THE ROLE OF SPEECH RATE IN MOTIVATIONAL COMMUNICATION IN TEACHER-STUDENT INTERACTION IN PHYSICAL EDUCATION

Miika Tuominen

Master's thesis in Sport and
Exercise Psychology
Spring 2019
Faculty of Sport and Health Sciences
University of Jyväskylä

Abstract

Tuominen, M. 2019. The role of speech rate in motivational communication in teacher-student interaction in physical education. Master's thesis in Sport and Exercise Psychology. Faculty of Sport and Health Sciences. University of Jyväskylä. 48 p. (2 appendixes).

As a way of combating the rising trend of physical inactivity, physical education has adopted inspiring students to lead a physically active life as one of its main goals. According to self-determination theory, achieving this outcome is more likely, if the students adopt autonomous motivation towards physical education. It is not surprising then that the nature of autonomy-supportive teacher-student interaction in physical education has been studied extensively in the recent years. What is surprising is that this research is almost exclusively focused on the verbal side of communication, seemingly forgetting the nonverbal side of human communication. However, there are some recent efforts focusing on the nonverbal aspects of autonomy-supportive communication in general that aim to address this gap by focusing on what is called motivational prosody. Prosody in general refers to properties and variations of voice that can be used to convey and infer meaning. It has been mainly studied in the fields of communication and speech research, but social and emotional prosody also count among the fields interested in the way we use our voice while communicating. Recent research in motivational prosody builds on these existing approaches while aiming to identify those prosodic properties of voice that are relevant or meaningful especially in motivational communication.

This study examines how speech rate is being used in motivational communication in teacher-student interaction in physical education. The question of interest here is whether the speech rate differs between autonomy-supportive and controlling messages spoken by teachers in physical education. To answer this, 12 autonomy-supportive and 13 controlling messages obtained from recordings of 10 physical education lessons were analyzed here. The selection of messages was done by presenting 42 pre-selected sample messages to 3 independent observers and retaining those messages that all the raters agreed on as being either autonomy-supportive or controlling. Two measures of speech rate were calculated for each message: overall speech rate (syllable count / duration) and articulation rate [syllable count / (duration – disfluencies)]. The two message-types were then compared for differences on these two measures by using independent samples t-tests.

The two message-types differed in terms of their speech rate. The measured articulation rate of autonomy-supportive messages was higher than that of controlling messages ($p < 0.05$). There was no significant difference in overall speech rate. However, the disfluency counts in the messages turned out to be considerable. As the measure of overall speech rate is sensitive to disfluencies, it might not be a valid measure of speech rate for material derived from real-life contexts. The measured difference in articulation rates indicated that the differences between autonomy-supportive and controlling communication are not limited to the choice of words. Autonomy-supportive messages appear to be spoken more quickly than controlling or, conversely, controlling messages more slowly than autonomy-supportive. The results of this study then further support the argument that studying the nonverbal aspects of motivational communication is an interesting and meaningful avenue of research.

Keywords: Motivational prosody, self-determination theory, autonomy support, physical education, nonverbal communication

CONTENTS

1 INTRODUCTION

As physical education is part of the school curricula, it provides an excellent platform for actions aimed at increasing the physical activity levels of the population. It reaches nearly everyone whereas the participation in many other physical activity contexts, such as sports clubs or fitness centers, is mainly determined by the willingness of the individual. For example, in 2017 there were 2 384 schools in Finland with 556 700 pupils (Official Statistics of Finland 2018). In terms of reaching and influencing people, the physical education is unrivaled in its scope and potential. However, people have been participating in physical education for a long time now and yet we have large proportions of population not meeting the physical activity levels required for optimal health. In fact, those who are active enough are a minority on a European-level as approximately two thirds of the populations fail to meet the physical activity recommendations for optimal health, including Finland (Sjöström, Oja, Hagströmer, Smith & Bauman 2006). What causes additional worry to many is the fact that the trend of physical inactivity is not limited only to adult populations. In Finland, on average only one in three children aged 9–15 meets the physical activity recommendations (Kokko et al. 2015). Without a doubt, there is a myriad of reasons contributing to this development, most of which are probably not related to physical education. Still, physical education reaches great proportions of the population and hence the potential it has in increasing physical activity levels should not be left unexamined.

According to self-determination theory (henceforth referred to as SDT; Deci & Ryan 2000; Ryan & Deci 2017) there are qualitative differences between motivational orientations, which have implications for the psychological and behavioral outcomes related to carrying out a given behavior. SDT suggests that for a certain behavior to become sustainable, it needs to be based on motivational orientations characterized as autonomous (Deci & Ryan 2000). As the motivational orientations seem to spread across similar contexts (Vallerand, 2007), it appears possible to influence the students' overall physical activity levels by influencing their motivation in physical education (Hagger 2014). Students' motivation in educational contexts is, in turn, influenced by the extent to which they perceive the educational context as supporting their autonomy (Núñez &

León 2015). It is not inconsequential then, how teaching is organized or how teachers interact with their students.

Research interests on teacher-student interaction have increased within the SDT-framework. Information and guidelines are available on how teachers can support their students' autonomy (e.g. Reeve & Jang 2006; Sarrazin, Tessier, Pelletier, Troilloud & Chanal 2006; Standage, Gillison & Treasure 2007). However, the majority of this research has focused almost exclusively on the verbal content of the teacher-student interaction with only a few explicitly addressing or mentioning the nonverbal aspects of communication. Without belittling the importance of the verbal content of communication, the lack of research regarding nonverbal communication's role in autonomy-supportive interaction represents a significant gap in the literature. After all, the nonverbal side is a major part of the overall communication process (Hall, Horgan & Murphy 2019; Knapp & Hall, 2010, 10–21). Fortunately, there is some recent literature available that aims to bridge this gap by focusing on what the researchers call "motivational prosody" (Weinstein, Zougkou & Paulmann 2018). The term prosody in general refers to the qualities and variations of voice that can be used to convey and infer meaning (Knapp & Hall 2010, 367) whereas motivational prosody refers especially to those qualities and variations of voice that are relevant or meaningful in motivational communication. Research conducted in social and emotional prosody suggests, for example, that different types of emotions are expressed via different prosodic patterns of voice and that these differences in prosodic qualities can be used to make inferences about the emotional states of the speaker (e.g. Banse & Scherer 1996; Laukka, Juslin & Bresin 2005; Scherer 2003; Knapp & Hall 2010, 381–387). What motivational prosody is interested in is whether similar differences could be discovered between different kinds of motivational messages.

Based on a series of studies conducted by Weinstein, Zougkou and Paulmann (2018), it appears that autonomy-supportive messages differ not only in their verbal content but also in the way they are being spoken. Weinstein et al. suggest that autonomy-supportive messages tend to be spoken with lower intensity, slower speech rate and less voice energy when compared to controlling messages. It appears then, that it is not only *what* is being said that matters for experiences of autonomy-support to become realized but also *how*

something is being said. Interestingly, Weinstein et al. also demonstrated that the *how* appears to be meaningful in its own as people seem to be able to pick up motivationally laden meanings even in semantically neutral or identical messages (Weinstein et al. 2018).

The current study continued from where the previously mentioned researchers left off. My aim here was to see if some of the differences in the prosodic patterns discovered in the lab setting by Weinstein et al. were also found in a real-life context involving teacher-student interaction in physical education classes. To limit the scope of this study, I only examined prosodic variables related to speech rate such as the *overall speech rate* (spoken message taken as a whole, with pauses, hesitations and other possible discontinuities contained in the message included) and the *articulation rate* (with pauses and other discontinuities of speech longer than 250ms in duration excluded). The aim of this study was to explore, if there were significant differences found in the speech rate variables between autonomy-supportive and controlling messages spoken by the physical education teachers. In other words, the question of interest here was whether autonomy-supportive and controlling messages are spoken differently in terms of their speech rate and if they are, then how? The results attained here serve to examine the real-life applicability of the results obtained by Weinstein et al. in the lab as well as provide information about the nonverbal aspects of motivational communication in physical education.

The current study utilizes tools created and data collected during the PETALS-study carried out in the Faculty of Sport and Health Sciences in the University of Jyväskylä, Finland. PETALS is an intervention study the main phase of which consists of a teacher-delivered theory-based trial to promote student participation in leisure-time physical activity via fostering the autonomy-support provided by the teachers in physical education lessons (Polet et al. 2019). The PETALS itself is a sub-study of a larger IMPAct-project (Increasing Motivation for Physical Activity) conducted at the University of Jyväskylä, Finland. The PETALS-study consists of two phases – the pilot phase and the main study. One of the aims of the pilot phase of PETALS was to develop an observation tool which is to be used in locating and classifying teacher-sent messages into motivationally relevant categories during the main study. The observation tool being

developed for PETALS is based on and adapted from similar tools used in previous research (see Sarrazin et al. 2006; Reeve & Jang 2006). This study utilizes both the data collected during the pilot phase of PETALS as well as the preliminary version of the PETALS-observation tool (see Appendix A) to locate motivationally relevant messages.

2 THEORETICAL FRAMEWORK

The theoretical framework underlying this study is that of the SDT, which aims to understand the motivational processes behind behavior regulation (Deci & Ryan 2000; Ryan & Deci 2017). According to SDT, there are qualitative differences between motivational orientations that influence the resulting behavioral and psychological outcomes. However, SDT is more than just a theory of motivation as it also aims to establish conditions under which human beings can flourish and grow. One of the central tenets of SDT is that we humans have three basic psychological needs. They are characterized as "innate psychological nutriments that are essential for ongoing psychological growth, integrity, and well-being" by Deci and Ryan, the main figures behind the SDT (Deci & Ryan 2000, 229). In SDT, these three basic needs are identified as needs for *autonomy*, *competence* and *relatedness.*

Autonomy as a basic need refers to a sense of self-regulation and volition related to one's experiences and actions, *competence* to a need to act effectively with the environment in contexts that are perceived as important by the person and *relatedness* to social connectedness – to feeling belonging, acceptance and significance while acting in the social sphere (Ryan & Deci 2017, 10–11). By the virtue of being basic, all three needs must be fulfilled for optimal development, functioning and well-being while the thwarting of them leads to increasingly negative behavioral and psychological outcomes (Deci & Ryan 2000). In SDT, these needs are also assumed to be universal - meaning that they are thought to apply to all humans at all times. The possible cultural differences between values, need-fulfilling conditions and behaviors are viewed merely as different ways to realize the same outcome, i.e. the satisfaction of the three basic needs (Deci & Ryan 2000, 246–247). The basic needs have a central role in SDT as the differences between different types of motivational orientations are established by the extent to which the processes of behavioral regulation related to any given behavior fosters or thwarts the fulfillment of these needs.

2.1 Motivational orientations

In SDT motivational orientations are classified in three general categories: intrinsic motivation, extrinsic motivation and amotivation (Ryan & Deci 2007, 1–13). In this classification, *intrinsic motivation* refers to behavior that is done for its' own sake – e.g. for enjoyment, pleasure or fun inherent in the behavior itself. In other words, when intrinsically motivated, the behavior becomes autotelic. The purpose of the behavior is fulfilled by carrying out the behavior. *Extrinsic motivation* on the other hand refers to situations where the behavior is carried out for something else. That is, the behavior is instrumental to realizing some outcome that is conceptually distinct from the behavior itself. In SDT, extrinsic kinds of motivation can be further divided into qualitatively different sub-categories identified as follows: *integrated regulation, identified regulation, introjected regulation* and *external regulation* (Ryan & Deci 2007, 1–13).

According to SDT, *external regulation* refers to situations, where the external reinforcements are the sources of motivation. Therefore, the existence of motivation and persistence with the behavior become contingent on the presence of external rewards and punishments. *Introjected regulation* refers to situations where the behavior is regulated via internalized rewards and punishments such as feelings of pride or guilt. The crucial point to notice here is that in both cases above, the self is controlled by the existence of behavior-related contingencies. *Identified regulation* in turn refers to situations where the person identifies with the purpose and values related to certain actions and their outcomes. That is, the behavior is perceived as leading to an outcome that is judged important or valued by the agent. Therefore, the motivation is no longer dependent on the existence of external or internal contingencies as the motivation flows from the values held by the self and from the perceived importance of the outcomes. When this kind of behavior and the regulation related to it become coordinated with the overall life goals and values of the person, we are talking about *integrated regulation.* The behavior has been integrated as part of the person's identity and sense of self and it is in congruence with other behaviors and values of the person. Yet, the motivation is still external in kind as the behavior itself is instrumental to something else, e.g. for pursuing valued outcomes or acting in congruence with one's sense of self. *Amotivation* is the third general kind of behavioral regulation identified by SDT. However, it is not exactly a form of behavioral regulation

or motivation but represents their absence. When amotivated towards something, the person sees no point in carrying out the behavior and therefore lacks all motivation towards it. Although the sources for the amotivation might differ, they all lead to absence of intentionality towards a given activity or behavior (Ryan & Deci 2007, 1–13).

Another important concept in the SDT-framework is the perceived locus of causality (henceforth referred to as PLOC). The PLOC refers to the extent to which a given type of behavioral regulation is self-determined or autonomous from the point of view of the individual. It refers to the extent that the individual perceives the self as the source of causality behind the behavior (Deci & Ryan 2000, 233–234). It is characterized as a continuum ranging from autonomous motives to controlling ones with the autonomous motives corresponding with the internal PLOC and controlling motives corresponding with the external PLOC. Internal PLOC then refers to situations where the self is seen as the initiator in the causal chain leading up to behavior, whereas the external PLOC represents situations where the self is controlled by something external to it.

As was mentioned above, the introjected and external regulation are both characterized by the rewards and punishments, either internal or external, that are exerting control over the self. Point worth mentioning here is that even though the rewards and punishment are administered internally in introjected regulation, i.e. they originate from within the person, they are still understood as external to the self. There is a distinction then between the *person* and the *self* and it is the *self* that is referred to as the source of causality with internal PLOC (Ryan & Deci 2017, 67–70). As the introjected and external regulation are both controlling towards the self, they both have an external PLOC. This means that they fall within the controlling end of the motivational spectrum. In contrast, the identified regulation includes more volition and personal agency as the behavior is carried out for valued outcomes. The behavior has an autonomous source as the motivation flows from the values held by the self and therefore the PLOC is more internal in kind. In integrated regulation the regulation is even more autonomous as the behavior in question is in congruence with other values and behaviors of the self. At the high autonomy end of the PLOC continuum is the intrinsic motivation as it represents behaviors that serve no instrumental purposes.

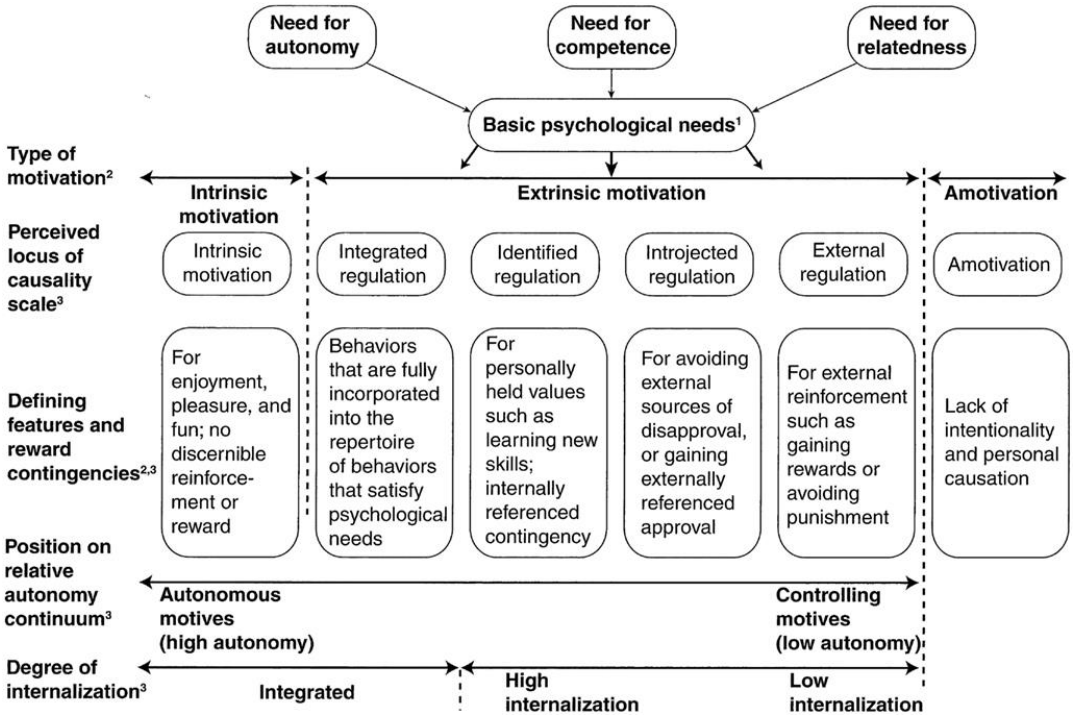

Figure 1. Overview of the SDT presented in Hagger & Chatzisarantis (2007).

It is worth emphasizing that it is not only intrinsic motivation but also other autonomous motivational orientations as well that produce desirable behavioral and psychological outcomes. Also, as is highlighted by Ryan and Deci (2007, 17–19), it is not that the controlling motives do not motivate behavior. Besides amotivation, all the forms of motivation presented in the SDT are motivational – meaning that they influence behavior and behavioral intentions. Yet, due to thwarting of the basic needs, the controlling motivational orientations tend to produce short-term behavioral outcomes which are only maintained as long as the controlling rewards and punishments are present (Deci & Ryan 2000). Also, as the controlling motivational orientations are not supportive of the fulfillment of the basic needs, maintaining the behavior becomes psychologically taxing. What becomes important from the point of view of SDT then is the fostering of autonomous motivational orientations.

2.2 Motivation in physical education

As was mentioned above, SDT suggests that for the physical activity behavior to become sustainable, it needs to be based on motivational orientations that are autonomous in kind. Therefore, it is in our interest as physical educators to increase the autonomous motivation of the people we are working with. The research has shown that the adoption of autonomous motivation in educational contexts is more likely, if the students perceive their teachers as acting in an autonomy-supportive way (Núñez & León 2015).

Adopting autonomous motivation in physical education can have far-reaching consequences as Vallerand's hierarchical model of intrinsic and extrinsic motivation indicates that motivational orientations can spread across similar contexts (Vallerand 2007). This allows us to formulate a hypothesis about the connection between motivation and behavior in physical education classes and motivation and behavior in leisure-time physical activity contexts. Building on Vallerand's model, the research based on the trans-contextual model of motivation has explicitly tested this connection (Hagger 2014; Hagger, Chatzisarantis, Barkoukis, Wang & Baranowski 2005; Hagger, Chatzisarantis, Culverhouse & Biddle 2003). The results indicate that perceived autonomy-support and autonomous motivations in physical education classes are in fact connected to autonomous motivations and physically active behavior in leisure-time. Furthermore, it is suggested that this connection exists even after controlling for sources of autonomy-support related to physical activity other than physical education, such as parents or peers (Hagger et al. 2009). It appears then that the motivation and behavior in physical education and in leisure-time physical activity contexts can be influenced through the students' perceptions of autonomy-support in physical education. Although the perceptions of the students are what is thought of as a motivational determinant in the framework discussed here, the teacher's behavior has an influence in the formation of those perceptions (Reeve & Jang 2006; Nuñez & León 2015).

2.3 Autonomy-supportive teachers

Teachers differ in their instructional and interactional style and this has implications for whether the students perceive their teachers as acting in an autonomy-supportive or controlling way. For example, according to Reeve and Jang (2006) autonomy-supportive teachers tend to focus on encouraging their students to utilize their inner resources, whereas controlling teachers are more focused on carrying out the "teacher-centered agenda". What Reeve and Jang mean with "teacher-centered agenda" is that when oriented this way, the teacher has a certain preconception about what should happen or how the students should behave, and the teacher then aims to fulfill this agenda, often by imposing external rewards and punishments (Reeve & Jang 2006, 210). Both autonomy-supportive and controlling teachers aim to engage their students but they are doing it in different ways – autonomy-supportive teachers seek students' initiative, whereas controlling teachers seek students' compliance (Reeve, Bolt & Cai 1999; Reeve & Jang 2006). From the point of view of the SDT it is not a trivial question then, how the teacher chooses to interact with his or her students. The normative implication of the SDT is that teachers should aim to support their students' autonomy, even if this might require some alterations to their already existing interaction-styles. Fortunately, it has been demonstrated that teachers can and do learn to become more supportive of their students' autonomy (Cheon & Reeve 2013; Cheon, Reeve & Moon 2012; Su & Reeve 2011).

Much of the research related to autonomy-supportive teacher-student interaction is carried out in subjects other than physical education. Compared to other subjects, especially academic ones, the physical education seems somewhat different in its content and purpose. However, physical education is an educational context and hence one might suppose that the same principles would apply. Also, there is strand of research within the SDT framework that focuses explicitly in fostering autonomy-support in physical education (for an overview of this research, see Ryan & Deci, 2017, 481–507). For example, in relation to physical education, Standage, Gillison and Treasure suggest (2007, 84–85) that in order to support the autonomy of their students, teachers should aim to adopt an autonomy-supportive discourse. That is, they should avoid the language of "should", "must" and "have to", and focus on promoting a sense of choice by adopting the language of "may", "can" and "could". They should also aim to provide their students

with possibilities for making informed choices, give informational feedback while avoiding normative feedback, encourage effort, acknowledge students' experiences and emotions – especially, if the student is not motivated by the activity, provide meaningful rationales for activities and focus on self-referenced standards and signs of ability (Standage et al. 2007, 84–85).

2.4 Nonverbal communication and autonomy-support

Although the autonomy-supportive communication of teachers has been a subject to a lot of research in the last decades, the focus has often been on the verbal content of the interaction, as is exemplified by the guidelines presented above. That is, the focus of research has been mainly on the *what* it is that should be said in order to promote the experience of autonomy-support or the adoption of autonomous motivation. As important as this may be, there seems to be a gap in the literature regarding the other side of human communication, the nonverbal side, and its connection to autonomy-supportive interaction. *How* something should be said in order for it to be interpreted as autonomy-supportive is a question that remains unasked.

Nonverbal aspects are sometimes mentioned in the research regarding the autonomy-supportive teacher behavior, but usually they are not the main focus of studies nor elaborated more fully in them. For example, in their categorization of autonomy-supportive and controlling teacher behaviors Reeve and Jang mention nonverbal signals in their definition of an instructional behavior termed "time listening", but they do not provide any further information on what those nonverbal signals exemplifying listening are (Reeve & Jang 2006). Tone on the other hand has an implicitly important role in the categorization made by Sarrazin et al. as their categories of neutral messages are characterized as having neither autonomy-supportive nor controlling tone (Sarrazin et al. 2006). However, what it is exactly that makes a tone either autonomy-supportive or controlling is left unexplained. A more explicit effort to include nonverbal aspects was made by Koka and Hagger (2010) who included positive and negative nonverbal feedback as separate variables in their study regarding the perceptions of need satisfaction and self-

determined motivation in physical education. Among the things they examined were the nonverbal gestures that the teachers used while responding to performance and effort. Koka and Hagger mention “clapping hands, smiling, or patting a shoulder” as examples of positive nonverbal feedback and “rolling their eyes, shaking their head, or displaying an angry expression” as examples of negative nonverbal feedback (Koka & Hagger 2010).

Although nonverbal aspects of communication are sometimes mentioned or even included in studies, the main criteria used in the research for distinguishing between autonomy-supportive and controlling communication appear to be verbal. The main focus appears to be on *what* it is that is being said whereas *how* something is said has received very little attention. This omission might be due to challenges related to reliably measuring the nonverbal communication process as the nonverbal aspects seem somewhat harder to pin down. Nonverbal communication appears to involve discreet signals and subjective interpretations to such an extent, that it is hard to say anything about it with any level of certainty. Of course, words contained in the verbal communication require interpretation as well but at least in that case there are no ambiguities related to the *what* that is being interpreted. Whatever the reasons may be, the *how* should not be overlooked if we wish to further our understanding related to motivational communication.

2.5 Examining the prosody of motivational communication

Human communication is a holistic concept consisting of both verbal and nonverbal aspects. That is, the communicated meaning is often the result of an interplay of a great variety of things, both verbal and nonverbal. In that sense the distinction between verbal and nonverbal is artificial. However, they can be separated for analytical purposes. For example, sarcasm can be characterized by certain kinds of nonverbal properties of the speech although it also depends on the verbal content of the message (Cheang & Pell 2008). To further complicate matters, the nonverbal communication also appears to be a very broad concept in itself. It can refer to, for example, speech-related or speech-independent signals or to specific signal types, such as gestures, faces, body

positions or vocal cues in speech etc. (Knapp & Hall 2010, 3–10). The focus of this study is then on a very restricted set of aspects of nonverbal communication as the interest here lies explicitly in the prosody – the qualities and variations of voice that can be used to convey and infer meaning (Knapp & Hall 2010, 367). Further restricting the scope of this study, only prosodic variables related to speech rate will be considered here.

As was mentioned earlier, Weinstein et al. (2018) examined if it was possible to establish differences in prosodic properties when it comes to motivational communication. What they wanted to know was, if it was possible to find prosodic patterns that could distinguish between autonomy-supportive and controlling messages. To analyse the prosody, they examined the quality of sound produced by the speakers by using four measures – pitch, amplitude, speech rate and voice quality. What they found was that autonomy-supportive messages tend to be spoken with lower intensity, slower speech rate and more "softly" (exemplified by a certain kind of energy distribution in the sound spectrum). In their series of studies, the results related to pitch yielded conflicting results. Interestingly, they also demonstrated that people can infer motivational meaning based on prosodic properties alone by examining the perceptions related to listening to semantically neutral or identical sentences spoken with different motivationally laden prosodic patterns (Weinstein et al. 2018). It appears then that the prosodic patterns do differ between autonomy-supportive and controlling messages and that people can use this information to infer motivationally laden meanings even in sentences that appear neutral judging by their verbal or lexical-semantic content. That is, the prosody alone appears to have the ability to carry motivationally meaningful information to the receiver.

While the initial results attained in lab conditions by Weinstein et al. are promising, they await support from real-life contexts. After all, the setting might influence the results as the context surrounding the communication in the lab is artificial at best (see Barrett, Mesquita & Gendron 2011). This study aims to follow the suggestion given by Weinstein et al. by examining, if some of the observed differences in the prosodic patterns between autonomy-supportive and controlling messages can be obtained from a sample collected from a real-life setting involving teacher-student interaction in physical education classes.

2.6 Measuring the speech rate

Out of the prosodic properties of pitch, intensity, speech rate and voice quality examined by Weinstein et al. (2018), only speech rate was considered in the current study. This limitation was partly necessitated by the need to restrict the scope of this study but also by the quality of the data at hand. The data here consists of recordings of actual physical education lessons recorded during the pilot phase of the PETALS-study. The recordings contain a fair amount of on-going and dynamic background noise, which precludes the possibility of reliably measuring pitch, amplitude and energy distributions. However, measuring speech rate is more flexible in terms of data quality and hence it was chosen as the focus of this study.

Weinstein et al. defined and measured speech rate as duration per syllable (Weinstein et al. 2000, 900). However, measuring speech rate this way has the possibly confusing effect of producing what might be called reversed results. That is, when speech rate is measured as the duration per syllable, lower value for the speech rate actually means faster speech and, conversely, higher value means slower speech. This is because the less time one spends on a syllable, the more syllables one can produce in a given timeframe. To avoid the possible confusion resulting from measuring speech rate this way, a different method for defining and measuring speech rate was chosen for this study.

Two measures of speech rate were examined here, both of which are based on defining the speech rate as the number of syllables produced per second (e.g. Sturm & Seery 2007). I will examine here:

1) the *overall speech rate* defined as the number of syllables uttered per second when the message is taken as a whole, with pauses, hesitations and other disfluencies contained in the message included, and

2) the *articulation rate* defined as the number of syllables uttered per second when pauses, hesitations and other disfluencies longer than 250ms (milliseconds) contained in the message are excluded.

The difference between the two ways of measuring speech rate mentioned above is that the overall speech rate aims to capture the pace at which certain message is communicated when taken as a whole whereas the articulation rate aims to capture the rate of the actual speech activity contained within the communicated message (Suomi, Toivanen & Ylitalo 2007, 147). The purpose of the exclusion threshold in measuring articulation rate then is to exclude hesitations and pauses that are not part of the articulatory activity but represent either disfluencies in speech or other processes, such as cognitive processes, related to speaking (Robb, Maclagan & Chen 2004, 5–6). In other words, the articulation rate aims to capture the production rate of the actual speech segments contained in the communicated message.

However, there appears to be some disagreement in the literature related to measuring the articulation rate as the exclusion threshold used seems to vary from 50ms to 250ms (see Robb, Maclagan & Chen 2004; Sturm & Seery 2007; Yaruss 1997). In this study the exclusion threshold was set at 250ms as it seemed most suitable for the analysis of real-life teacher-student interaction. Pauses and silent intervals as such are normal and natural parts of fluent speech as they might be related to, for example, respiration while talking or to articulatory pauses between certain kinds of syllables or phonemes (Robb et al. 2004, 5–6). That is, there are naturally occurring pauses even in fluent speech. The purpose of the exclusion threshold then is to distinguish between these naturally occurring pauses and those that can be described as disfluencies or discontinuities of the speech. In this study, the threshold of 250ms seemed best suited for this purpose as the lower thresholds appeared to pick out pauses whose nature was not clear.

The measures of overall speech rate and articulation rate then approach speech rate slightly differently. They differ mainly on the question of what to include in, or exclude from, the message. Both are measuring the rate at which something is happening and hence they can be considered as having face validity as measures of speech rate, although their approach to it differs. That is, depending on how the speech rate is understood, it can be measured either as overall speech rate or as articulation rate. Whereas the former understands discontinuities contained in the message as essential parts of the message, the latter is more focused in the production rate of actual speech segments. As the data for this study is gathered from a real-life interaction context, it makes sense to examine

both the overall speech rate and the articulation rate. Speech accompanying real-life interaction seems to contain many kinds of disfluencies, which in this context refers to any discontinuities of speech such as stuttering or pausing but also to certain interfering behaviors such as laughing and sneering etc. Examining both the overall speech rate and articulation rate then allows a more precise analysis to be made as the articulation rate functions as a measure, where the influence of discontinuities is controlled for.

3 THE PURPOSE OF THE STUDY

The purpose of this study was to examine if there were significant differences found in the speech rate of autonomy-supportive and controlling messages spoken by teachers during physical education lessons. That is, the question that this study was aiming to answer was, in terms of speech rate, are autonomy-supportive and controlling messages spoken differently, and if so, then how? To answer this question, the current study analyzed data derived from real-life communicational settings involving teacher-student interaction in physical education. By examining the role of speech rate in teacher-student interaction, the current study aimed to further our understanding of the nonverbal aspects of motivational communication in general and motivational communication in physical education in particular.

4 METHODS

4.1 Design

As was mentioned in the introduction, this study utilizes data collected for the pilot phase of the PETALS-study carried out in the University of Jyväskylä, Finland (see Polet et al. 2019). During the pilot phase of the PETALS, ten physical education lessons from five teachers (five teachers with two classes) were recorded with a video camera. During the videotaped lessons, the teachers also wore a portable microphone that was connected to the camera, allowing for an accurate recording of the teachers' speech during the lessons.

For the purposes of the study at hand, these recordings were first analyzed with the help of PETALS-observation tool (see Appendix A) to pre-select and classify teacher-sent messages into autonomy-supportive and controlling categories. These pre-selected messages were then presented to three independent observers who were given a task to rate each message they heard either as autonomy-supportive, neutral or controlling. Those messages that all the raters agreed as being either autonomy-supportive or controlling were selected for the final analysis. Based on these ratings, two message groups were formed – autonomy-supportive and controlling – which were then compared for differences in the overall speech rate and articulation rate.

4.2 Participants

Participants in this study were five (3 males and 2 females) qualified full-time PE teachers teaching students in 7.–9. grades in lower secondary school in Finland. The teachers were asked to select two of their PE classes to participate in the study. One lesson from each class was then videotaped for the study. Out of the ten recorded physical education classes, four were seventh, three were eighth and three were ninth grade classes. Prior to recording, written consent for the participation in the study was asked from the

teachers. As the teachers' participation in the study also meant that their students were going to be exposed to being videotaped, written opt-in consent for the participation was also asked from the students and their guardians. Substitutive activities were arranged during the videotaped lessons for those students from whom consent was not received. Ethical permission for this study was awarded by the ethical committee of the University of Jyväskylä.

4.3 Materials

The sample messages used in this study were extracted from video recordings of lower secondary school PE lessons. The video recordings represent ten different physical education lessons with ten different classes and five different teachers, each teacher recorded twice. The video recordings were first analyzed with the help of an observation tool developed for the PETALS-study with the aim of pre-selecting examples of autonomy-supportive and controlling messages to be presented for independent observers.

The term "message" refers to what might be called an utterance contained in an interactional or communicational turn. The messages represent, for example, instructions, suggestions, statements or feedback given by the teacher or questions asked by the teacher during the lessons. Besides the conditions articulated in the PETALS-observation tool, there was only one further criterion for inclusion in the pre-selection phase. Only messages containing more than two words were chosen to account for the random variation in speech rate caused by the specific words spoken. Once the relevant messages were located, audio tracks were extracted from the video recordings using VLC player and saved as audio files. From these audio files the individual sample messages were extracted with Audacity and saved as separate audio files (.wav).

Altogether 42 pre-selected sample clips were obtained, each representing a single message spoken by the teacher (Teacher I – 8 clips, Teacher II – 10 clips, Teacher III – 8

clips, Teacher IV – 6 clips and Teacher V – 10 clips). The messages were of varying length and from various situations in the lessons. The 42 pre-selected sample clips were presented to three independent observers who were given a task to categorize each message they heard either as autonomy-supportive, neutral or controlling. The neutral option was included to avoid pressuring the raters to choose between autonomy-supportive and controlling options. The independent observers were three master's level students of sport and exercise psychology from the University of Jyväskylä who were familiar with the theoretical framework of the study. The pre-selection phase was included here as the amount of material was considerable and it would not have been possible to have the independent raters go through all of it.

All the raters agreed on the status of 27 (13 controlling, 12 autonomy-supportive and 2 neutral) pre-selected messages out of the initial 42. Overall, Cohen's κ suggested substantial agreement between the raters 1 and 2 ($\kappa = 0.651$, $p < 0.001$) as well as between raters 1 and 3 ($\kappa = 0.643$, $p < 0.001$) and moderate agreement between raters 2 and 3 ($\kappa = 0.607$, $p < 0.001$) (Landis & Koch 1977). Those sample messages that all the observers agreed on as being either autonomy-supportive or controlling were selected for final analysis. The sample messages that all the raters categorized as neutral or where there was no consensus among the ratings were dropped at this point. It is worth mentioning here that in cases where there was disagreement among the raters, the disagreement was always between neutral and autonomy-supportive or neutral and controlling – never between autonomy-supportive and controlling.

For the final analysis, altogether 25 messages from five teachers were selected (for examples of these messages, see Appendix B). Based on the ratings mentioned above, each message was placed either in the autonomy-supportive or controlling category ($n_{auto} = 12$, $n_{control} = 13$). The number and kind of the chosen messages per teacher is presented in the table below.

Table 1. The number and kind of messages chosen for the final analysis.

Teacher	Autonomy-supportive	Controlling	Total
I	3	2	5
II	3	5	8
III	1	1	2
IV	2	2	4
V	3	3	6
Total	12	13	25

Besides the requirement of minimum length of two words, the only inclusion criterion in the pre-selection phase was whether a given message fitted the categories of autonomy-support and control described in the PETALS-observation tool. The inclusion criterion for the final analysis was, in turn, whether all the raters agreed on a given message as being autonomy-supportive or controlling. As neither of the aforementioned places any demands on the general characteristics of the messages, the final sample messages turned out to be quite varied in both categories in terms of their length and content (Duration: M_{auto} = 3.22s, SD_{auto} = 1.71s; $M_{control}$ = 3.46s, $SD_{control}$ = 1.78s; Syllable count: M_{auto} = 19.2, SD_{auto} = 8.7; $M_{control}$ = 19.9, $SD_{control}$ = 8.6).

4.4 Procedure

Once the sample clips for the final analysis had been selected, they were processed with PRAAT-software (Boersma & Weenink 2018). The sample clips were processed and analysed manually as they contained a lot of background noise due to being recorded at actual physical education lessons. Manual processing included determining the beginning and end points of the messages to accurately determine the length of the spoken message, transcribing and segmenting the messages into syllables as well as locating and timing the possible disfluencies contained in the spoken messages.

The beginning and end points of the messages and disfluencies were identified by observing the variations in acoustic energy and amplitude displayed by PRAAT. The

beginnings were identified as points where the acoustic energy and amplitude started to increase and the ends as points where they decreased. As the recordings were gathered from physical education lessons, there was always background noise meaning that the acoustic energy or the amplitude never faded out entirely. The beginning and end points were then determined in relation to the level of baseline energy and amplitude produced by the background noise. However, as some samples had bursts of acoustic energy caused by the background, such as students shouting or balls bouncing near the teacher, all the identified points were further checked by listening to the clips. Based on this, adjustments to the chosen points were made if necessary.

After the sample clips had been processed with PRAAT, the overall speech rate and articulation rate for each clip was calculated. The *overall speech rate* was calculated by dividing the number of syllables contained in the message by the total length of the message (in seconds). The *articulation rate* was calculated by dividing the number of syllables contained in the message by the total length of the message minus the length of disfluencies contained in the message. Thus, the unit describing both the overall speech rate and the articulation rate was syllables per second (or syl/s). After calculating the values for overall speech rate and articulation rate for each message, the two message types were compared for differences.

5 RESULTS

*Overall speech rate***.** Independent samples t-test indicated that the overall speech rate of autonomy-supportive messages (n_{auto} = 12, *M* = 6.36syl/s, *SD* = 1.43syl/s) did not significantly differ from that of controlling messages ($n_{control}$ = 13, *M* = 5.93syl/s, *SD* = 1.28syl/s); *t*(23) = 0.78, *p* = 0.443 two-tailed, *d* = 0.32.

*Articulation rate***.** When looking at the articulation rate, however, independent samples t-test indicated that there was a significant difference between the two message types. The articulation rate of the autonomy-supportive messages (n_{auto} = 12, *M* = 7.19syl/s, *SD* = 0.68syl/s) was higher compared to the articulation rate of the controlling messages ($n_{control}$ = 13, *M* = 6.37syl/s, *SD* = 1.11syl/s); *t*(20) = 2.24, *p* = 0.037 two-tailed, *d* = 0.89. As Levene's test indicated unequal variances (*F* = 4.69, *p* = 0.041), the degrees of freedom were adjusted from 23 to 20.

As the sample sizes were small, nonparametric Mann-Whitney U-tests were also performed to check for differences between the two message types. The results of Mann-Whitney U-tests were similar to those obtained by independent samples t-tests. Mann-Whitney U-test indicated that there was no significant difference in overall speech rate between autonomy-supportive (*Mdn* = 6.60syl/s) and controlling (*Mdn* = 5.65syl/s) messages, *U* = 61, *p* = 0.376 two-sided. For the articulation rate, Mann-Whitney U-test indicated that the articulation rate of autonomy-supportive messages (*Mdn* = 7.20syl/s) was higher than for controlling messages (*Mdn* = 6.75syl/s) and this difference was significant at *U* = 39, *p* = 0.035 two-sided.

6 DISCUSSION

The aim of this study was to see if autonomy-supportive and controlling messages of the physical education teachers were spoken differently in terms of their speech rate. To answer this question, two measures of speech rate were examined: overall speech rate and articulation rate. As was mentioned above, independent samples t-test revealed no significant difference between the two types of messages for the overall speech rate. However, when looking at the articulation rate, significant difference emerged between the two message-types. The articulation rate was higher in autonomy-supportive messages, or, conversely, lower in controlling messages. This suggests that autonomy-supportive messages are spoken more quickly when compared to controlling messages. However, as the overall speech rate produced no difference, it is worth examining what might be the source of the observed mismatch between the test results for overall speech rate and articulation rate.

6.1 Measuring the speech rate in real-life communication

Although there appears to be more than one way to define and measure speech rate, they all seem contain two elements – time unit and some unit of content. The former are usually seconds or minutes whereas the latter are usually syllables or words (e.g. Sturm & Seery 2007). As minutes consist of seconds and words consist of syllables, the options that can be derived from these seem to represent simply different levels of specificity. Also, as the resulting value in each case represents a relationship between time and unit of content, it does not seem to make a difference, which way this relationship is presented. That is, the value derived from duration per syllable-method can be converted into syllables per second-value. It is the context and the purpose of the study then that determines, which measure of speech rate is the best suited, although, in essence, they all refer to the same thing – the speed or rate at which something is happening.

The possible pitfalls in measuring the speech rate are then not so much related to the mathematics used to calculate it but to selecting and processing the materials to be calculated on. That is, as one of the determinants of the resulting value for the speech rate is time, every decision made in the data processing phase that influences the length of the examined utterance, sentence or message is bound to have an effect on the results. In this study this was highlighted by the fact that a significant difference between the two message types emerged only after the effect of disfluencies was controlled for by looking at the articulation rate, which involves the removal of time spent on disfluency from the calculations.

Based on the sample of this study, the disfluency counts in real-life communication appear to be considerable. The number of disfluencies exceeding the exclusion threshold of 250ms set for determining the articulation rate turned out to be high in the sample with a total of 20 counts of disfluency distributed across 13 messages. As the total number of final sample messages was 25, this meant that approximately half of the examined messages contained at least one case of disfluency. The disfluencies were also spread across conditions with 6 autonomy-supportive messages and 7 controlling messages containing at least one case of disfluency. Out of the total of 20 cases of disfluency, 12 were found in autonomy-supportive messages and 8 in controlling messages meaning that they were not distributed evenly across message types.

As the measure of overall speech rate examines the spoken messages taken as a whole, it includes the time spent on disfluencies in the resulting value for the speech rate. As the overall speech rate is calculated by dividing the number of syllables by the length of the message, the disfluencies influence the resulting speech rate by increasing the overall length of the message. As the disfluencies increase the length of the message without adding any syllables, they have the effect of decreasing the resulting value of the speech rate. This means that it is possible, for example, that the pace of the actual speech activity might be high but the resulting overall speech rate value to be low due to large number or length of disfluencies or pauses contained in the message. Therefore, the overall speech rate does not seem to capture the pace of the actual speech production well in cases, where the disfluency counts are high.

Based on the results attained here, it appears that the count and distribution of disfluencies had the effect of increasing the dispersion of scores and narrowing the difference between the two conditions when measuring the overall speech rate. Although the mean overall speech rate was measured to be higher in autonomy-supportive messages, this difference was not significant. However, when the influence of disfluencies was controlled for by examining the articulation rate, significant difference between the two types of messages emerged. As the disfluencies seem to distort the resulting value for the speech rate, examining the articulation rate appears to provide a more appropriate estimate of the speech rate when analyzing material derived from real-life communication. The distorting effects of disfluencies were also identified by Weinstein et al. (2018) who in their lab-study aimed to select sentences that were free from disfluency. Lab-conditions may allow for sample sentences to be re-read until the result is free from disfluency, but this is not possible with data derived from real-life communication where one must use whatever gets recorded. Hence, measuring the articulation rate appears to be the method best suited for analyzing speech rate of messages derived from real-life communication. Also, it should be noted that in cases where the sample messages are free from disfluency, there is basically no difference between measuring overall speech rate and articulation rate.

6.2 Conflicting results?

Based on the results attained here, it appears that autonomy-supportive messages are spoken more quickly than controlling ones. That is, the pace of the actual speech activity appears to be faster in autonomy-supportive messages, or, conversely, lower in controlling messages. Therefore, this study further supports the argument made by Weinstein et al. (2018) who suggest that autonomy-supportive and controlling sentences differ not only in their verbal or semantical content but also in the way they are being spoken. However, it appears that the results attained here are in conflict with the ones attained by Weinstein et al. who seem to suggest that autonomy-support was expressed with slower speech rate (Weinstein et al. 2018, 898). The results of this study point to opposite direction.

Taking a closer look at the results of Weinstein et al. reveals that the mismatch is only apparent and probably due to their way of defining and measuring speech rate as duration per syllable. As was mentioned above, measuring speech rate this way produces what might be called reversed results and it appears that this has created some confusion. For example, while referring to the results of their study-2 Weinstein et al. write that the sentences perceived as more pressuring and less supporting of choice were "spoken more quickly" whereas at a later point they seem to contradict this earlier statement by writing that they were characterized by "slower speaking rate" instead (Weinstein et al. 2018, 903; 907).

It appears then that at times Weinstein et al. equate higher speech rate with faster speech or lower speech rate with slower speech, which are both incorrect due to the definition of speech rate adopted by them. Because they are measuring speech rate as duration per syllable, lower value for the speech rate actually means faster speech and vice versa. What they have demonstrated is that the value of speech rate is lower in autonomy-supportive sentences and that listeners perceived sentences which had a higher value for speech rate as more pressuring and less supportive of choice (Weinstein et al. 2018, 901–905). However, as the value for speech rate in this case refers to duration per syllable, the conclusion should be that the pace of the speech in autonomy-supportive sentences is actually faster than in controlling sentences. The less time one spends on a syllable, the more syllables one can produce in a given timeframe. Based on their results, it would seem then that it is the slower speech that is perceived as more pressuring and less supporting, not the other way around.

The mismatch between the results of this study and those attained by Weinstein et al. seems to be only apparent then. It has more to do with the way Weinstein et al. discuss and report their results rather than what their results seem to suggest. It appears then that both the results attained here and those attained by Weinstein et al. suggest that autonomy-supportive messages are spoken more quickly than controlling, or, controlling messages more slowly than autonomy-supportive. Whether this difference is more aptly described as controlling messages being spoken more slowly or autonomy-supportive messages spoken more quickly seems to depend on the relationship of these two message types to some third criterion. This criterion could be motivationally neutral messages. It could be

that the speech rate of motivationally neutral messages would fall between the speech rates of autonomy-supportive and controlling messages, but it might also be that it would be closer to one than the other. This is something that future research could aim to look for. In any case, the fact that there seems to be a difference between the autonomy-supportive and controlling message types already has implications for both research and practice.

6.3 Implications of the results

Together with the work done by Weinstein et al. (2018), the results attained here suggests that studying the prosody of motivational communication is an interesting and meaningful new avenue of research. Pursuing to answer questions about the role of prosody in motivational communication can provide important insights to complement the existing work related to motivational communication by bringing attention to the way certain message is being communicated. We know a lot about the kind of language that facilitates either perceptions of autonomy-support or control (e.g. Sarrazin et al. 2006; Standage, Gillison & Treasure, 2007; Reeve & Jang 2006; Reeve, Bolt, & Cai 1999) but little is known about the effects of the way this language is being communicated.

As was demonstrated by Weinstein et al., the lexical-semantic content of the message is not the only thing that counts as people seem to be able to pick up motivationally relevant meanings even in semantically neutral sentences spoken in autonomy-supportive or controlling way (Weinstein et al. 2018). An interesting question would be, for example, how do people perceive messages that are autonomy-supportive or controlling by their verbal or lexical-semantic content but are expressed with prosodic patterns of the opposing style. That is, if an incongruence is created between the verbal or lexical-semantic content of the motivational message and the way in which it is said, how do people interpret the message? Which is the primary source used to infer motivationally relevant meaning – the content, the prosody or some other nonverbal features? Or, are they all equally important? However, answering these kinds of questions becomes

possible only after the role of prosody and other nonverbal aspects in motivational communication is more thoroughly understood.

The practical applications of this study are perhaps more limited in scope. Although the effect size attained here for the difference in articulation rate was large at $d = 0.89$ (Cohen 1988, 24–27), the unit of measurement was syllables per second. Hence, the measured difference between articulation rates of different types of messages seems rather small in practical terms as it was less than one syllable per second ($M_{auto} - M_{control} = 0.82$syl/s). As speaking is highly automatized activity, it seems questionable whether differences of this size are always controllable or even noticeable from the point of view of the speaker. To get an idea about the timeframe of the measured difference, we can convert the measured syllable per second-values to duration per syllable-values by dividing 1 by the measured articulation rate (for autonomy-supportive: 1/7.19 = 0.139s/syl, for controlling: 1/6.37 = 0.156s/syl). Based on this conversion, we can see that, on average, the time taken to produce a single syllable is quite small and hence the difference between the two types of messages is bound to be small as well. However, in longer speech segments the syllable count is naturally higher and the higher the syllable count, the more prominent the difference between speech rates becomes.

Also, even if the difference between speech rates in autonomy-supportive and controlling messages would be too small to be something that can be monitored consciously while speaking, demonstrating that a difference exists is not inconsequential. Even if one would not be able to monitor one's speech rate directly or meaningfully while talking, it might be, that the cause of slower speech rate in controlling messages is due to some other factor that can, in turn, be monitored consciously. For example, it is suggested by Weinstein et al. that the prosodic characteristics of the controlling speech might be linked to emphasizing the message or to physiological arousal accompanying controlling behavior that might influence the physiological systems related to speech production (Weinstein et al. 2018, 908). Although the variation in the speech rate in itself would be beyond conscious monitoring and control, the wider activity or situation, such as emphasizing or the level of physiological arousal, might not be. Becoming cognizant of the fact that one might actually be speaking differently in some situations and that these differences might be motivationally relevant is an important step in understanding motivational

communication. And of course, although the measured difference here was rather small in practical terms, it is certainly not the case that we have no conscious control over the rate at which we are speaking. It seems possible to produce a different speech rate by, for example, reading this sentence aloud first slowly and then quickly.

It should also be kept in mind that although speech rate was at the center of focus here, it is only one among several prosodic characteristics that could be relevant in motivational communication. It is unlikely that speech rate alone could determine whether a certain message is perceived as autonomy-supportive or controlling. For example, in addition to speech rate, Weinstein et al. discovered intensity or amplitude and distribution of energy in the sound spectrum to be connected with the message type (Weinstein et al. 2018). To further complicate matters, it also seems possible that both the levels and the variations of the prosodic properties within messages might play a role in the communication process (see Knapp & Hall 2010, 367–372). That is, variations of prosodic properties contained in the message might have some implications relevant for motivational communication that are not directly related to the levels of those properties but to the way in which they vary. It is more likely then, that speech rate operates in tandem with several other prosodic characteristics in producing tones that are interpreted as autonomy-supportive or controlling by the receiver.

Naturally, speech and prosody also serve many other functions than communicating autonomy-support or control. Prosodic characteristics of speech have been examined, for example, in relation to expression of emotion (Banse & Scherer 1996; Laukka, Juslin & Bresin 2005; Scherer 2003), establishing authority (Ko, Sadler & Galinsky 2015) and sarcasm (Cheang & Pell 2008). Some of the characteristics of speech related to other functions might overlap with communicating autonomy-support or control. For example, it seems possible that the emotional state of the teacher influences not only the properties of his/her speech but also the inclination towards autonomy-support or control (Soenens, Sierens, Vansteenkiste, Dochy & Goossens 2012). It might be then that the certain kind of prosody is simply a function of some factors internal to the speaker. Either way, analyzing the prosody provides a way of characterizing and measuring the changes in the speech that can accompany motivationally relevant communication. As such, prosody might be one answer to the question of why communication that is intended as autonomy-

supportive is not perceived as such by the receiver and hence it deserves a place among the research and practice related to motivational communication.

6.4 Motivational communication in educational contexts

Educational context provides an interesting opportunity to examine motivational communication. Not only is motivating students one of the aims of the educational activity, the teacher-student interaction also carries with it a ready-made hierarchical structure which might allow the teachers to express themselves more clearly and uninhibitedly. It can be expected then, that due to these contextual factors, the prosodic characteristics of motivational communication should be readily detectable, if they exist. Here the results suggested that autonomy-supportive messages were spoken faster than controlling.

However, as the data for this study is collected solely from physical education lessons, the extent to which these results are generalizable to other contexts is unclear. Some indication about the existence of a general trend of autonomy-supportive sentences to be spoken more quickly is the fact that similar results were also obtained by Weinstein et al. (2018). Still, it might be that it is precisely the contextual factors, that allow for the prosodic characteristics of motivational communication to be readily present in educational context, that are also causing the results to remain specific to similar contexts. For example, it might be that autonomy-support and control is expressed differently in horizontal relationships than in vertical ones. To allow for more general inferences to be made about the way of motivational communication, future research could aim to look for differences in prosody between the two types of messages from varied real-life situations and contexts.

6.5 Limitations

There are three main sources of limitation in this study. The first is the threshold-based definition of disfluency used to analyse articulation rate. Here the threshold of 250ms was used as it seemed best suited for the data. However, it is not clear whether this kind of unconditional threshold-based exclusion of discontinuities of the speech is the best way to analyze the speech rate of motivational communication. Although some discontinuities, such as stuttering, might be clear examples of disfluency, some discontinuities, such as pauses and silences, might actually be understood as meaningful parts of the nonverbal communication (Knapp & Hall 2010, 5–17). They may serve communicational functions, some of which might also be relevant in motivational communication. It is then a legitimate question, whether some pauses exceeding the threshold should be counted in the resulting speech rate value as they may be considered as essential pieces of the message being communicated. Answering this would require a more thorough analysis about the role and nature of the pauses and silences in communication in general, and hence the decision was made here to use a simple threshold-based exclusion strategy to identify certain discontinuities of the speech as disfluencies. However, it remains and interesting question, whether pauses within speech have some role in motivational communication. For example, if the controlling messages are partly due to the need to emphasize something, it seems plausible that they might contain fewer pauses than autonomy-supportive messages.

The second main source of limitation is related to the nature of the data used in the study. When working with data derived from real-life interaction context, the researcher has no control over the characteristics or content of the messages that gets included in the recordings. As the utterances, sentences and messages are bound to be very diverse, it should be critically examined whether the messages of very different kind, e.g. long and short or a question and a statement, can be meaningfully compared to one another. However, at the same time, the diversity can also be considered as strength of the data derived from real-life interaction. For example, in this study the content and length of the measured messages was very varied in both conditions and yet a significant difference emerged between the two types of messages in their articulation rate. One possible explanation for this is that autonomy-supportive and controlling messages are in fact

expressed differently and this style of expression is carried over regardless of other properties of the messages. Also, as real-life interaction is quite fluid and dynamic by nature, it can be considered that the diversity of the data is partially a function of its authenticity. However, although the diversity of content might turn out to be a strength instead of a weakness, the question of diversity was not thoroughly addressed here. Hence the diversity of content should be looked as a potential weakness of the study.

The third limitation is related to the method used in selecting the material to be examined. The independent observers used in this study were students of sport and exercise psychology so they can be considered as expert-raters. As experts, they might be more sensitive to some aspects of communication than the average person might be. In other words, they might have a clearer idea about what to look for which might result in overly enthusiastic categorizations. However, the opposite might also be the case. The beneficial effects of autonomous motivation and autonomy-supportive communication as well as the detrimental effects of controlling motivation and controlling communication are constantly being implicated by research (e.g. Behzadnia, Adachi, Deci, Mohammadzadeh 2018; Hein, Koka & Hagger 2015; Vansteenkiste & Ryan 2013). This might result, perhaps perfectly justifiably, in autonomy-supportive communication style having some normative force over the controlling communication style. However, this might also lead to some reluctance to categorize messages as controlling – a point raised by one of the raters.

Categorizing a message as controlling might be interpreted as a critique against the teacher by the expert-raters who are familiar with the wider framework and implications of the two communication styles. Hence, it might be that the categorization threshold is looser for autonomy-supportive messages and stricter for controlling messages, possibly leading to inclusion of some neutral messages as autonomy-supportive and inclusion of some controlling messages as neutral messages. On the other hand, it might be that due to their background knowledge, the expert categorizations are actually more accurate. It would be interesting to see what kind of Cohen's κ-values could be derived from comparing the ratings of instructed layman and experts. And, how these ratings would match with the perceptions of those who are at the receiving end (i.e. students in this case) of the motivational communication.

It also turned out to be rather challenging to categorize messages either as autonomy-supportive or controlling in the pre-selection phase as there were not that many messages that clearly fitted or fulfilled the inclusion criterion articulated in the PETALS-observation tool. Including the independent observers acted here as way of controlling for, possibly quite considerable, subjective bias inherent in the pre-selection phase. The demand of full agreement for the inclusion in the final analysis, on the other hand, acted as a control for subjective bias caused by individual raters. What is left uncontrolled for in this study then is the possible bias resulting from what might be called the expert-status of the raters. Also, the perceptions of those at the receiving end of the communication were not examined here. In other words, it was not tested here whether the messages that were categorized as autonomy-supportive or controlling were also perceived as such by the students of the teachers expressing the messages.

6.6 Suggestions for future research

I have mentioned some general questions and suggestions in the chapters above. Here I will focus mainly on what could be done with the data that is collected during the main phase of the PETALS-study. It seems that the PETALS provides an interesting opportunity to examine the prosody of motivational communication which should not be left unutilized. During the main phase of PETALS, numerous physical education lessons from several teachers are audio recorded and analyzed (Polet et al. 2019). As one of the purposes of analysis in PETALS is to identify and code teacher-sent messages into autonomy-supportive and controlling categories, the PETALS is likely to result in a large pool of real-life messages categorized either as autonomy-supportive or controlling. This offers interesting possibilities for analyzing the prosody of motivational communication. For example, the categorized messages could be compared to each other, as was done here with speech rate, on several prosodic indicators to see if significant differences emerge between the two message types.

Also, as PETALS is an intervention study consisting of several waves of data collection, it will result in several recordings gathered from the same teachers throughout the

schoolyear from different contents of teaching. It could be examined then, for example, do the prosodic properties of teacher-sent messages stay the same on a within-teacher level or do they vary across different timepoints. As there are several recordings gathered from many individual teachers, the PETALS-data could also allow for examining the individual differences that might exist in motivational communication and, as a result, to allow for inferences about the possible general characteristics of motivational communication to be made. Of special interest is of course the role or the effect of the intervention inherent in PETALS might have on motivational communication. For example, on a within-person level, the possible changes in the prosody prior- and post-intervention could be examined.

Although PETALS has great potential for studying the prosody of motivational communication, there are some possible problems as well. It might be that the quality of the recordings rules out reliably measuring some prosodic characteristics. A balance should be then struck between what can be looked for and what is likely to be motivationally meaningful. There are surely many measures that are resistant to poorer data quality that could nevertheless be interesting in terms of motivational communication. Along with the speech rate that was examined here, for example pitch variability and emphasis could be interesting options. In general, PETALS would seem to provide a rather large and ready-made set of real-life messages categorized as autonomy-supportive and controlling that could be used to examine the prosodic properties of the two message types. As such it provides an excellent opportunity to further our understanding of motivational communication.

6.7 Conclusion

The results obtained here suggest that autonomy-supportive and controlling messages spoken by physical education teachers differ in terms of their speech rate. The rate of the actual speech activity measured with articulation rate appears to be faster in autonomy-supportive messages, or, slower in controlling messages. By excluding the time spent on disfluency, the articulation rate appears to be a better measure than the

overall speech rate for data collected from real-life contexts. Real-life interaction contains many pauses, hesitations, stuttering and other discontinuities, which might have a disrupting effect in the analysis, especially, if they are not distributed equally across messages. However, focusing on the articulation rate has the unwanted effect of concealing the possible role pauses and silences have in motivational communication. Yet, it appears that regardless of the role of pauses and silences, the pace of the actual speech activity is faster in autonomy-supportive messages or slower in controlling messages, which is an interesting discovery on its own. The main significance of the results attained here is then to further justify the claim that the differences between autonomy-support and controlling messages are not just limited to their lexical-semantic or verbal content. That is, being autonomy-supportive seems to require more than just replacing “should” with “may” or “must” with “can”. As the results attained here suggests, there is more to autonomy-supportive and controlling communication than the choice of words and hence further attention should be given to the way motivational messages are being communicated.

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APPENDIXES

APPENDIX A. Preliminary version of the PETALS-observation tool.

Type of verbal interaction	Definition		
A. Instructions, leading questions and answers			
Verbal communication related to organizational, technical and tactical instructions (statements, questions, answers, commands etc.)			
A.1. Autonomy-supportive	a) Expressions that communicate choice b) Expressions that take into consideration students' interests, problems, values, wishes etc. (expressions that express interest towards students' opinion or point of view). c) Expressions that encourage students' initiative, independent problem-solving, reflection and action d) Attributing positive characteristics to students		
A.3. Controlling	a) Expressions that communicate lack of choice (i.e. expressions communicating that students "must" or "have to" do something) b) Expressions that communicate hurry or lack of time c) Providing answers to questions before students are given a chance to consider the answer themselves		

B. Praise and Encouragement			
Verbal communication aiming to provide students praise and encouragement, both on outcome and procedure			
B.1. Autonomy-supportive	a) Acknowledging students effort or skills by providing informative feedback b) Praise or encouragement that increases or maintains students' commitment and effort		
B.3. Controlling	a) Conditional approval and praise of students' actions or attributing negative characteristics to students' (ignoring students' autonomy or opinion) b) Giving praise for obedience or encouraging obedience		
C. Dealing with misbehaviors			
Verbal communication aiming to deal with discipline (on or off task related)			
C.1. Autonomy-supportive	a) Expressions that indicate taking students' opinion or point of view into consideration (including acknowledging negative emotions) b) Expressions that indicate understanding (not the same as approval) of misconduct or motivational problems		

C.3. Controlling	a) Orders and bans b) Expressions that emphasize lack of effort of the students' c) Insulting comments d) Expressions where the disobedience towards teachers' orders is condemned e) Saying the student's name as a means of maintaining discipline (e.g. to get the student to stop doing something)		
D. Links with Out of school physical activity			
Verbal communication aiming to explicitly highlight the links between PE class and out of school PA			
D.1. Autonomy-supportive	a) Expressions that aim to explain how the things taught in physical education can be used in out-of-school contexts		
E. Provision of explanatory rationales			
Verbal communication aiming to provide rationales			
E.1. Autonomy-supportive	a) Expressions that aim to explain why a certain activity can be beneficial and worth doing or trying b) Answering students' questions by giving rationales for why things are being done the way they are		

APPENDIX B. Examples of autonomy-supportive and controlling messages from the final sample.

Autonomy-supportive	**Controlling**
“Tuntuuks siltä, että jos tosta tipahtaa, ni ois kiva et siel ois matto alla” ”Does it feel like, if you drop from here, that it would be nice to have a mattress underneath?”	“Nytte hei hereillä koko ajan hei ni ei tarvi heti tulla vaihtoon” ”Hey now, stay alert all the time so you don’t have to come back to the bench right away”
”Miettikää teiän oman joukkueen ehdotus mikä ois seuraava laji” ”You can think of a suggestion with your team, what would be the next sport?”	”Ja hei viisloikka, nyt osa kyselee teistä vaikka on tehty jo ne viis kertaa” ”And hey, five-jump, now some of you are asking although we have already done this five times”