 bits) with Xiaomi Redmi Note 7 voice recorder. I ensured that there was a similar distance between the participants and the device throughout the data collection process; approximately 10 centimetres close to the source of the voice. The recordings were saved as sound files, more specifically the file type of wav.

After recording the voice of the teacher for the first text, I chatted with the participants for a few minutes about different things than the study. Then, the other text was presented to the participant, and the same procedure described above was followed. The participants received the texts in changing order; if participant 1 was first recorded while reading the autonomy-supportive text and followed by reading the controlling text, then participant 2 was first recorded while reading the controlling text and followed by reading the autonomy-supportive text. After the recordings were done, the participants were given more information about the study,

and they were told that their voice characteristics would be examined and find out if and how they differ between the cases.

Data Analysis

The voice recordings were analyzed using Praat software. Specifically, the frequency of voice (pitch in Hz), vocal intensity (amplitude; in other words, loudness in dB), the energy level of the voice, power of the voice and speech rate in the recordings were measured by using Praat. The voice characteristics for each text as a whole and each sentence separately were entered in an SPSS file. The differences and similarities between the voice characteristics were analyzed using SPSS version 22. Wilcoxon signed-rank test was performed to identify the differences in the characteristics of teachers' voice recorded while reading the autonomy-supportive and controlling text.

The Wilcoxon signed-rank test is non-parametric. It is used to compare two dependent samples, matched samples, or repeated measurements on a single sample to assess whether the mean ranks differ (Rey & Neuhäuser, 2011).

This test was chosen because there were only 8 participants in this study, and the aim was to compare the voice characteristics of a participant's speech that supports autonomy and the same participant's controlling speech.

CHAPTER 4: RESULTS

Introduction

This study aimed to explore teachers' specific voice characteristics and to identify possible differences in voice characteristics of teachers, while they were introducing an assignment to students in an autonomy-supportive or a controlling motivating style. The study also aimed to explore the likelihood of using voice characteristics to identify teachers' motivating styles.

To achieve this aim, 8 teachers' voices, while they were introducing an assignment to students by reading an autonomy-supportive and a controlling text, were recorded.

Analysis

Firstly, descriptives of the voice characteristics were assessed by Praat software. Frequency of the voice (pitch), vocal intensity (amplitude; in other words, loudness), the energy level of the voice, power of voice and speech rate in the recordings were measured for each text as a whole and for each sentence. After the exploration of these, data were entered into an SPSS file. The differences and similarities between the voice characteristics were analyzed using SPSS version 22. A non-parametric test (Wilcoxon-signed rank test) to compare the voice characteristics of autonomy-supportive and controlling motivating styles was conducted.

Table 3

Results of the Wilcoxon Signed-Rank Test From the Comparison of Controlling Versus Autonomy-Supportive Sentences (*N* = 8)

Controlling Versus Autonomy Supportive Sentence (Paired Comparison)	z -scores								
	Pitch	Intensity	Energy Level (0-500 Hz)	Energy Level (0-1000 Hz)	Energy Level (0-5000 Hz)	Power	Speech Rate (at word level)	Speech Rate (at syllables level)	Speech Rate (at characters level)
Sentence 1	–0.42[a]	–0.70[b]	0.00[c]	–1.82[b]	–1.26[b]	–1.12[b]	–2.52[b*]	–0.28[b]	–2.52[b*]
Sentence 2	–0.70[a]	–1.40[a]	–0.98[a]	–0.84[b]	0.00[c]	–0.42[a]	–2.38[b*]	–1.54[a]	–0.14[a]
Sentence 3	–0.84[a]	–1.54[b]	–1.40[b]	–1.54[b]	–1.40[b]	–0.98[b]	–2.52[b*]	–1.54[b]	–0.42[a]
Sentence 4	–0.98[a]	–1.54[a]	–1.26[a]	–0.84[a]	–0.14[a]	–1.40[a]	–1.54[a]	–1.12[b]	–0.98[b]
Sentence 5	–1.68[b]	–0.56[b]	–0.56[b]	–1.40[b]	–1.26[b]	–1.40[b]	–2.52[b*]	–2.38[a*]	–0.28[b]
Sentence 6	–1.96[b*]	–1.82[b]	–1.68[b]	–2.52[b*]	–1.12[b]	–2.10[b*]	–2.52[b*]	–2.10[b*]	–0.28[a]
Sentence 7	–1.68[b]	–0.14[a]	–0.14[b]	–0.70[b]	–1.68[b]	–0.70[b]	–2.52[b*]	–2.52[a*]	–2.52[a*]
Sentence 8	–1.54[b]	–0.28[b]	0.00[c]	–0.84[a]	–0.42[a]	–0.56[b]	–1.40[b]	–1.82[a]	–2.10[a*]
Sentence 9	–0.42[b]	–0.14[b]	–0.84[a]	–1.12[b]	–0.70[a]	–0.84[a]	–2.38[b*]	–0.42[b]	–0.28[b]
Sentence 10	–0.56[a]	–0.98[a]	–0.98[a]	–0.56[b]	–0.98[b]	–0.14[a]	–1.82[b]	–0.56[a]	–1.82[b]
Sentence 11	–0.56[a]	–1.12[b]	–1.40[b]	–1.40[b]	–0.56[b]	–1.54[b]	–2.38[b*]	–0.56[b]	–0.42[b]
Sentence 12	–1.82[a]	–0.56[a]	–0.14[a]	–0.56[a]	–1.54[b]	–0.84[b]	–2.52[b*]	–1.96[a*]	–0.28[b]
Sentence 13	–1.12[a]	–0.56[a]	–0.42[a]	–0.28[a]	–0.14[b]	–1.12[b]	–2.52[a*]	–0.98[a]	–0.70[a]
Sentence 14	–0.14[a]	–0.14[a]	–0.98[a]	–0.98[a]	–0.14[b]	0.00[c]	–1.54[b]	–1.12[b]	–1.54[b]
Whole text	–0.28[a]	–0.42[a]	0.00[c]	–0.91[b]	–0.98[b]	–0.84[b]	–2.52[b*]	–1.40[a]	–0.98[a]

Note. z-scores are expressed by considering the subtraction of the highest rank (either positive or negative) from the lowest rank.

[a] indicates positive ranks.

[b] indicates negative ranks.

[c] indicates that the sum of negative ranks equals the sum of positive ranks.

*p < .05.

The speech rate was calculated by three different methods. In the first method of calculation the number of words in the sentence was divided by the duration of the sentence. In the second method of calculation the number of syllables in the sentence was divided by the duration of the sentence. Lastly, in the third method of calculation the number of characters in the sentence was divided by the duration of the sentence.

Regarding the whole speech Wilcoxon-signed rank test showed a statistically significant difference in the speech rate (at word level) between the autonomy-supportive and controlling teaching style ($z = –2.52$, $p < .05$). The controlling speech was delivered with a faster voice. No other difference between the voice characteristics of each teaching style was found to be statistically significant.

Paired sentence 1 represents the sentence “Today I am going to give you a challenging task to work on it.” in the autonomy-supportive text and the sentence “Today I decided to give you a difficult task to challenge you.” in the controlling text. As it is indicated in the Table 3, the difference in speech rate (at word and character level) of autonomy-supportive and controlling teaching style was statistically significant ($z = –2.52$, $p < .05$) for the first sentences of the texts. The controlling sentence was delivered with a faster voice than the autonomy-supportive sentence. Although the controlling sentence was delivered with a voice with higher energy (in 0-1000 Hz frequency band), (in other words, it was expressed in a harsher way), this difference was not statistically significant.

Paired sentence 2 represents the sentence “Listen to what I suggest.” in autonomy-supportive text and the sentence “Listen to me.” in controlling text. As it is indicated in the Table 3, the difference in speech rate (at word level) of autonomy-supportive and controlling teaching style was statistically significant ($z = –2.38$, $p < .05$) for the second sentences of texts. Although the autonomy-supportive sentence

was delivered with a louder voice, only the speech rate differed significantly; the controlling sentence was delivered with a faster voice.

Paired sentence 3 represents the sentence “Read the instructions carefully and ask me any questions to clarify them.” in autonomy-supportive text and the sentence “Read my directions carefully and don’t ask me any question that can be answered by them.” in controlling text. As it is indicated in the Table 3, the difference in speech rate (at word level) of autonomy-supportive and controlling teaching style was statistically significant ($z = –2.52$, $p < .05$) for the third sentences of the texts. Although the controlling sentence was delivered with a louder voice, with less voice energy (in all frequency bands) and less power, only the speech rate differed significantly; the controlling sentence was delivered with a faster voice.

Paired sentence 4 represents the sentence “Remember to also ask yourself: Do I understand what the instructions are telling me?” in the autonomy-supportive text and the sentence “Remember what I have taught you in previous lessons to better understand the directions.” in controlling text. As it is indicated in the Table 3, in the fourth sentence none of the voice characteristics differed significantly although the autonomy-supportive sentence was delivered with a louder and higher energy (in all frequency bands) voice.

Paired sentence 5 represents the sentence “The steps you could follow are flexible.” in the autonomy-supportive text and “The steps you should follow are very specific.” in controlling text. The controlling sentence was delivered with a faster voice than the autonomy-supportive sentence. As it is indicated in the Table 3, the difference in speech rate (at word and syllables level) of autonomy-supportive and controlling teaching style was statistically significant ($z = –2.52$, $p < .05$) for the fifth sentences of texts. Although the controlling sentence was delivered with a louder,

higher-pitched voice and with higher voice energy (in all frequency bands), only the speech rate in two different levels differed significantly; the controlling sentence was delivered with a faster voice at word level, while it was delivered with a slower voice at syllables level.

Paired sentence 6 represents the sentence “Feel free to work out of the box.” in the autonomy-supportive text and the sentence “Do not stray from what is written.” in controlling text. As it is indicated in the Table 3, the difference in pitch ($z = –1.96$, $p < .05$), energy level (in 0-1000 Hz frequency band), ($z = –2.52$, $p < .05$), power ($z = –2.10$, $p < .05$) and speech rate at word ($z = –2.52$, $p < .05$) and syllables level ($z = –2.10$, $p < .05$) of autonomy-supportive and controlling teaching style was statistically significant for the sixth sentences of texts. The controlling sentence was delivered with a higher-pitched, more powerful and faster voice and also with a voice with higher energy (in 0-1000 Hz frequency band). Although it was also delivered with a louder voice, and a voice with higher energy (in all other frequency bands), these characteristics did not differ significantly.

Paired sentence 7 represents the sentence “You may consider different or alternative strategies.” in the autonomy-supportive text and the sentence “Do not use different or alternative strategies.” in controlling text. The controlling sentence was delivered with a faster voice than the autonomy-supportive sentence. As it is indicated in the Table 3, the difference in speech rate (in all levels) of autonomy-supportive and controlling teaching style was statistically significant ($z = –2.52$, $p < .05$) for the seventh sentences of texts. Although the controlling sentence was delivered with a higher-pitched, louder voice, only the speech rate differed significantly; the controlling sentence was delivered with a faster voice at word level, while it was delivered with a slower voice in other levels.

Paired sentence 8 represents the sentence “When you feel ready, begin working on the task” in the autonomy-supportive text and the sentence “Now, begin working on the task.” in controlling text. The controlling sentence was delivered with a faster voice than the autonomy-supportive sentence. As it is indicated in the Table 3, the difference in speech rate (at character level) of autonomy-supportive and controlling teaching style was statistically significant ($z = –2.10$, $p < .05$) for the eighth sentences of texts. Although the controlling sentence was delivered with a higher-pitched voice, no other variables except the speech rate differed significantly, but in this pair of sentences, it was the autonomy-supportive sentence that was delivered with a faster voice.

Paired sentence 9 represents the sentence “Next Tuesday is the time to turn in your solution.” in the autonomy-supportive text and the sentence “I set the deadline for next Tuesday to turn in the solution.” in controlling text. The controlling sentence was delivered with a faster voice than the autonomy-supportive sentence. As it is indicated in the Table 3, the difference in speech rate (at word level) of autonomy-supportive and controlling teaching style was statistically significant ($z = –2.38$, $p < .05$) in the ninth pair of sentences in the texts. No other variable except the speech rate differed significantly.

Paired sentence 10 represents the sentence “I encourage you to manage your time.” in the autonomy-supportive text and the sentence “Do not waste time.” in controlling text. As it is indicated in the Table 3, none of the voice characteristics of the tenth pair of sentences differed significantly, although the controlling sentence was delivered with a higher-pitched voice.

Paired sentence 11 represents the sentence “Just as you know, we could adjust the due date.” in the autonomy-supportive text and the sentence “It goes

without saying I won't adjust the due date." in controlling text. The controlling sentence was delivered with a faster voice than the autonomy-supportive sentence. As it is indicated in the Table 3, the difference in speech rate (at word level) of autonomy-supportive and controlling teaching style was statistically significant ($z = -2.38$, $p < .05$) for the eleventh sentence of texts. Although the controlling sentence was delivered with a louder and more powerful voice, and also a voice with higher energy (in 0-500 Hz and 0-1000 Hz frequency bands), these characteristics did not differ significantly.

Paired sentence 12 represents the sentence "You might need more time to complete the task." in the autonomy-supportive text and the sentence "There is plenty of time to complete the task." in controlling text. The controlling sentence was delivered with a faster voice than the autonomy-supportive sentence. As it is indicated in the Table 3, the difference in speech rate (at word ($z = -2.52$, $p < .05$) and syllables ($z = -1.96$, $p < .05$) levels) of autonomy-supportive and controlling teaching style was statistically significant for the twelfth sentence of the texts. The controlling sentence was delivered with a faster voice at word level, while it was delivered with a slower voice at syllables level. Although the controlling sentence was delivered with a higher-pitched voice this difference was not statistically significant.

Paired sentence 13 represents the sentence "Remember, I can answer any questions that help you to find the appropriate sources" in the autonomy-supportive text and the sentence "Remember, I will not answer any question that you can answer by searching the appropriate sources." in controlling text. The controlling sentence was delivered with a faster voice than the autonomy-supportive sentence. As it is indicated in the Table 3, the difference in speech rate (at word level) of

autonomy-supportive and controlling teaching style was statistically significant ($z = -2.52$, $p < .05$) for the thirteenth sentence of the texts. No other variables except the speech rate differed significantly, the autonomy-supportive sentence was delivered with a faster voice.

Paired sentence 14 represents the sentence “Enjoy the task!” in the autonomy-supportive text and the sentence “Enjoy the task!” in controlling text. As it is indicated in the Table 3, none of the voice characteristics of the fourteenth sentence of the texts differed significantly although the controlling sentence was delivered with a faster voice (at all levels).

The aim of the study was to seek clues from teachers’ voices that help to identify the teaching styles of teachers (i.e., need-supportive teaching, need-thwarting teaching). The analysis of the teachers’ voice showed that in 11 of the 14 sentences the speech rate (at word level) differed significantly. The sentences which represent the controlling teaching style were delivered mostly with a faster voice. In other words, the participants spoke faster while they were reading the sentences of the controlling text. In addition, only in the sixth pair of sentences the pitch, the energy level of the voice in 0-1000 Hz frequency band and the power of the voice differed significantly. The sentence in the controlling text (i.e., Do not stray from what is written) was delivered with a higher-pitched voice which contains more energy. In other words, the participants spoken less softly, in a more forceful way and were more “stern” while delivering the sentence (Guzman et al., 2013; Weinstein et al., 2018).

Table 4

A Summary of the Statistically Significant Findings of the Results of the Wilcoxon Signed-Rank Test From the Comparison of Controlling Versus Autonomy-Supportive Sentences (*N* = 8)

Controlling Versus Autonomy-Supportive Sentence (Paired Comparison)	z-scores								
	Pitch	Intensity	Energy Level (0-500 Hz)	Energy Level (0-1000 Hz)	Energy Level (0-5000 Hz)	Power	Speech Rate (at word level)	Speech Rate (at syllables level)	Speech Rate (at characters level)
Sentence 1							✓		✓
Sentence 2							✓		
Sentence 3							✓		
Sentence 4									
Sentence 5							✓	✓	
Sentence 6	✓			✓		✓	✓	✓	
Sentence 7							✓	✓	✓
Sentence 8									✓
Sentence 9							✓		
Sentence 10									
Sentence 11							✓		
Sentence 12							✓	✓	
Sentence 13							✓		
Sentence 14									
Whole text							✓		

Note: The statistically significant differences of the indicated voice characteristics between the autonomy-supportive sentences and the controlling sentences ($p < .05$) are marked.

Supplementary Analysis

During voice analysis, it was noticed that three of the eight participants did not interpret appropriately the context of the text through their voice. To test my observation, I distributed the recordings of these three participants to 10 teachers (M_{age} = 30 years) to assess whether indeed the tone of the autonomy-supportive recordings was more understanding and respectful than the tone of the controlling recordings and whether the controlling recordings were more pressuring than the autonomy-supportive recordings.

Table 5

Results of the Wilcoxon Signed-Rank Test From the Comparison of Raters' Ratings About the Supportiveness or Controllingness of the Autonomy-Supportive Versus Controlling Recordings of Three Teachers (*N* = 10)

Teachers	z-scores	
	Understanding and Respectful	Pressuring
Teacher 3	–0.85[b]	–1.19[a]
Teacher 4	–2.27[b*]	–2.22[a*]
Teacher 8	–1.90[b]	–1.51[a]

Note. z-scores are expressed by considering the subtraction of the highest rank (either positive or negative) from the lowest rank.

[a] indicates positive ranks.

[b] indicates negative ranks.

*$p < .05$.

The results of the Wilcoxon signed-rank test showed that there was not a statistically significant difference between the recordings of participants 3 and 8 as indicated in Table 4. This means that these two participants interpreted the two

different texts in more or less the same voice tone. For this reason, a supplementary analysis was done to examine if the results of my initial analyses would change when those two participants were excluded from the analysis.

Table 6

Results of the Wilcoxon Signed-Rank Test From the Comparison of Controlling Versus Autonomy-Supportive Sentences (n = 6)

Controlling Versus Autonomy-Supportive Sentence (Paired Comparison)	z-scores								
	Pitch	Intensity	Energy Level (0-500 Hz)	Energy Level (0-1000 Hz)	Energy Level (0-5000 Hz)	Power	Speech Rate (at word level)	Speech Rate (at syllables level)	Speech Rate (at characters level)
Sentence 1	–0.52[a]	–1.36[b]	–0.73[b]	–1.99[b*]	–1.78[b]	–1.99[b*]	–2.20[b*]	–0.31[b]	–2.20[b*]
Sentence 2	–0.73[a]	–0.94[a]	–0.73[a]	–1.36[b]	–1.15[b]	–0.10[b]	–1.99[b*]	–0.94[a]	–0.31[a]
Sentence 3	–0.31[b]	–2.20[b*]	–2.20[b*]	–2.20[b*]	–2.20[b*]	–1.78[b]	–2.20[b*]	–1.15[b]	–0.52[a]
Sentence 4	–0.31[a]	–0.73[a]	–0.52[a]	–0.10[b]	–0.52[b]	–0.52[b]	–1.57[a]	–0.94[b]	–0.73[b]
Sentence 5	–2.20[b*]	–1.36[b]	–1.57[b]	–1.57[b]	–1.36[b]	–1.99[b*]	–2.20[b*]	–1.99[a*]	–0.10[b]
Sentence 6	–1.57[b]	–1.78[b]	–2.20[b*]	–2.20[b*]	–0.94[b]	–1.99[b*]	–2.20[b*]	–1.78[b]	–0.52[a]
Sentence 7	–1.57[b]	–0.94[b]	–0.94[b]	–0.73[b]	–1.57[b]	–1.36[b]	–2.20[b*]	–2.20[a*]	–1.99[a*]
Sentence 8	–1.36[b]	–0.31[b]	–1.36[b]	–0.10[b]	–0.94[b]	–1.36[b]	–1.15[b]	–1.36[a]	–1.57[a]
Sentence 9	–0.94[b]	–0.73[b]	–0.10[a]	–0.31[b]	–0.31[b]	–0.10[a]	–1.99[b*]	–0.73[b]	–0.10[b]
Sentence 10	–1.15[b]	–0.10[b]	–0.10[b]	–0.94[b]	–1.36[b]	–0.52[b]	–1.36[b]	–0.10[b]	–1.36[b]
Sentence 11	–0.31[a]	–1.15[b]	–0.94[b]	–0.94[b]	–0.52[b]	–1.15[b]	–1.99[b*]	–0.10[a]	–0.31[a]
Sentence 12	–1.57[b]	–0.31[b]	–1.36[b]	–0.31[b]	–1.78[b]	–1.36[b]	–2.20[b*]	–1.78[a]	–0.73[a]
Sentence 13	–0.10[a]	–0.73[b]	–0.52[b]	–0.31[b]	–0.94[b]	–2.20[b*]	–2.20[a*]	–0.31[b]	–0.10[b]
Sentence 14	–0.73[b]	–1.15[b]	–1.15[b]	–1.15[b]	–1.78[b]	–0.73[b]	–0.94[b]	–0.52[b]	–0.94[b]
Whole text	–1.15[b]	–0.52[b]	–1.15[b]	–1.26[b]	–1.36[b]	–1.57[b]	–2.20[b*]	–0.94[a]	–0.52[a]

Note. z-scores are expressed by considering the subtraction of the highest rank (either positive or negative) from the lowest rank.

[a] indicates positive ranks.

[b] indicates negative ranks.

[c] indicates that the sum of negative ranks equals the sum of positive ranks.

*p < .05.

The whole speech of six speakers was analysed. As it is indicated in the Table 5, the results show that only the difference between speech rate (at word and syllable levels) ($z = –2.20$, $p < .05$) was significantly significant. The controlling speech was expressed with a faster voice at word level as expected. No other difference between the voice characteristics of each teaching style was found to be statistically significant as it was also found in the analysis with eight participants.

Paired sentence 1 represents the sentence “Today I am going to give you a challenging task to work on it.” in the autonomy-supportive text and the sentence “Today I decided to give you a difficult task to challenge you.” in controlling text. As it is indicated in the Table 5, the energy level in 0-1000 Hz frequency band ($z = –1.99$, $p < .05$), power of the voice ($z = –1.99$, $p < .05$) and speech rate (at word and character level) ($z = –2.20$, $p < .05$) differed significantly for the first sentence of the texts. The controlling sentence was delivered with a voice with higher energy (in 0-1000 Hz frequency band), with a more powerful voice and a faster voice (at word and character levels). Although the controlling sentence was delivered with a louder voice, this difference was not statistically significant.

Paired sentence 2 represents the sentence “Listen to what I suggest.” in the autonomy-supportive text and the sentence “Listen to me.” in controlling text. As it is indicated in the Table 5, speech rate (at word level) differed significantly ($z = –1.99$, $p < .05$) for the second sentence of the texts. The controlling sentence was delivered with a faster voice. Although the controlling sentence was delivered with a voice with higher energy (in 0-1000 Hz frequency band), this difference was not statistically significant.

Paired sentence 3 represents the sentence “Read the instructions carefully and ask me any questions to clarify them.” in the autonomy-supportive text and the

sentence “Read my directions carefully and don’t ask me any question that can be answered by them.” in controlling text. As it is indicated in the Table 5, the loudness ($z = –2.20$, $p < .05$), energy levels (in all frequency bands) ($z = –2.20$, $p < .05$), power ($z = –2.20$, $p < .05$) and speech rate (at word level) ($z = –2.20$, $p < .05$) differed significantly for the third sentence of the texts. The controlling sentence was delivered with a louder, more powerful and faster voice and also with a voice with higher energy. Although the controlling sentence was delivered with a more powerful voice, this difference was not statistically significant.

Paired sentence 4 represents the sentence “Remember to also ask yourself: Do I understand what the instructions are telling me?” in the autonomy-supportive text and the sentence “Remember what I have taught you in previous lessons to better understand the directions.” in controlling text. Although the controlling sentence was delivered with a slower voice, as it is indicated in the Table 5, none of the voice characteristics differed significantly for the fourth sentence of the texts.

Paired sentence 5 represents the sentence “The steps you could follow are flexible.” in the autonomy-supportive text and the sentence “The steps you should follow are very specific.” in controlling text. As it is indicated in the Table 5, pitch ($z = –2.20$, $p < .05$), power ($z = –1.99$, $p < .05$), and speech rate at word level ($z = –2.20$, $p < .05$), and speech rate at syllables level ($z = –1.99$, $p < .05$) differed significantly for the fifth sentence of the texts. The controlling sentence was delivered with a higher-pitched, more powerful and faster voice at word level, but with a slower voice at syllables level. Although the controlling sentence was delivered with a voice with higher energy and louder voice, this difference was not statistically significant.

Paired sentence 6 represents the sentence “Feel free to work out of the box.” in the autonomy-supportive text and the sentence “Do not stray from what is written.” in controlling text. As it is indicated in the Table 5, the energy levels (in 0-500 Hz and 0-1000 Hz frequency bands), power ($z = –1.99$, $p < .05$) and speech rate (at word level) differed significantly ($z = –2.20$, $p < .05$) for the sixth sentence of the texts. The controlling sentence was delivered with a voice with higher energy in 0-500 Hz and 0-1000 Hz frequency bands, with a more powerful and faster voice. Although the controlling sentence was delivered with a higher-pitched and louder voice, this difference was not statistically significant.

Paired sentence 7 represents the sentence “You may consider different or alternative strategies.” in the autonomy-supportive text and the sentence “Do not use different or alternative strategies.” in controlling text. As it is indicated in the Table 5, speech rate at word level ($z = –2.20$, $p < .05$), syllables level ($z = –2.20$, $p < .05$) and characters level ($z = –1.99$, $p < .05$) differed significantly for the seventh sentence of the texts. The controlling sentence was delivered with a faster voice at word level, but with a slower voice at syllables and characters level. Although the controlling sentence was delivered with a higher-pitched, louder and more powerful voice, this difference was not statistically significant.

Paired sentence 8 represents the sentence “When you feel ready, begin working on the task” in the autonomy-supportive text and the sentence “Now, begin working on the task.” in controlling text. As it is indicated in the Table 5, none of the voice characteristics differed significantly for the eighth sentence of the texts. Although the controlling sentence was delivered with a voice with higher energy (in 0-500 Hz frequency band), with a higher-pitched and more powerful voice, this difference was not statistically significant.

Paired sentence 9 represents the sentence “Next Tuesday is the time to turn in your solution.” in the autonomy-supportive text and the sentence “I set the deadline for next Tuesday to turn in the solution.” in controlling text. As it is indicated in the Table 5, only the speech rate at word level ($z = –1.99$, $p < .05$) differed significantly for the ninth sentence of the texts. No other voice characteristics of the ninth pair of sentences differed significantly.

Paired sentence 10 represents the sentence “I encourage you to manage your time.” in the autonomy-supportive text and the sentence “Do not waste time.” in controlling text. As it is indicated in the Table 5, none of the voice characteristics differed significantly for the tenth sentence of the texts. Although the controlling sentence was delivered with a voice with higher energy (in 0-5000 Hz frequency band), with a higher-pitched and a faster voice, this difference was not statistically significant.

Paired sentence 11 represents the sentence “Just as you know, we could adjust the due date.” in the autonomy-supportive text and the sentence “It goes without saying I won’t adjust the due date.” in controlling text. As it is indicated in the Table 5, only the speech rate at word level differed significantly ($z = –1.99$, $p < .05$) for the eleventh pair of sentences. Although the controlling sentence was delivered with a voice with higher energy, with a louder and more powerful voice, this difference was not statistically significant.

Paired sentence 12 represents the sentence “You might need more time to complete the task.” in the autonomy-supportive text and the sentence “There is plenty of time to complete the task.” in controlling text. As it is indicated in the Table 5, only the speech rate at word level differed significantly ($z = –2.20$, $p < .05$) for the twelfth pair of sentences. Although the controlling sentence was delivered

with a voice with higher energy (in 0-500 Hz and 0-1000 Hz frequency bands), with a louder, higher-pitched and more powerful voice, this difference was not statistically significant.

Paired sentence 13 represents the sentence “Remember, I can answer any questions that help you to find the appropriate sources” in the autonomy-supportive text and the sentence “Remember, I will not answer any question that you can answer by searching the appropriate sources.” in controlling text. As it is indicated in the Table 5, power and speech rate (at word level) differed significantly ($z = –2.20$, $p < .05$) for the thirteenth sentences. The controlling sentence was delivered with a more powerful and slower voice.

Paired sentence 14 represents the sentence “Enjoy the task!” in the autonomy-supportive text and the sentence “Enjoy the task!” in controlling text. As it is indicated in the Table 5, none of the voice characteristics differed significantly for the fourteenth sentence of the texts. Although the controlling sentence was delivered with a louder voice, this difference was not statistically significant.

The purpose of this research was to identify whether there are differences in voice characteristics that can be used to measure the teaching style (i.e., need-supportive teaching, need-thwarting teaching) of Turkish teachers. The supplementary analysis showed that in the 11 of the 14 sentences the speech rate (at word level) differed significantly. The sentences which represent the controlling teaching style were delivered mostly with a faster voice, only one autonomy-supportive sentence (i.e., “Remember, I can answer any questions that help you to find the appropriate sources”) was delivered at a faster pace. In other words, the participants spoke faster while they were reading the sentences of the controlling text as expected. The sentence 5 which represent the controlling teaching style was

delivered with a higher-pitched voice (i.e., “The steps you should follow are very specific”) in other words the participants spoken less softly. The sentence 3 which represent the controlling teaching style was delivered with a louder voice (i.e., “Read my directions carefully and don’t ask me any question that can be answered by them.”) As it was expected, the teachers while giving instructions for a task in a controlling way were more loudly speaking. As also expected, the controlling sentences 3 and 6 were delivered with a voice with higher energy in 0-500 Hz frequency band, the controlling sentences 1, 3 and 6 were delivered with a voice with higher energy in 0-1000 Hz frequency band, while only the sentence 3 was delivered with a voice with higher energy in 0-5000 Hz frequency band which means the teachers were being more “stern” (Guzman et al., 2013; Weinstein et al., 2018).

Table 7

A Summary of the Statistically Significant Findings of the Results of the Wilcoxon Signed-Rank Test From the Comparison of Controlling Versus Autonomy-Supportive Sentences (n = 6)

Controlling Versus Autonomy-Supportive Sentence (Paired Comparison)	z-scores								
	Pitch	Intensity	Energy Level (0-500 Hz)	Energy Level (0-1000 Hz)	Energy Level (0-5000 Hz)	Power	Speech Rate (at word level)	Speech Rate (at syllables level)	Speech Rate (at characters level)
Sentence 1				✓			✓		✓
Sentence 2							✓		
Sentence 3		✓	✓	✓	✓	✓	✓		
Sentence 4									
Sentence 5	✓						✓	✓	
Sentence 6			✓	✓			✓		
Sentence 7							✓	✓	✓
Sentence 8									
Sentence 9							✓		
Sentence 10									
Sentence 11							✓		
Sentence 12							✓		
Sentence 13							✓		
Sentence 14									
Whole text							✓		

Note: The statistically significant differences of the indicated voice characteristics between the autonomy-supportive sentences and the controlling sentences ($p < .05$) are marked.

CHAPTER 5: DISCUSSION

Introduction

This study focused on teachers' voice characteristics while they are giving instructions. While introducing homework or exam, teachers may have different attitudes towards their students. Teachers can encourage students for an exam by saying "I am sure you will be successful in this exam." However, this statement may have a different effect on students depending on whether it is said with an enthusiastic and energetic voice or if it is conveyed in a manner that is sarcastic and careless. With their voices, teachers can seek to emphasize and promote what they say in a positive or a negative way. Furthermore, it is possible that even though teachers are saying one thing, they are meaning another. Hence, the voice may give clues about the teachers' communication style.

In this study, the aim was to seek clues from teachers' voices that help to identify communication styles of teachers (i.e., need-supportive teaching, need-thwarting teaching). Often researchers try to gain insights into educators' teaching style by observations or scales; these instruments, however, are inadequate for measuring tonal differences. Therefore, the current study recorded teachers' voices while they were giving instructions in an autonomy-supportive or controlling style and use technical devices to measure tonal characteristics (e.g., loudness) of the voices. Subsequently, this study investigated teachers' voice characteristics in certain teaching styles (i.e., being autonomy-supportive vs. controlling) to find out whether voice differences can be identified.

Overview of the Study

To achieve the aim of the present study, the following research question was investigated:

To what extent are Turkish teachers' specific voice characteristics of autonomy-supportive motivating style different from their voice characteristics of controlling motivating style?

In the study, the quantitative descriptive research design was selected to investigate and examine the voice characteristics of autonomy-supportive motivating style and the voice characteristics of controlling motivating style. Wilcoxon signed-rank test was chosen to identify the differences in the characteristics of teachers' voice recorded while reading the autonomy-supportive and controlling text. The texts were prepared with the help of a native speaker of English to make it sound natural. Then the improved texts were sent to Professor Dr. Netta Weinstein who is an expert in SDT and has carried out a very similar study on voice characteristics of autonomy-supportive and controlling speech in English (Weinstein et al., 2018). Then, the texts were translated into Turkish with the feedback of a native speaker of Turkish. Lastly, the texts were given to 20 MA students who were blind to the purpose of the study. These students assessed the texts in terms of being pressuring or providing choices. Their review confirmed that controlling text was distinguishable from the autonomy-supportive text.

Subsequently, the texts were given to participants. The study was carried out in a high school affiliated with a private non-profit university which is located in Ankara, with the voluntary participation of eight high school in-service teachers. They were native speakers of Turkish and specialized in different subject areas. Participants' task was to read as they were in real classrooms introducing a

challenging task to students. The texts were given in random order to the participants to avoid any order effect on their voice characteristics. Before recording the teachers reading the first text, they were provided with the necessary time to familiarize themselves with the context of the text. When they thought they understood the context of the speech and were ready, they were asked to read it out loud expressively and clearly. Also, they were asked to pronounce clearly. After recording the voice of the teacher for the first text, I chatted with the participants for a few minutes about different things than the study. Then, the other text was presented to the participant, and the same procedure described above was followed.

The voice recordings were analyzed using Praat software. Specifically, the frequency of voice (pitch in Hz), vocal intensity (amplitude; in other words, loudness in dB), the energy level of the voice power of the voice and speech rate in the recordings were measured by using Praat. Finally, the voice characteristics for each text as a whole and each sentence separately were entered in an SPSS file and Wilcoxon signed-rank test was performed to identify the differences of the teachers' autonomy-supportive voice and controlling voice.

Major Findings and Discussions

Building on the results of the analyses and grounded on the literature review, major findings of this study are explained and discussed below.

Regarding the whole speech Wilcoxon-signed rank test showed a statistically significant difference in the speech rate (at word level) between the autonomy-supportive and controlling teaching style ($z = -2.52$, $p < .05$). The controlling speech was delivered with a faster voice. More specifically, this means when teachers were being controlling, they spoke faster than when they were being autonomy-supportive. This finding was supported by past research. Weinstein et al. (2018) found that

autonomy-supportive sentences were read out loud more slowly although the difference in speech rate was not significant. Paulmann et al. (2018), however, found that speech rate did differ significantly in a different language (Dutch). Controlling messages were conveyed with a faster rate than autonomy-supportive messages. As I expected, in Turkish as well the participants spoke faster while reading controlling sentences. No other difference between the voice characteristics of each teaching style was found to be statistically significant when we considered the whole speech. This finding shows that, in Turkish, the main characteristic of a controlling motivating style during task instructions is the fast speech rate. However, when analyzing the speech as a whole, it is not certain whether in specific phrases with a higher controlling meaning (at the semantic level) the voice characteristics can be further differentiated.

For this reason, in the present study, I also analyzed the speech sentence by sentence. As it was expected, 11 of the 14 sentences differed significantly in the speech rate (at word level). The sentences which represent the controlling teaching style were delivered mostly with a faster voice similar to the findings of the whole speech analysis and Weinstein et al.'s (2018) and Paulmann et al.'s (2018) studies. In other words, the participants spoke faster while they were reading the sentences of the controlling text compared to when they were reading the autonomy-supportive sentences.

In addition, contrary to my expectations, only in the sixth pair of sentences (i.e., "Feel free to work out of the box." Versus "Do not stray from what is written.") the pitch was higher when delivering the controlling sentence. The energy level of the voice in the 0-1000 Hz frequency band and the power of the voice also differed significantly. The sentence in the controlling text was delivered with a higher-pitched

voice which contains more energy. In other words, the participants spoke less softly, in a more forceful way and were more “stern” while delivering the sentence, a finding that it is supported by the past research of Guzman et al. (2013) and Weinstein et al. (2018). It seems that when teachers invite students to be creative, they do it in a soft voice, while when they order them to obey the instructions, their voice can easily become pressuring and strict. It seems that the content of the phrase could further differentiate the characteristics of the voice in Turkish as well.

To further explore this finding, I considered whether the less differentiation in Turkish of the voice characteristics in the two different motivating styles were due to participants’ inability to interpret appropriately the context of the text through their voice. Listening carefully to the recordings, I spotted the recordings of three participants to be read in a “flat” voice mode for both types of texts. The recordings of these three teachers were further assessed by 10 raters in terms of being understanding and respectful versus pressuring in voice tone. The recordings of two out of these three participants found not to differ in voice tone and excluded from supplementary analyses. The results were to some extent different. Specifically, regarding the whole speech, only the difference between the speech rate (at word level; $z = –2.20$, $p < .05$) was significantly different as it was found in the results with all the participant teachers. Teachers spoke faster while delivering the controlling sentences. This finding is similar to the findings of the study of Weinstein et al. (2018) and Paulmann et al. (2018) and shows that in Turkish as well, the voice characteristics can be differentiated for the autonomy-supportive and controlling content in terms of speech rate.

This supplementary analysis also showed that in 11 of the 14 sentences the speech rate (at word level) differed significantly. The sentences which represent the

controlling teaching style were delivered mostly with a faster voice, only one autonomy-supportive sentence (i.e., “Remember, I can answer any questions that help you to find the appropriate sources”) was delivered at a faster pace. In other words, the participants spoke faster while they were reading the sentences of the controlling text as expected. The sentence 5 was delivered with a higher-pitched voice in the controlling teaching style (i.e., “The steps you should follow are very specific”), in other words, the participants spoke less softly. The sentence 3 which represent the controlling teaching style was delivered with a louder voice (i.e., “Read my directions carefully and don’t ask me any question that can be answered by them.”). As also expected, the controlling sentences 3 and 6 were delivered with a voice with higher energy in 0-500 Hz frequency band, the controlling sentences 1, 3 and 6 were delivered with a voice with higher energy in 0-1000 Hz frequency band, while only the sentence 3 was delivered with a voice with higher energy in the 0-5000 Hz frequency band which means the teachers were being more “stern” (Guzman et al., 2013; Weinstein et al., 2018).

The results of the present study showed that the specific voice characteristics of Turkish teachers differed while they were introducing an assignment to students in an autonomy-supportive or a controlling motivating style. In Turkish, the controlling teaching speech was expressed with a louder and more powerful voice; there was also, faster speech rate and higher voice energy. Contrarily, the autonomy-supportive teaching speech was expressed with a less loud and less powerful voice; furthermore, as expected the speech was at a slower rate and had less energy. However, these differences were not significant throughout all the segments of the speech. Contrary to my expectations, in a few segments the controlling teaching speech was expressed with a higher-pitched voice while the autonomy-supportive teaching speech was

expressed with a lower-pitched voice. Further research is needed to clarify whether this finding is due to particularities of the Turkish language or to the conditions of my study. In the present study, the teachers read the two different texts out of the classroom context and therefore they might not interpret them appropriately.

Implications for Practice

The results of the present study showed that since the voice characteristics differed in different teaching styles (i.e., the autonomy-supportive teaching style and the controlling teaching style) the voice characteristics of Turkish teachers might be used to have insights into the teachers' motivating styles. Therefore, teachers' voices can be automatically analyzed by algorithms in simple devices (e.g., apps in mobile phones) during teachers' talk in classrooms to identify the autonomy-supportive or controlling moments. The results can be used by teachers as a feedback on their teaching style. This feedback as it will be objective and delivered by a "neutral" source than students, parents or colleagues could be more easily accepted and trigger improvements in teaching. Such a feedback is particularly valuable during the teaching practice of pre-service teachers, for novice teachers and professional development of in-service teachers.

Moreover, the feedback about the moments that a teacher is autonomy-supportive or controlling in the classroom can be paired with students' assessments as well to capture whether each particular motivating style is positively or negatively related to students' feelings, motivation and engagement assessed during the lecture through real-time surveys (i.e., experience sampling method) or physiological reactions (e.g., heart rate).

Up to now, teachers' motivating styles were assessed by student reports (Bennett et al., 2017; Mih & Mih, 2013; Reeve & Jang, 2006; Shen et al., 2009),

observation (Haerens et al., 2013; Jiang et al., 2019; Turner et al., 2002) and self-reports (Aelterman, 2019; Aelterman et al., 2019; Reeve, 1998; Vermote et al., 2020). These assessing methods are relatively subjective. In the field of motivation, facial expressions (Reeve, 1993; Reeve & Nix, 1997) were suggested as a less subjective manner to measure students' motivational states. The current study suggests one more objective measure to assess motivating style in the classroom, the voice characteristics.

Implications for Further Research

The present study was conducted in Ankara, the capital city of Turkey and more particularly in only one high school affiliated with a private non-profit university. Therefore, similar studies can be conducted in different types of schools, in different cities and at different school levels (i.e., pre-school, primary school).

The present study was conducted with 8 Turkish teachers. It was not possible to perform a parametric test due to the small number of participants. Further research can be done by recording the voices of at least 30 different teachers while they were reading the prepared texts that represent autonomy-supportive and controlling teaching styles.

The present study was conducted with Turkish teachers and examined the voice characteristics of the Turkish language. Further research can be done to examine the voice characteristics of people speaking different languages. The same person can use his/her voice differently when speaking in different languages. Therefore, speaking in a different language can also affect the voice characteristics of the person. Further research can also examine voice characteristics of the same person as the person speaks in two different languages and being autonomy-supportive and controlling.

The present study was carried out with two pre-prepared texts representing an autonomy-supportive teaching style and a controlling teaching style. The participants were asked to read the texts as they mean it. Further research can be done in real classroom settings with observational methods to capture teachers' autonomy-supportive and controlling styles in real classroom settings.

The present study investigated the prosody of teachers' autonomy-supportive and controlling motivating styles. Further research can be done to investigate the brain parts and neural networks involved in the procession of the autonomy-supportive and controlling motivating styles of teachers. Furthermore, the parts activated during the exposure of autonomy-supportive prosody and the controlling prosody can be examined and also compared.

Limitations

Although the study aimed to identify possible differences in Turkish teachers' voice characteristics as a function of their motivating style, it is limited in capturing only 8 native Turkish speaking teachers' voice characteristics in Turkish language.

Moreover, participants were high school teachers from Ankara, the capital city of Turkey. Also, they were teachers working in the same high school affiliated with a private non-profit university. I do not know whether the same voice characteristics are applied to elementary teachers or to high school teachers of public schools. Therefore, it is almost impossible to generalize the study to all types of schools (i.e., public, vocational) and teachers of all ages, all fields (i.e., chemistry, mathematics, language, history, geography) and all levels (i.e., pre-school, primary school).

The study was conducted in a silent classroom environment. Participants were told to imagine they were in one of their classes and their task was to read two

texts (one autonomy-supportive and one controlling) as if they were speaking to actual students. Also, they are asked to read the texts out by using a loud and expressive voice tone that corresponds to the meaning of the texts and pronounce clearly. However, some of the participants might not have had sufficient concentration or they might not have understood the context of the texts. Furthermore, they might not have adjusted the tone of voice according to the content.

Last but not least, time constraint was one of the limitations of the present study. It was not possible for me to recruit a larger sample. If it was possible to ask more teachers to read the texts and record their voices, more objective findings could have been found and more insights to the likelihood of using voice characteristics to identify teachers' motivating style.

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APPENDICES

Appendix A

Ethics Committee Approval

Bilkent Üniversitesi
Akademik İşler Rektör Yardımcılığı

Tarih : 15 Mayıs 2019

Gönderilen : Gülcehan Ceyhan

Tez Danışmanı : Aikaterini Michou

Gönderen : Fatma Taşkın
İnsan Araştırmaları Etik Kurulu Başkanı

Konu : *"The voice ..."* çalışması etik kurul onayı

Üniversitemiz İnsan Araştırmaları Etik Kurulu, 15 Mayıs 2019 tarihli görüşme sonucu, "*The voice characteristics of an autonomy-supportive or controlling teaching style*" isimli çalışmanız kapsamında yapmayı önerdiğiniz etkinlik için etik onay vermiş bulunmaktadır. Onay, ekte verilmiş olan çalışma önerisi, çalışma yürütücüleri, ve bilgilendirme formu için geçerlidir.

Bu onay, yapmayı önerdiğiniz çalışmanın genel bilim etiği açısından bir değerlendirmesine karşı gelmektedir. Çalışmanızda, kurulumuzun değerlendirmesi dışında kalabilen özel etik ve yasal sınırlamalara uymakla ayrıca yükümlüsünüz.

Etik Kurul Üyeleri:

Ünvan / İsim	**Bölüm / Uzmanlık**	**İmza**
1. Doç.Dr. Fatma Taşkın	İktisat	
2. Prof.Dr. Erdal Onar	Hukuk	
3. Prof.Dr. Haldun Özaktaş	Elektrik ve Elektronik Müh.	
4. Doç.Dr. Işık Yuluğ	Moleküler Biyoloji ve Genetik	
5. Dr. Öğr. Üyesi Gül Günaydın	Psikoloji	
Yd.1.Doç.Dr. Çiğdem Gündüz Demir	Bilgisayar Mühendisliği	
Yd.2. Dr. Öğr. Üyesi A.Barış Özbilen	Hukuk	

Kurul karar/toplantı No: 2019_15_05_04

Bilkent Üniversitesi, 06800 Bilkent, Ankara • Telefon: (312) 290 12 13 • (312) 290 12 14 • Faks: (312) 266 41 52

Appendix B

Autonomy-Supportive Text (Turkish)

Bugün size üzerinde çalışmanız için zorlu bir ödev vereceğim. Önerilerimi dikkatlice dinleyin. Talimatları dikkatlice okuyun ve açıklamamı istediğiniz herhangi bir şey varsa, lütfen sorun. Talimatları anlıyor muyum diye kendinize sorun. Takip edebileceğiniz adımlar değişken olabilir. Yaratıcı düşünmekte özgürsünüz. Sınıfta kullanmadığımız alternatif çözüm yolları kullanabilirsiniz. Hazır olduğunuzda ödev üzerinde çalışmaya başlayabilirsiniz. Önümüzdeki salı çözümünüzü getirebilirsiniz. Zamanınızı verimli kullanmanızı öneriyorum. Teslim tarihini erteleyebiliriz. Tamamlamak için daha fazla zamana ihtiyacınız olabilir. Unutmayın, uygun kaynakları bulmanıza yardım edecek her soruyu cevaplayabilirim. Keyfini çıkarın.

Appendix C

Controlling Text (Turkish)

Bugün size zorlu bir ödev vermeye karar verdim. Beni dikkatlice dinleyin. Talimatlarımı dikkatlice okuyun ve bana orada yazan herhangi bir şeyi sormayın. Talimatları daha iyi anlamak için önceki derslerde öğrettiklerimi hatırlayın. Takip etmeniz gereken adımlar belli. Orada yazılı olanın dışına çıkmayın. Sınıfta kullandığımızdan farklı ya da alternatif bir çözüm yolu kullanmayın. Şimdi, ödev üzerinde çalışmaya başlayın. Çözümlerinizi önümüzdeki salı teslim edeceksiniz. Vaktinizi harcamayın. Teslim tarihini ertelemeyeceğimi söylememe gerek yok. Ödevi yapmak için çok vaktiniz var. Unutmayın, diğer kaynaklardan öğrenebileceğiniz hiçbir soruyu cevaplamayacağım. Keyfini çıkarın.

Appendix D

Teacher Consent Form

Information sheet for participants

Dear participant,

You are invited to participate in a research related to your voice characteristics while giving instructions. This is a research project being conducted by Gülcehan Ceyhan Erken, a Master's student at the Graduate School of Education at Bilkent University and the supervision of the Assistant Professor Dr. Aikaterini Michou.

Your participation in this research is voluntary. You may refuse to take part in the research or exit the process at any time without penalty. There are no foreseeable risks involved in participating in this study.

Your participation involves your voice recording while you are reading two texts prepared. The voice will be recorded by a device where the data will be stored in a password-protected electronic format. The device does not collect identifying information such as your name or photo. Therefore, your voice will remain confidential. No one will know whether you participated in the study or not.

Your relation with Bilkent will not be affected if you do not participate or if you withdraw your participation.

If you want to be informed about your analysis, please indicate it below. In this case, your name and email will be recorded. Then, the result of your analysis will be sent to you in November - December 2020.

The result of our study will be presented in a seminar and you will be invited to attend it. The results of the study may be published, but it will not be possible to identify individual participants. If you have questions about the study or the procedures, you may contact me via email at gulcehan.ceyhan@bilkent.edu.tr or my research supervisor, Dr. Aikaterini Michou at aliki.michou@bilkent.edu.tr

Consent Form

I have read the above information and I am consenting to participate in this study.

Participant’s name…….

_____

Signature Date:

This consent form is obtained by Gülcehan Ceyhan Erken

_____

Signature

I would like my name and e-mail address to be recorded so as to receive the results of my voice analysis.

Yes No