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IMPROVING PHYSICAL ACTIVITY PROMOTION AND SPORTS PROFESSIONALS' MOTIVATING STYLES

Exploring the effects and processes of the MotiStyleSport intervention during the feasibility phase of intervention development

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ABSTRACT

Katarina Kohonen: Improving physical activity promotion and sports professionals' motivating styles: Exploring the effects and processes of the MotiStyleSport intervention during the feasibility phase of intervention development
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Physical activity (PA) and sports engagement have many individual- and societal-level benefits, but in many countries engagement in them does not meet public guidelines, raising public health concerns. According to vast research on Self-Determination Theory, PA and sports behaviour can be improved by PA promotion and sports professionals' use of interaction styles that support the basic psychological needs for autonomy, competence, and relatedness. Need-supportive motivating styles (i.e., autonomy supportive and structuring style) foster autonomous motivation and well-being among students, athletes, and patients, whereas need-thwarting demotivating styles (i.e., controlling and chaotic style) increase controlled motivation and illbeing. Multiple interventions have been developed to help professionals improve their interaction practices, but meta-analyses and reviews suggest that they have on average failed to reach optimal, long-term changes. Thus, there is a need for research on how to effectively improve motivating interaction. The MotiStyleSport intervention was developed to improve PA promotion and sports professionals' motivating styles, incorporating novel aspects from the field of behaviour change science to improve its long-term effects.

The purpose of this study was to explore the effects and processes of the MotiStyleSport intervention in improving professionals' motivating styles during the feasibility phase of its development. The first research question concerned whether there were changes to participants' self-reported (de)motivating styles and to what direction. The second research question looked at whether effects of the intervention differed between professional groups. The third research question focused on whether making and enacting implementation intentions to break or form habits and participants' quality of motivation toward using motivating styles predicted changes to motivating styles.

The data consisted of quantitative questionnaire data gathered before intervention and 12 weeks after baseline. 145 participants took part in the intervention, but due to missing post-training data, 87 participants were included in the present study. Participants were Physical Education (PE) teachers (n = 22), sports coaches (n = 20), and healthcare professionals (HCPs; i.e., physiotherapists, PA counsellors, health nurses; n = 45). Participants' (de)motivating styles were measured with validated self-report vignette questionnaires. Other measurements included participants' post-training quality of motivation toward using motivating styles and making and enacting implementation intentions. Paired-samples t-tests, mixed ANOVA, and standard multiple regression analyses were used to answer the research questions.

Results showed that on average, participants' motivating styles increased and demotivating styles decreased, although changes to structuring style were not statistically significant. These effects of time were found regardless of participants' profession. Profession showed a main effect in controlling and chaotic styles, where HCPs consistently scored higher on chaotic style than others, and PE teachers had significantly higher scores for controlling style than HCPs. For controlling style, a significant interaction effect of time and profession was found, where coaches' use of controlling style decreased more during the intervention than other professionals'. Regression analyses showed that participants' autonomous motivation toward using motivating styles predicted changes in autonomy supportive style, but controlled motivation and implementation intentions did not. No significant relationships were found between structuring style and other variables in the regression analysis.

The results of this study suggest that the MotiStyleSport intervention can be effective in improving different professionals' motivating styles, although focus in developing the intervention should be placed on improving participants' structuring style. The effect sizes attained from this study can be used to inform future randomised controlled trial studies. Due to the research design of this study, such robust experimental research designs and follow-up measurements are needed to make more valid claims on the effects of the intervention. Additionally, future studies could benefit from looking more closely at determinants of (de)motivating styles and their subareas, as well as the influence of professional background and the use of multiple behaviour change techniques. Future interventions may also benefit from supporting participants' autonomous motivation toward target behaviours. Overall, this study indicates that the MotiStyleSport intervention offers a promising avenue for research and features of this intervention may be applicable to other fields as well.

Key words: Self-Determination theory, motivating interaction, physical activity, sports

Tampereen yliopisto

TIIVISTELMÄ

Katarina Kohonen: Fyysisen aktiivisuuden edistämisen ja urheilun ammattilaisten motivoivien vuorovaikutustyylien kehittäminen: tutkimus MotiStyleSport-intervention vaikutuksista ja prosesseista toteutettavuustutkimusvaiheessa
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Fyysisellä aktiivisuudella ja urheilulla on monia yksilö- ja yhteiskuntatason hyötyjä. Tästä huolimatta useissa maissa fyysisen aktiivisuuden ja liikunnan taso ei vastaa suosituksia, mikä uhkaa kansanterveyttä. Itsemääräämisteoriaan pohjautuvan tutkimuksen mukaan fyysistä aktiivisuutta ja liikuntaa voidaan lisätä liikunnan alan ammattilaisten käyttämien vuorovaikutustyylien kautta, jotka tukevat autonomian, pätevyyden ja yhteenkuuluvuuden psykologisia perustarpeita. Tarpeita tukevat motivoivat tyylit (autonomian tuen ja rakenteen tyylit) vahvistavat urheilijoiden, opiskelijoiden ja potilaiden autonomista motivaatiota ja hyvinvointia, kun taas tarpeita turhauttavat epämotivoivat tyylit (kontrollin ja kaaoksen tyylit) lisäävät kontrolloitua motivaatiota ja pahoinvointia. Monia interventioita on kehitetty ammattilaisten vuorovaikutuskäyttäytymisen kehittämiseksi, mutta meta-analyysit ja systemaattiset katsaukset osoittavat, etteivät ne ole keskimäärin onnistuneet tuottamaan optimaalisia, pitkäkestoisia muutoksia. Tämän takia on tarve sen tutkimukselle, miten motivoivia vuorovaikutustyylejä voitaisiin tehokkaasti parantaa. MotiStyleSport-interventio luotiin fyysisen aktiivisuuden edistämisen ja urheilualan ammattilaisten vuorovaikutustyylien kehittämiseksi ja sen kehityksessä huomioitiin uusia näkökulmia käyttäytymismuutostieteen alalta.

Tämän tutkimuksen tarkoituksena oli tarkastella MotiStyleSport-intervention vaikutuksia ja prosesseja ammattilaisten vuorovaikutustyylien parantamiseksi intervention kehityksen toteutettavuustutkimusvaiheessa. Ensimmäinen tutkimuskysymys koski sitä, ilmenikö osallistujien itseraportoimissa (epä)motivoivissa tyyleissä muutoksi, ja millaisia nämä muutokset olivat. Toinen tutkimuskysymys koski sitä, oliko ammattiryhmien välillä eroja intervention vaikutuksissa. Kolmas tutkimuskysymys tarkasteli sitä, selittivätkö kun-niin suunnitelmien teko ja osallistujien motivaatio tarpeita tukevien tyylien käyttöä kohtaan muutoksia vuorovaikutustyyleissä.

Aineisto koostui kvantitatiivisesta kyselyaineistosta, joka kerättiin ennen interventiota ja 12 viikkoa myöhemmin. Koulutuksessa oli 145 osallistujaa, mutta puuttuvien koulutuksen jälkeisten vastausten takia 87 osallistujaa sisällytettiin tähän tutkimukseen. Osallistujat olivat liikunnanopettajia (n = 22), urheiluvalmentajia (n = 20) ja terveydenhuollon ammattilaisia (fysioterapeutteja, liikuntaneuvojia ja terveydenhoitajia; n = 45). Osallistujien (epä)motivoivia tyylejä mitattiin validoiduilla itseraportointi vinjettikyselyillä. Lisäksi mitattiin osallistujien koulutuksen jälkeistä motivaation laatua motivoivien tyylien käyttöä kohtaan sekä kun-niin suunnitelmien tekoa ja toteutusta. T-testejä parivertailulle, varianssianalyysia ja usean muuttujan regressioanalyysiä käytettiin tutkimuskysymyksiin vastaamiseksi.

Tulokset osoittivat, että keskimäärin osallistujien motivoivat tyylit vahvistuivat ja epämotivoivat tyylit heikentyivät, mutta muutokset rakenteen tyyliin eivät olleet tilastollisesti merkittäviä. Nämä ajan vaikutukset ilmenivät riippumatta osallistujien ammatista. Ammatilla oli vaikutus kontrolloivaan ja kaoottiseen tyyliin, joissa terveydenhuollon ammattilaisilla oli johdonmukaisesti muita korkeammat pisteet kaoottisessa tyylissä ja liikunnanopettajilla oli terveydenhuollon ammattilaisia merkittävästi korkeammat pisteytykset kontrolloivassa tyylissä. Kontrolloivan tyylin osalta esiintyi myös yhteisvaikutus, jossa valmentajien kontrolloivan tyylin käyttö väheni intervention aikana enemmän kuin muiden ammattilaisten. Regressioanalyysi osoitti, että osallistujien autonominen motivaatio motivoivien tyylien käyttöä kohtaan ennusti muutoksia autonomiaa tukevaan tyyliin, mutta kontrolloitu motivaatio ja kun-niin suunnitelmat eivät. Rakenteen tyylin ja muiden muuttujien välillä ei ilmentynyt merkitseviä yhteyksiä regressioanalyysissä.

Tämän tutkimuksen tulokset viittaavat siihen, että MotiStyleSport-interventio voi olla vaikuttava keino kehittää eri ammattilaisten motivoivia tyylejä, mutta interventiota kehitettäessä tulisi keskittyä etenkin rakenteen tyylin tukemiseen. Tästä tutkimuksesta saatuja efektikokoja voidaan käyttää mahdollisen satunnaistetun kontrolloidun tutkimuksen tekemisessä. Tämän tutkimuksen tutkimusasetelman takia vastaavia luotettavampia kokeellisia tutkimuksia ja seurantamittauksia tarvitaan, jotta voidaan tehdä pätevämpiä johtopäätöksiä intervention vaikutuksista. Lisäksi jatkotutkimuksissa voisi olla hyödyllistä tarkastella tarkemmin (epä)motivoivien tyylien ja niiden osien determinantteja, ammatillisen taustan vaikutusta, sekä eri käyttäytymismuutostekniikoita. Tulevat tutkimukset voivat hyötyä myös osallistujien autonomisen motivaation tukemisesta käytöksen muutoksessa. Kaiken kaikkiaan, tämä tutkimus viittaa siihen, että MotiStyleSport tarjoaa lupaavan suunnan jatkotutkimukselle ja tämän intervention piirteitä voidaan mahdollisesti soveltaa myös muille aloille.

Avainsanat: itsemääräämisteoria, vuorovaikutuskoulutus, fyysinen aktiivisuus, urheilu

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1. Introduction

The positive associations between physical activity (PA), sports, and health have been known for millennia, and contemporary research has continued to highlight the importance of PA for individuals' health throughout their lifespan (Haskell et al., 2009; Kokkinos & Myers, 2010). For instance, regular PA and high fitness levels are associated with decreased risk of premature death and reduction of many chronic diseases, like cardiovascular disease, breast and colon cancer, and type 2 diabetes, as well as improved psychological well-being (Warburton et al., 2006). Despite the well-known benefits of adequate PA, according to a 2018 report by the World Health Organization (WHO), globally 23 % of adults and 81 % of adolescents do not meet the WHO global guidelines on PA for health, and in some adult subpopulations inactivity can reach even 80 % (World Health Organization, 2018). WHO states that inadequate PA levels contribute negatively to health systems, economic development, the environment, community well-being, and quality of life, highlighting the importance of improving PA engagement globally (World Health Organization, 2018). In Finland, a report published by the Finnish Ministry of Education and Culture concluded that Finnish adults (18 – 64-year-olds) do not move enough and most of peoples' waking time is sedentary (Husu et al., 2022). Similarly, a study by Kokko and Martin (2019) showed that among Finnish children (7 – 15-year-olds) only a third meets international guidelines for PA. One reason for this might be that PA and sports require motivation, which has been linked to frequency and duration of PA (Gray et al., 2018; Raabe et al., 2019). As such, public health programmes and methods for improving individuals' motivation towards PA and sports can have an important individual- and societal level impact.

One avenue for improving individuals' PA and sports behaviour is through guidance and help offered by PA promotion and sports professionals, such as Physical Education (PE) teachers, sports coaches, and public health professionals (e.g., Gillet et al., 2010; Hsu et al., 2013; Matosic et al., 2016; Ntoumanis & Standage, 2009). In addition to offering information and guidance for improving PA behaviours, professionals can influence their patients, students, and athletes by supporting their motivation towards sports (e.g., Ntoumanis, 2001). Research across multiple fields has shown that the way how professionals interact with others influences relevant professional outcomes, such as students' learning outcomes (e.g., Aelterman et al., 2019; Vansteenkiste et al., 2009), patient wellbeing (e.g., Ng et al., 2012), and employee work performance and organisational well-being (Slemp et al., 2018). Within the field of sports and PA

promotion, professionals' interaction styles and behaviours have been found to improve for example individuals' PA levels and athletes' engagement, performance, and well-being (Hsu et al., 2013; Ntoumanis & Mallett, 2014). As such, many interventions for improving professionals' interaction styles have been developed (e.g., Keogh et al., 2018; Renko et al., 2022). However, meta-analyses have shown that despite receiving comprehensive interaction training, many professionals do not reach optimal interaction styles (Hall et al., 2016; Schwalbe et al., 2014). Thus, research into how to effectively improve PA promotion and sports professionals' interaction styles is needed.

This study examines results on the effects and processes of the MotiStyleSport intervention in improving PA promotion and sports professionals' motivating styles during the feasibility phase of intervention development. First, theoretical background and previous literature on motivating interaction styles, behaviour change science, and the MotiStyleSport training intervention are discussed in Section 2. After this, research questions and hypotheses are introduced in Section 3, followed by Section 4 outlining the methods used. Results are shown in Section 5 and further discussed in Section 6, before highlighting the limitations, strengths, and implications of this study.

2. Theoretical background and previous research

2.1 Self-Determination Theory

Many theories of human behaviour and motivation have been developed within the multidisciplinary field of behaviour change science (Hagger, Cameron, et al., 2020). One of the most researched theories is Ryan and Deci's Self-Determination Theory (SDT; 2000), which is a broad theory of motivation, personality development, and well-being (Ryan & Deci, 2019). SDT is a meta-theory, consisting of six mini-theories: cognitive evaluation theory, organismic integration theory, causality orientations theory, basic psychological needs theory, goal contents theory, and relationship motivation theory (see Ryan & Deci, 2019 for detailed description of each). According to Ryan and Deci's (2019) overview of the history and future of SDT, these mini-theories and other related models and theories are overlapping and continuously developing through new empirical results. Overall, the main tenet of SDT is the notion that humans have three basic psychological needs on which motivation and flourishing of the human potential is based (Deci & Ryan, 2000; Hagger, Hankonen, et al., 2020).

2.1.1 Basic psychological needs and quality of motivation

According to Deci and Ryan (2000), individuals' integrity, psychological growth, and well-being requires that their psychological basic needs for competence, autonomy, and relatedness are satisfied. The need for competence has been defined as the "need to feel effectance, control, and mastery over tasks and behaviours" (Hagger, Hankonen, et al., 2020, p.108), whereas autonomy is the "need to feel that one is the 'origin' of one's actions" (p.108). The need for relatedness has been defined as "the need for noncontingent, unconditional support and connectedness with others" (p.108).

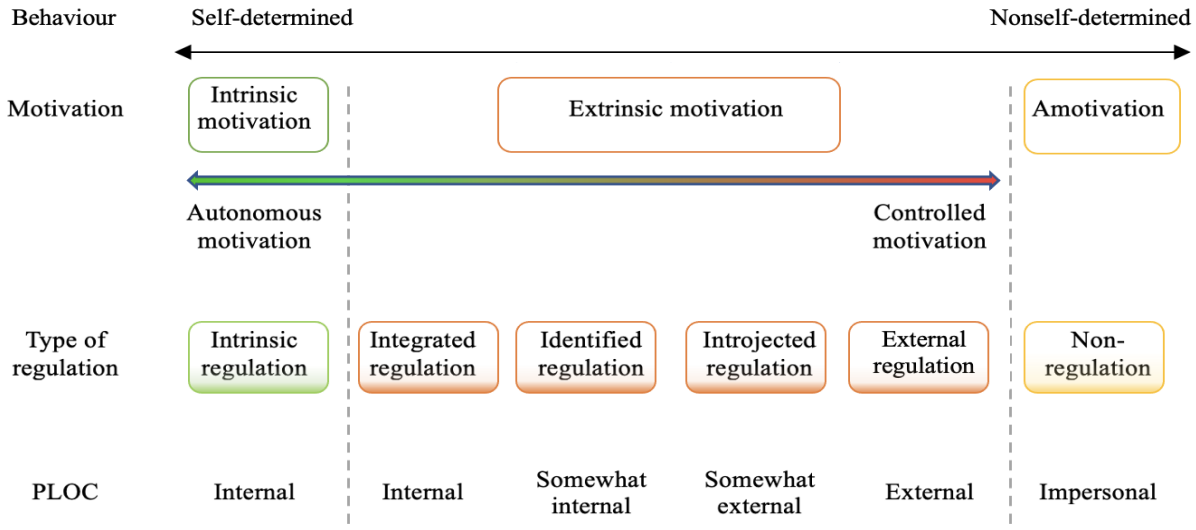
SDT suggests that at its core, human nature is not fully malleable, but instead has a deep, universal structure that includes the needs for autonomy, competence, and relatedness (Ryan & Deci, 2019). The universal nature and existence of these three needs has been explained via their evolutionary benefits (Deci & Ryan, 2000). According to Deci and Ryan (2000), the need for competence has been evolutionarily adaptive to humans because being interested, open, and willing to learn helps organisms to grow and adapt to new challenges in changing contexts. The

need for relatedness reflects the social nature of human beings and has adaptive benefits for coordination of group behaviour, specialisation of labour, and cohesive social organisation (Deci & Ryan, 2000). The need for autonomy supports self-regulation of behaviour and coherence in behavioural aims: to function effectively in changing contexts, it is beneficial to regulate one's own actions instead of being just pushed to action by external coercion (Deci & Ryan, 2000). I

Whereas other theories of motivation have focused on quantity of motivation (i.e., how motivated an individual is), SDT focuses on quality of motivation (Hagger, Hankonen, et al., 2020). According to SDT, the satisfaction of the needs for autonomy, competence, and relatedness supports intrinsic motivation, which means doing things for the inherent satisfaction of the action itself (Ryan & Deci, 2000). Thwarting these needs is linked to extrinsic motivation, which means doing things to attain separable outcomes (Ryan & Deci, 2000). In addition to intrinsic and extrinsic motivation, SDT includes amotivation, which refers to "the state of lacking intention to act" (Ryan & Deci, 2000,p. 72). Beyond amotivation, SDT states that motivation forms a continuum from extrinsic to intrinsic motivation, consisting of five distinct regulatory styles: external, introjected, identified, integrated, and intrinsic regulation (see Figure 1).

Figure 1.

The Self-Determination Continuum, based on Hagger, Hankonen et al., 2020; Ryan & Deci, 2000.



According to Ryan and Deci (2000), each regulatory style is associated with differing perceived locus of causality, relevant self-regulatory processes, and related outcomes. Perceived locus of

causality (PLOC) refers to the extent to which a person feels like they are the origin of their behaviour (Deci & Ryan, 2000). Internal PLOC means that the behaviour is seen to originate from oneself, whereas external PLOC means that the behaviour is felt to originate from outside forces, such as threats or rewards (Deci & Ryan, 2000). Internal PLOC highlights personal causation, thus supporting individuals' need for autonomy, whereas external PLOC thwarts the need for autonomy (Deci & Ryan, 2000; Hagger, Hankonen, et al., 2020). As seen from Figure 1, types of motivation and regulation vary in their PLOC, so that some are more autonomously motivated (i.e., support the need for autonomy) and others reflect more controlled motivation (i.e., thwart the need for autonomy) (Hagger, Hankonen, et al., 2020). Intrinsic regulation can be seen as the prototype of autonomous motivation, whereas extrinsic regulation is prototypical of controlled motivation (Hagger, Hankonen, et al., 2020).

As seen in Figure 1, externally regulated behaviour is the most controlled form of extrinsic motivation, and it reflects behaviours that are performed to meet external demands, rewards, or to avoid punishments (Ryan & Deci, 2000). These behaviours typically feel controlled and have an external PLOC (Ryan & Deci, 2000). Introjected regulation is also a somewhat controlled form of regulation, where behaviours are carried out to avoid anxiety or guilt or to gain ego enhancements, like pride (Ryan & Deci, 2000). These behaviours are internally driven but still have a somewhat external PLOC, as they are not experienced as reflecting oneself (Ryan & Deci, 2000). Identified regulation is a more self-determined and autonomous form of extrinsically motivated behaviour, as identification reflects consciously valuing a behaviour or regulation, so that the behaviour is seen as personally important and it becomes internalised (Ryan & Deci, 2000). The most autonomous form of extrinsic motivation is integrated regulation, where external regulations and motives have been evaluated, internalised, and integrated into one's other values and needs (Ryan & Deci, 2000). Although these behaviours are extrinsically motivated (i.e., they are done to attain some separable outcome), they are autonomously motivated and have internal PLOC (Ryan & Deci, 2000). Thus, according to SDT external regulations and goals can become self-determined and autonomously motivated via the processes of internalisation and integration, where the behaviours become integrated with one's sense of self (Ryan & Deci, 2000).

SDT posits that maintenance of intrinsically motivated behaviours requires satisfaction of the basic psychological needs (Deci & Ryan, 2000). Intrinsically motivated or self-determined behaviours are not necessarily always directed at satisfying the needs for competence, relatedness,

or autonomy, nor are behaviours which do satisfy these needs always intrinsically motivated (Deci & Ryan, 2000). Nevertheless, conditions that support satisfaction of the basic needs generally facilitate intrinsic and autonomous motivation, whereas conditions that thwart the basic needs lessens them (Deci & Ryan, 2000). Research on SDT has shown that satisfaction of the basic needs, higher intrinsic motivation, and autonomously motivated behaviours are linked to many positive outcomes, such as increased behavioural perseverance, learning, performance, and well-being (Ryan & Deci, 2019). More controlled forms extrinsic motivation and thwarting of basic needs have been linked to negative outcomes, such as poor maintenance of behaviour, self-critical perfectionism, ill-being, and psychopathology (Ryan & Deci, 2019).

Overall, there is vast empirical evidence supporting SDT's claims for the links between basic psychological needs and quality of motivation, across different research fields, professional domains, and cultures (Gillison et al., 2019; Hagger, Hankonen, et al., 2020; Mossman et al., 2022). Central areas where SDT has been applied include healthcare, education, work and organisations, sports and PA, and technology (Ryan & Deci, 2019). For instance, within the field of sports there are thousands of studies supporting the importance of intrinsic motivation for sustained PA and sports practice (Ryan & Deci, 2019).

2.1.2 Quality of motivation in learning and behaviour change

SDT suggests that quality of motivation (i.e., extrinsic or intrinsic, autonomous or controlled) influences important outcomes, such as behavioural perseverance, learning, and performance (Deci & Ryan, 2000). The influence of quality of motivation has been studied extensively in the field of education, where intrinsic motivation and internalisation of values and regulation have been empirically linked to high-quality learning, conceptual understanding, students' personal growth, and better adjustment (Deci et al., 1991). According to Deci and colleagues' 1991 summary of past research on education and SDT, more autonomous and intrinsic forms of motivation support learning via for example improved memory performance, positive emotions in the classroom, enjoyment of learning, and better self-esteem. Controlled and extrinsic forms of motivation on the other hand have been empirically linked with greater anxiety and poor coping with failures, lower interest in learning, and poorer conceptual learning (Deci et al., 1991).

More recent research on this topic includes multiple studies by Vansteenkiste and colleagues (e.g., 2005; 2009; 2010). In their 2005 study Vansteenkiste, Zhou and colleagues looked at the

influence of autonomous and controlled motivation among Chinese learners and found that autonomous motivation predicted adaptive learning attitudes, well-being, and academic success. Controlled motivation was predictive of maladaptive learning attitudes, ill-being, and higher drop-out rates (Vansteenkiste et al., 2005). In a 2009 study Vansteenkiste, Sierens and colleagues studied high-school and college students' motivational profiles. They found that optimal learning patterns were associated with good quality of motivation (i.e., high autonomous and low controlled motivation), which was connected to teachers' need-supportive practices (Vansteenkiste et al., 2009). This study supported the claim of SDT that quality of motivation matters more than its quantity, as students in the good quality motivation group showed the best educational outcomes, even over those who had higher overall amounts of motivation (i.e., high autonomous and high controlled motivation) (Vansteenkiste et al., 2009). Lastly, in their 2010 study Vansteenkiste, Smeets and colleagues looked at the influence of autonomous and controlled motivation for performance-approach goals (i.e., aiming to outperform peers) on educational outcomes. They found that students' reasons for pursuing goals explained their adaptive and maladaptive outcomes (Vansteenkiste et al., 2010). When aiming to outperform others was based on autonomous motivation and seen as an exciting challenge and way to improve oneself, these goals were associated with positive outcomes, such as effective organisation of study time, deeper learning, stronger focus during studying, and greater persistence when facing obstacles (Vansteenkiste et al., 2010). More controlled motivation, where the desire to outperform others was based on experienced pressure, was connected to negative outcomes, such as less effective time-management, more superficial learning, lesser engagement in learning, higher anxiety, and greater likelihood of giving up when facing difficulties (Vansteenkiste et al., 2010).

Overall, these studies suggest that quality of motivation influences important learning outcomes. Although much of earlier research has focused on learning among students and children, learning processes are also central in many behaviour change interventions (e.g., Keogh et al., 2018; Palsola et al., 2023). Thus, fostering autonomous motivation among intervention participants could improve their learning during training programmes. In addition to influencing learning, quality of motivation has been found to influence uptake of new behaviours (e.g., Phillips et al., 2016) and long-term maintenance of behaviour (e.g., Gardner & Lally, 2013; Hopkins et al., 2022). It has been suggested that interventions should promote internalisation of extrinsic motivation and facilitate autonomous forms of regulation to create long-term changes to target behaviours (Gardner & Lally, 2013). Thus, it seems that behaviour change

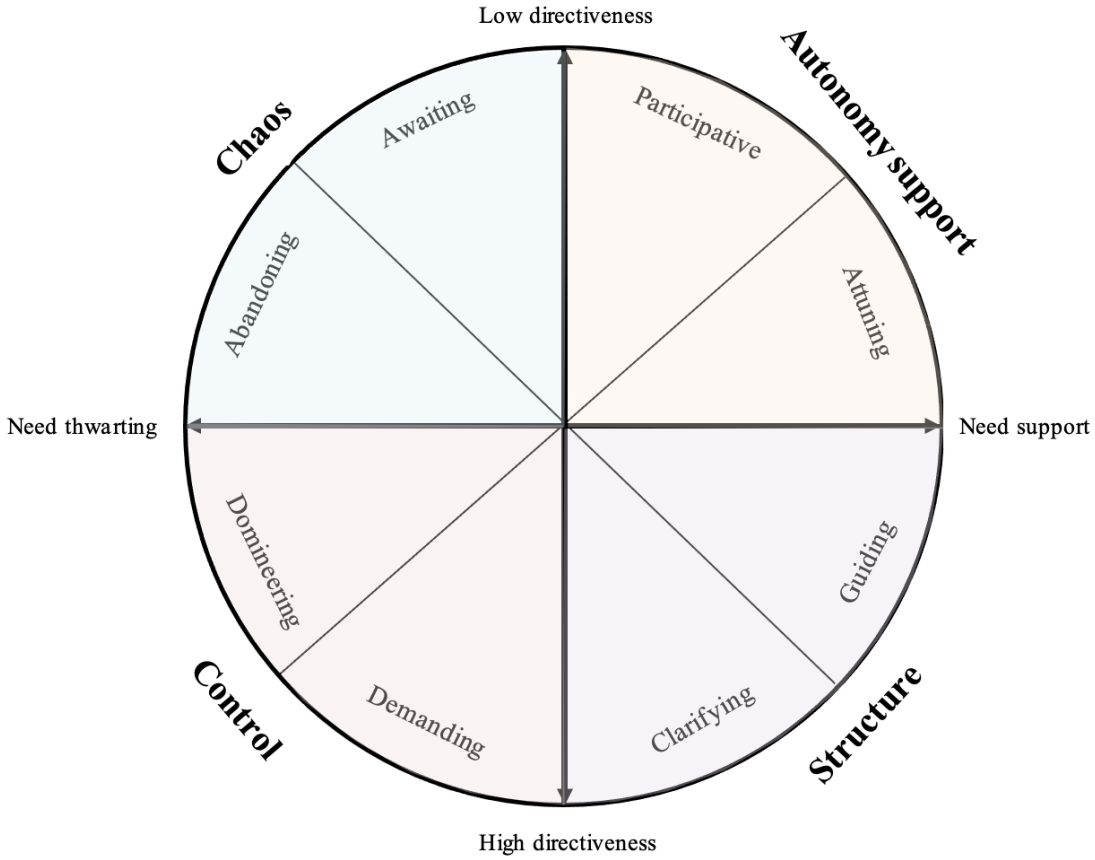
interventions should support participants' autonomous motivation toward change in order to improve learning and behavioural outcomes.

2.1.3 The circumplex model of (de)motivating interaction style

SDT states that environmental factors are central to the processes of internalisation and integration of extrinsically motivated behaviours, as they influence individuals' motivation for performing and maintaining new behaviours (Deci & Ryan, 2000). Social agents can support others' psychological basic needs and autonomous motivation by using need-supportive interaction styles (Hagger, Hankonen, et al., 2020). Interaction practices that support the needs for autonomy, competence, and relatedness have been linked to basic need satisfaction, autonomous motivation, and well-being, whilst need thwarting social environments predict controlled motivation, ill-being, and psychopathology (Aelterman & Vansteenkiste, 2023). In accordance with SDT, Aelterman and colleagues (2019) have developed a circumplex model of (de)motivating interaction style (see Figure 2). In their 2019 study, Aelterman and colleagues studied teachers' motivating interaction styles, which they defined as "practices (teachers) rely on to foster children's motivation" (p. 497). Based on multidimensional scaling analyses, the researchers found that teachers' interaction styles may best be described through a circumplex-model with two axes: directiveness (low or high) and basic need supportiveness (supportive or thwarting). This two-dimensional structure of interaction styles has been identified in multiple other studies and across different settings, such as PE, sports, nursing, parenting, and work (Aelterman & Vansteenkiste, 2023).

Figure 2.

The Circumplex Model of (De)motivating Interaction Style, based on Aelterman et al., 2019.



The circumplex model consists of four overarching (de)motivating interaction styles: autonomy support, structure, control, and chaos (Aelterman et al., 2019). As seen in Figure 2, autonomy supportive style is low in directiveness but supports satisfaction of others' basic needs for autonomy, competence, and relatedness. According to Aelterman and colleagues (2019), autonomy supportive interaction is characterised by having a curious, open, and receptive attitude and using a tone of understanding towards students. Central autonomy supportive interaction practices include offering input and choice, giving meaningful rationales, using inviting language, nurturing curiosity and task interest, and accepting negative affect (Aelterman & Vansteenkiste, 2023). The structuring style is similarly need-supportive, but also high in directiveness, with the teacher's tone focusing on guidance and helping students (Aelterman et al., 2019). Concrete structuring practices include communicating clear expectations, goals, and guidelines, as well as offering help and guidance, adjusting task difficulty, providing positive informational feedback, and expressing confidence in others' capabilities (Aelterman &

Vansteenkiste, 2023). According to Aelterman and Vansteenkiste (2023), structuring and autonomy supportive interaction have generally been shown to positively correlate, so that social agents that use one style, often also use the other. However, structuring practices can also be used in a controlling manner, if for example guidelines are accompanied by threats (Aelterman & Vansteenkiste, 2023). As seen from Figure 2, controlling style is situated opposite to autonomy support in the circumplex model, being high in directiveness but thwarting to others' basic psychological needs (Aelterman et al., 2019). A controlling teacher is characterised as having a tone of pressure and insisting on how students should think, feel, and behave without considering students' feelings (Aelterman et al., 2019). Aelterman and Vansteenkiste (2023) state that controlling social agents, often unconsciously, have a narrow view where their own agenda and expectations are prioritised over others', leading to the use of pressuring interaction techniques, such as yelling, commanding, or using intimidation or appeals to guilt and shame. Lastly, chaotic style is low in directiveness and is need-thwarting (Aelterman et al., 2019). Chaotic interaction practices include inconsistent, arbitrary, and unpredictable behaviour, such as leaving students to their own devices and having a laissez faire -attitude (Aelterman & Vansteenkiste, 2023). Chaotic and controlling styles reflect demotivating interaction, whereas autonomy supportive and structuring styles are motivating in nature (Aelterman et al., 2019).

As seen in Figure 2, the circumplex model identifies eight subareas within the four overarching styles: participative, attuning, guiding, demanding, domineering, abandoning, and awaiting practices (Aelterman et al., 2019). These subareas are based on empirical findings across multiple fields of research (Aelterman et al., 2019; Aelterman & Vansteenkiste, 2023). They correlate with each other so that each subarea correlates positively and most strongly with adjacent subareas, whilst the correlation decreases in strength and becomes negative when moving along the model (Aelterman & Vansteenkiste, 2023). Through these subareas, the circumplex model offers a dynamic and gradual approach to understanding the relationship between different (de)motivating styles (Aelterman & Vansteenkiste, 2023). This means that, for example, different autonomy supportive and structuring interaction practices may have different effects on students' motivation because they are slightly differently located on the two axes (Aelterman et al., 2019). Additionally, the gradual approach suggests that different need-supportive interaction components are not necessarily mutually exclusive, and in reality, social agents may use multiple need-thwarting or need-supportive practices in a single situation or across different settings (Aelterman et al., 2019; Aelterman & Vansteenkiste, 2023). For instance, not using autonomy supportive practices does not automatically imply the use of controlling practices,

but rather social agents may showcase individual interaction profiles, where different elements across the circumplex are utilised based on the situation at hand (Aelterman & Vansteenkiste, 2023). Social agents' (de)motivating styles have been empirically measured with many self-report questionnaires, such as the Situations-In-Schools (SIS) questionnaire developed by Aelterman and colleagues (2019), and other versions of it (e.g., SIS-Sport, Delrue et al., 2019). Other ways for measuring interaction styles include using observers, such as students or trained observers, or observational tools to assess professionals' interaction practices (e.g., Duprez, Haerens, et al., 2021; Su & Reeve, 2011). Due to the novelty of the circumplex model and vignette-based questionnaires based on it (i.e., the SIS-questionnaires), research and intervention studies utilising these constructs is still sparse but offer a promising avenue for research.

2.1.4 Interaction styles in sports and training interventions

Overall, in the field of sports using an autonomy supportive style has been linked to many positive outcomes, like higher intrinsic motivation and better sports performance for athletes (Gillet et al., 2010) and sustained PA and sports behaviours (e.g., Hsu et al., 2013). For instance, a study by Bartholomew and colleagues (2011) examined the role of sports coaches' interpersonal control and thwarting of psychological needs in the development of athletes' ill-being. They found that coaches' autonomy supportive behaviours predicted athletes' need satisfaction, which in turn predicted vitality and positive affect (Bartholomew et al., 2011). Coach control on the other hand predicted athletes' need thwarting, which predicted maladaptive outcomes, such as burnout, depression, disordered eating, negative affect, poorer physiological functioning, and negative physical symptoms (Bartholomew et al., 2011). Overall, there is vast evidence for the claims of SDT holding true in the field of sports (e.g., Mossman et al., 2022; Van den Berghe, Vansteenkiste, et al., 2014). For example, in a systematic literature review Van den Berghe and colleagues (2014) found that many studies within the field of PE have supported the motivational sequence proposed by SDT. Additionally, the benefits of motivating interaction styles in PA and sports seem to be universal, as SDT claims: in a recent systematic literature review and meta-analysis, Mossman and colleagues (2022) assessed the correlations and effects of coaches' autonomy supportive style, basic needs, and well-being across different cultures. Their findings suggest that the relationships between autonomy support and relevant psychological, motivational, and behavioural outcomes are not moderated by culture (i.e., collectivistic or individualistic; Mossman et al., 2022).

In terms of changing professionals' (de)motivating interaction styles, previous interventions have been successful in training professionals to become more autonomy supportive (e.g., Cheon & Reeve, 2013; Raabe et al., 2019). In their 2013 intervention study Cheon and Reeve (2013) used a training programme to improve PE teachers' autonomy supportive style when giving PE instructions to students. Compared to a control group, teachers who had undergone the training were scored by observers and perceived by students as more autonomy supportive and less controlling (Cheon & Reeve, 2013). These changes were long-lasting, as trained teachers were more autonomy supportive still one year after the training (Cheon & Reeve, 2013). Such results are not uncommon, as shown by a review article by Raabe and colleagues (2019), which assessed 21 intervention studies that had aimed to improve PE teachers' and youth sport coaches' autonomy supportive interaction style. Their results showed that significant positive effects were observed in over 77 % of the studies (Raabe et al., 2019). However, the authors concluded that further research into the topic is needed, as heterogenous research designs, small sample sizes (the majority of the studies having on average 18 social agents as participants), and lack of follow-up assessments may limit the generalizability of these findings (Raabe et al., 2019). Additionally, most intervention studies have focused on only one professional group at a time such as sports coaches (e.g., Gillet et al., 2010) or PE teachers (e.g., Van den Berghe, Soenens, et al., 2014). Because of this, little is known of the potential of multiprofessional interventions to improve interaction styles and whether, for example, different professionals benefit from multiprofessional training interventions to different degrees.

In addition to intervention studies in the field of sports, effective motivating interaction interventions have been conducted with health care professionals (HCPs) (e.g., Duprez et al., 2022; Vancampfort & Mugisha, 2022). For instance, in an SDT-based intervention study by Vancampfort and Mugisha (2022) HCPs that had attended a brief 10-hour workshop had higher self-reported use of motivating styles and lower use of demotivating ones 12 months after the training, compared to professionals without training. Their sample consisted of 140 HCPs working in Uganda, of whom 55 had attended the workshop (Vancampfort & Mugisha, 2022). Participation in the workshop yielded large effect sizes for higher autonomy support ($d = 0.87$) and structure ($d = 0.84$) scores, as well as moderate effect sizes for lower control (d = 0.64) and chaos ($d = 0.71$) scores. However, their study did not include baseline assessments, making it impossible to evaluate changes to (de)motivating styles over time (Vancampfort & Mugisha, 2022). Additionally, the results attained by Vancampfort and Mugisha (2022) may have been

biased due to lack of randomisation of participants and convenience sampling methods. Participants of the study were chosen by hospital board directors based on professionals' work roles, but it is possible that selection bias influenced the results, as chosen participants might have been known to have positive attitudes towards the intervention topic (Vancampfort & Mugisha, 2022). In another SDT-based intervention study Duprez and colleagues (2022) evaluated the outcomes of a training programme aiming to enhance nurses' competencies for self-management support. Statistically significant change over time was found for only controlling style, although participants in general used motivating approaches more and demotivating ones less after the training (Duprez et al., 2022).

Despite evidence on the positive effects of SDT-based interventions, it has been noted that translating SDT into practice may be difficult and many professionals may fail to achieve desired skill levels or put skills learnt in training programmes into practice (Ntoumanis & Mallett, 2014; Renko et al., 2022). Shifting from a controlling interaction style may be challenging for some professionals, for instance due to difficulties in using motivational techniques in group settings or because of experienced mismatch between professional role demands (Renko et al., 2022). Multiple personal, situational, and cultural factors have been identified as possible barriers in promoting autonomy supportive coaching and teaching, and it has been stated that further research into the processes of changing interaction styles is needed (Mageau & Vallerand, 2003; Matosic et al., 2016; Taylor et al., 2009; Van den Berghe, Soenens, et al., 2014). For example, in the field of education, teachers' own need-satisfaction and quality of motivation towards teaching has been linked to the interaction styles they use with their students (Reeve, 2009; Van den Berghe, Soenens, et al., 2014). In general, it has been suggested that factors which influence professionals' own motivation also indirectly influence the motivational strategies they use with their subordinates (Taylor et al., 2009). According to a literature review on the antecedents of motivating interaction styles conducted by Matosic and colleagues (2016), autonomously motivated teachers use a more autonomy supportive teaching style and use a less controlling style. This highlights the importance of considering professionals' own quality of motivation when aiming to improve their interaction styles.

2.1.5 Improving professionals' motivating interaction: Research evidence from Motivational Interviewing training literature

One notable area of research on changing professionals' interaction styles has focused on Motivational Interviewing (MI; Miller, 1983), which is a client-centred counselling method for enhancing patients' intrinsic motivation toward behaviour change (Markland et al., 2005). Theoretically MI can be understood as an SDT-congruent need-supportive interaction practice, as central MI skills and practices support the needs for autonomy, competence, and relatedness (Markland et al., 2005). MI has been widely studied and applied in many fields and has been found to be efficient for improving different outcomes, such as increasing problem drinkers' help-seeking behaviours and decreasing their alcohol consumption (Berman et al., 2020; Markland et al., 2005).However, Söderlund and colleagues (2011) noted in a systematic review of 10 MI training studies that due to inconsistent methodological quality in studies, the positive effects of MI training should be interpreted with caution. Furthermore, meta-analyses and reviews of MI interventions have found that even comprehensive interaction training may not successfully change professionals' interaction behaviours in the long-term (Hall et al., 2016; Schwalbe et al., 2014). A meta-analysis of 21 studies on MI training interventions by Schwalbe and colleagues (2014), found that although training improved professionals' MI skills, these skills eroded quickly after the training. Post-training support was noted as an important factor for sustaining training gains and improving MI skills (Schwalbe et al., 2014). A systematic review of 20 MI interventions by Hall and colleagues (2016) also found that most training studies did not achieve sustained change in professionals' interaction practices. It was concluded that the learnt skills are rarely maintained without extended post-training contact and support, and that for the training to be effective, learnt practices must be integrated into the workplace setting in an ongoing manner (Hall et al., 2016). One explanation for these shortcomings might be that interaction behaviours and styles can be largely habitual, and thus methods for changing habits may be needed for improving these behaviours in the long-term (Puolamäki et al., 2024).

2.2 Habit theory and implementation intentions

The long-term success of behaviour change interventions can be seen to require participants forming new habits from the desired behaviours and undoing old, undesired habits (Orbell & Verplanken, 2020). Within psychology, habits have been defined as "a phenomenon whereby behaviour is prompted automatically by situational cues, as a result of learned cue-behaviour

associations" (Gardner, 2015, p.277). According to Orbell and Verplanken's (2020) account of habit theory, habits are formed via action repetition in a consistent cue context, where a cue-response association is formed in memory and the action becomes cue-contingent and thus independent of goals or motivation. Through repetition over time, habits become ingrained ways in which "neural networks 'remember' recurring contexts and optimal responses to them" (Orbell & Verplanken, 2020, p.179). The performance of cue-contingent habits is neurologically localised in the sensorimotor loop, whereas goal-directed behaviour is localised in the associative loop (Orbell & Verplanken, 2020). Because these neurological systems are in competition, neural systems related to planning, executive control, and deliberation are suppressed when habits are activated, making it difficult to consciously undo or override unwanted habits (Orbell & Verplanken, 2020). Additionally, forming new habits takes time and consistent repetition, making not only bad habits difficult to break, but also good habits difficult to create (Orbell & Verplanken, 2020). Nevertheless, habit theory has been utilised in many behaviour change interventions, for example to improve health behaviours such as PA (Gardner, 2015).

One approach to preventing the enactment of unwanted habits and forming new ones is using implementation intentions, or "if-then" plans (Rhodes et al., 2020, p.575). These plans consist of forming a link between a situational cue and a specific behavioural response, specifying when, where, and how a goal-directed plan is enacted, i.e., "If situation X is encountered, then I will perform the goal-directed response Y" (Gollwitzer & Oettingen, 2016, p.223). Compared to everyday goal intentions, i.e., "I want to reach goal X" (p.223), implementation intentions specify an expected obstacle or opportunity and link it to a goal-directed response which becomes habitual over time. In self-regulation training interventions, implementation intentions have been shown to have a strong effect (meta-analytic $d = 0.65$) in improving self-regulation capabilities (Berkman, 2016). Similarly, in a recent meta-analysis of 294 articles Sheeran and colleagues (2024) found that making implementation intentions is effective for influencing cognitive performance ($d = 0.47$), affect regulation ($d = 0.66$), behaviour change ($d = 0.27$), and social judgement ($d = 0.52$) outcomes. Their meta-analysis suggested that overall, implementation intentions can work in different contexts, among different age-groups and in creating long-term changes to multiple outcomes (Sheeran et al., 2024). According to Gollwitzer and Oettingen (2016), empirical evidence indicates that implementation intentions can be helpful in closing the gap between wanting to reach a goal and actually doing so. However, it has been noted that these positive findings may be influenced by publication bias, where negative and null results are not published, leading to biased meta-analytic effect sizes (Sheeran et al., 2024).

This issue does not only influence evidence on implementation intentions but is a well-known problem within all scientific research (Nosek et al., 2012).

Despite many positive findings, evidence on the effects of implementations intentions is heterogeneous and many factors which impact their usefulness have been identified (Rhodes et al., 2020; Sheeran et al., 2024). For instance, individuals' impulsivity and other self-regulatory skills and capabilities have been found to influence the effects of using implementation intentions to form or break habits (Rhodes et al., 2020). Other potential factors influencing the effects of implementation intentions include outcome measurement methods, i.e., self-report or device-based, and delivery method, i.e., in-person or remote (Sheeran et al., 2024). Furthermore, evidence is still unclear on whether there is an optimal number of implementation intentions to form, or whether rehearsal of the if-then plan influences outcomes (Sheeran et al., 2024). Earlier research suggests that a larger number of made plans is related to increased behaviour change (e.g., Wiedemann et al., 2011). However, in their meta-analysis, Sheeran and colleagues (2024) found that forming one, seven, or eight plans had larger effect sizes than forming 2 – 6 plans, indicating a nonlinear relationship between number of implementation intentions and outcome variables. Similarly, rehearsal of plans should increase the impact of implementation intentions via deeper encoding of a specified cue-response link, but Sheeran and colleagues found that whilst rehearsing a plan at least once increased the impact of the plan, rehearsing it more than once did not increase this effect (Sheeran et al., 2024). Sheeran and colleagues (2024) concluded that more research is needed to better understand the influence of number and rehearsal of implementation intentions. Thus, despite some promising results, research on the use of implementation intentions in interventions is still lacking (Rhodes et al., 2020; Sheeran et al., 2024). Given their possible power in influencing habitual behaviours, such as motivating interaction practices, use of implementation intentions in interaction interventions can be seen as a promising avenue for research.

2.3 The MotiStyleSport intervention

The MotiStyleSport (MSS) research project was implemented at the Tampere University during 2021 - 2023 with funding from the Ministry of Education and Culture of Finland (Palsola et al., 2023). The MSS intervention was developed based on a previous motivating interaction training

course developed by Renko and colleagues (2020; 2022), which targeted PE teachers. The MSS intervention was developed and optimised (Palsola et al., 2023) and its acceptability and optimisation needs were further evaluated in a feasibility study (Puolamäki et al., 2024).

In developing the MSS intervention, the aim was to systematically consider insights from complexity theory and behaviour change science to create an intervention to improve professionals' motivational interaction behaviours (Palsola et al., 2023). The target group of the intervention was PA promotion and sports professionals (i.e., PE teachers, PA counsellors, physiotherapists, health nurses, and sports coaches). Based on Aelterman and colleagues' (2019) circumplex model of (de)motivating styles, within the MSS programme theory motivational interaction was defined as a set of "motivational interaction behaviours" (Palsola et al., 2023,p.2). Defining motivational interaction styles as behaviours allowed for incorporating insights from behaviour change science (i.e., habit theory) for changing professionals' motivational interaction styles (Palsola et al., 2023). It was argued that because motivational interaction behaviours are habitual to a large extent, light educational interventions may not be sufficient in changing ingrained behavioural patterns in the long-term (Palsola et al., 2023). Additionally, according to the authors, earlier studies had failed to report specific behaviour change techniques (BCTs) used to induce change in interventions (Palsola et al., 2023). BCTs are "observable, replicable, and irreducible components of an intervention" (Michie et al., 2013, p.82) used in interventions to change causal processes of behaviour, such as reinforcement or self-monitoring. In developing the MSS intervention, explicit attention was placed on the utilised BCTs to underline what intervention components may lead to desired outcomes, as well as why and how these intervention mechanisms may have their effects (Palsola et al., 2023). Earlier motivational interaction behaviour change interventions had not incorporated insight from self-regulation and habit theory, making MSS a novel and promising approach (Palsola et al., 2023). Additionally, the MSS intervention was developed using a complexity science approach. This means that instead of assuming linear, predictable, and unidirectional dynamics behind effective interventions, the target of the intervention and the intervention itself was seen as a complex system embedded in other complex systems (Palsola et al., 2023). In practice, using a complexity science approach included, for instance, treating participants as active learning agents as well as acknowledging interconnectedness and individual change paths (Palsola et al., 2023).

Two main objectives were set for the MSS intervention during its development (Palsola et al., 2023). Firstly, the intervention had an educational objective of teaching participants about why

and how to use motivating interaction behaviours (Palsola et al., 2023). Secondly, the intervention aimed to change participants' interaction behaviour, i.e., to increase autonomy supportive and structuring behaviours and decrease controlling and chaotic behaviours (Palsola et al., 2023). Within this behaviour change objective, the intervention aimed to also "instil a compassionate, patient and strength-centred general philosophy of supporting people" (p.10), and to support long-term maintenance of behaviour change. The changes were thought to operate via participants' motivation towards pursuing motivating interaction behaviours as well as through individualised practice of the target behaviours in each participants' unique work contexts (Palsola et al., 2023).

Figure 3.
Key Processes and Outcomes Relevant for This Study, based on Palsola et al., 2023.

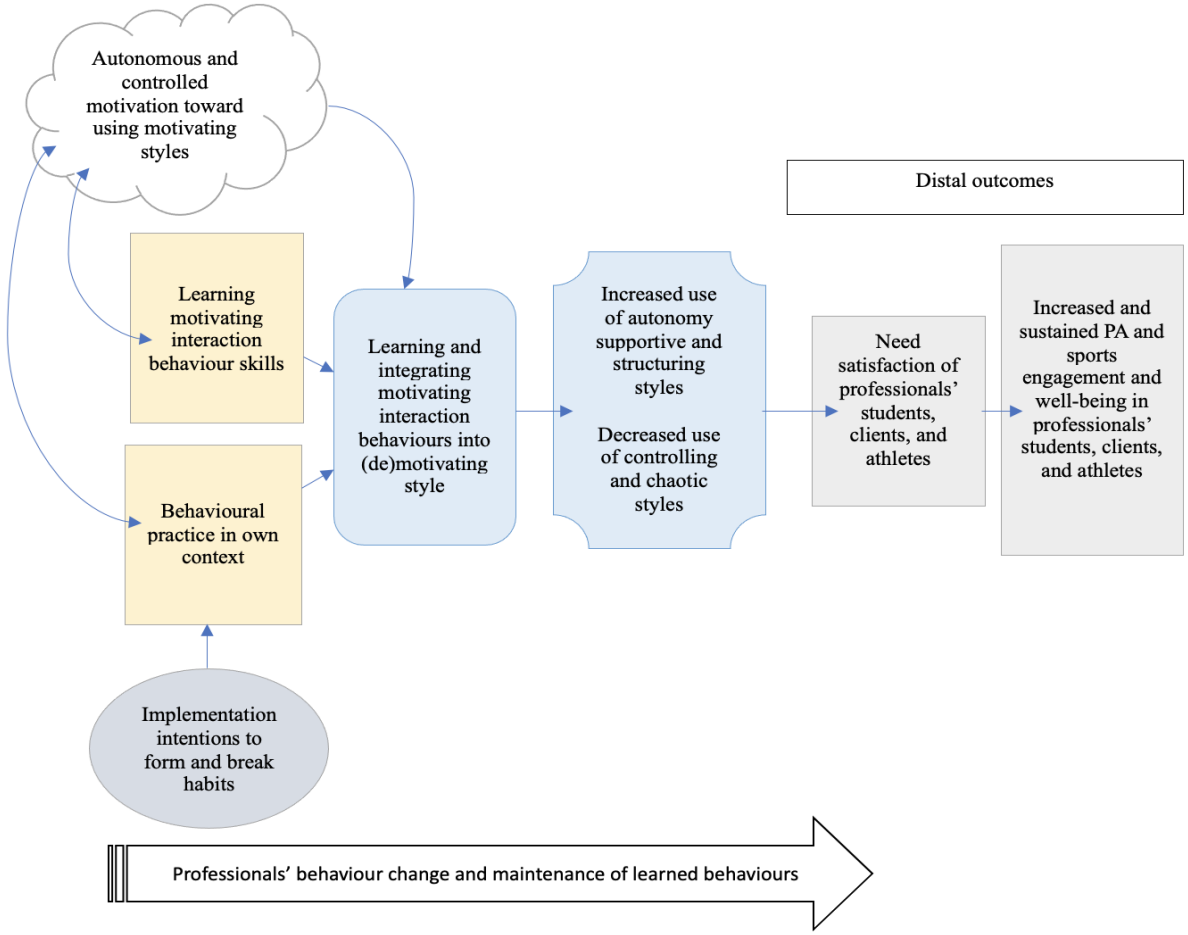


Figure 3 above shows the theory of change in the MSS intervention, modified for the purposes of the present study, highlighting the relationships between relevant variables and processes. Through creating and enacting implementation intentions, among other BCTs, participants

could practice motivating behaviours in their own contexts (Palsola et al., 2023). Through learning about motivating interaction skills and their benefits during the intervention, participants could learn and integrate motivating behaviours into their overarching (de)motivating styles (Palsola et al., 2023). Participants' autonomous and controlled motivation toward using motivating styles may have influenced their behavioural practice (e.g., use of implementation intentions), learning during the intervention, and integration of learned behaviours into (de)motivating styles. Learning about the consequences of using (de)motivating styles and practicing motivating techniques might have also influenced participants' quality of motivation toward using motivating styles.

The current study was conducted during the feasibility study phase of the MSS intervention, where Puolamäki and colleagues (2024) investigated the feasibility and acceptability of the MSS training intervention among Finnish PA promotion and sports professionals. Additionally, they investigated the trial procedures used in the MSS training in preparation for a later full-scale randomised controlled trial (RCT) study (Puolamäki et al., 2024). Their study found that overall, the intervention was highly acceptable among all professional groups, as shown by high retention rates and acceptability evaluations by participants (Puolamäki et al., 2024).

3. Research questions and hypotheses

The present study aimed to explore the effects and processes of the MSS intervention in improving professionals' (de)motivating interaction styles. By offering insights into the effects of the intervention, this study aimed to complement the results attained by Puolamäki and colleagues (2024) and help inform future research on the MSS intervention by highlighting possible points of interest for later development phases.

In determining the research questions, I paid attention to novel aspects of the MSS intervention, namely, the multidisciplinary participant group and utilising habit theory in changing motivating styles (Palsola et al., 2023; Puolamäki et al., 2024). As discussed in Section 2.1.4, although previous interventions have been successful in improving professionals' interaction styles, little is known about whether training programmes have similar effects on different professionals and how integrating principles from habit theory may influence the effects of SDT-based interaction training.

The first research question concerned the effects of intervention on improving professionals' motivating styles: *Q1: Are there differences in professionals' (de)motivating interaction styles before and after the training and if there are, what are the differences like?* Based on earlier research on SDT-based intervention programmes and the behaviour change objective of the MSS intervention, four hypotheses were set and preregistered (see Appendix A) for the first research question:

> H1: Participants' scores of autonomy supportive style are higher after the training than before the training.
>
> H2: Participants' scores of structuring style are higher after the training than before the training.
>
> H3: Participants' scores of controlling style are lower after the training than before the training.
>
> H4: Participants' scores of chaotic style are lower after the training than before the training.

If the MSS intervention had its intended effect, these hypotheses would be empirically supported, as the intervention aimed to increase the use of motivating styles and decrease the use

of demotivating styles. It was deemed appropriate to form separate hypotheses for all four interaction styles, as it has been noted that the use of different interaction styles is not necessarily mutually exclusive (Aelterman et al., 2019; Ahmadi et al., 2023).

The second research question concerned differences among the three professional groups in the effects of the intervention: *Q2: Are there differences between the three professional groups in changes to professionals' (de)motivating interaction styles before and after the training?* This question was explorative in nature, as no hypotheses could be formed based on earlier research: previous literature did not clearly indicate whether occupational differences could be expected, as most studies and review papers have only focused on one profession at a time, (e.g., Gillet et al., 2010; Van den Berghe, Soenens, et al., 2014).

The third research question was formed to further explore whether certain theoretically interesting and novel aspects of the intervention may explain results on the effects of the intervention: *Q3: Are participants' quality of motivation towards using motivating interaction styles and the amount of implementation intentions made and enacted to form or break habits predictive of participants' interaction styles after the training?* Similarly to Q2, this question was explorative in nature. Participants' quality of motivation toward using motivating styles was deemed interesting because of earlier literature highlighting the influence of professionals' quality of motivation on the interaction styles they use, learning, and behaviour change, and because in developing the MSS intervention, it was expected that participants' motivation would play a key role in behaviour change (Palsola et al., 2023). Similarly, because behavioural practice of the target behaviours was identified by Palsola and colleagues (2023) as a mechanism through which the intervention may have its effects, implementation intentions was chosen as a possible predictor of participants' post-training interaction styles.

All research questions and hypotheses were preregistered and decided before conducting analyses (see Appendix A). The preregistered plan was not deviated from, apart from minor changes to wording of phrases.

4. Methods

4.1 Research design

The present study was based on Puolamäki and colleagues' (2024) feasibility study, which used a pre-experimental one-group pretest-posttest research design (Creswell, 2014). All participants took part in the MSS intervention and the same participants were measured before and after the intervention with no control groups.

4.2 Participants and recruitment

Eligibility criteria for participants was twofold: participants were currently working in some of the target professions (PE teacher, sports coach, physiotherapist, PA counsellor, or health nurse) for at least 50 % of their weekly work hours and they had at least six months of work experience (Puolamäki et al., 2024). However, sports coaches who did not meet the 50 % paid working time criteria were also included in the sample, based on their work experience and work time, because it is common for coaching to be unpaid in Finland (Puolamäki et al., 2024).

A target sample size of 100-150 participants was determined based on an assessment of a sufficient sample size needed to answer the research questions of the feasibility study (Puolamäki et al., 2024). Participants were recruited via multiple avenues: emails sent by national unions of PA and sports professionals to their members, stakeholders' social media posts, emails to target groups via the city of Helsinki, and mentions by members of the research group in talks to relevant audiences (Puolamäki et al., 2024). 237 potential participants showed interest, from whom 146 participants were chosen based on balancing the professional group proportions and levelling gender differences (Puolamäki et al., 2024). Ultimately, 145 participants took part in the intervention (see Table 1 for demographic variables). According to Field (2018), usually if relevant data is missing from one timepoint when using repeated-measures designs, the whole case is deleted. Thus, only participants that answered to both pre- and post-training outcome measures (i.e., SIS-questionnaires) were included in the present study. All 145 participants answered to pre-training questionnaires, but only 87 answered to post-training questionnaires, forming the sample of this study. 58 participants were excluded from the analyses of the present

study due to missing data. Characteristics of the 145 participants and the 87 participants included in this study are shown below in Table 1. Results on statistical analyses of differences among the included and excluded participants are reported in Section 5 to assess possible non-response bias (Agresti, 2018).

Table 1.

Demographic Characteristics of All Participants and Participants Included in This Study.

	Total (N = 145) N (%)	Total (n = 87) n (%)
Gender		
Female	107 (73.8 %)	64 (73.6 %)
Male	38 (26.2 %)	23 (26.4 %)
Age		
20 – 29 years	22 (15.2 %)	14 (16.1 %)
30 – 39 years	49 (33.8 %)	31 (35.6 %)
40 – 49 years	38 (26.2 %)	19 (26.4 %)
50 – 59 years	32 (22.1 %)	23 (26.4 %)
60 + years	4 (2.8 %)	0 (0 %)
Profession		
PE teacher	32 (22.1 %)	22 (25.3 %)
Coach	39 (26.9 %)	20 (23.0 %)
HCP [a]	74 (51.0 %)	45 (51.7 %)
Work experience		
1 – 2 years	12 (8.3 %)	8 (9.2 %)
3 – 10 years	51 (35.1 %)	33 (37.9 %)
11 – 19 years	35 (24.1 %)	19 (22.7 %)
20 + years	47 (32.7 %)	27 (30.2 %)
Level of education		
Secondary	3 (2.1 %)	2 (2.3 %)
Upper secondary	19 (13.1 %)	7 (8.0 %)
Bachelor's or equivalent	67 (46.2 %)	42 (48.3 %)
Master's or equivalent	56 (38.6 %)	36 (41.4 %)

Note. [a] i.e., health nurses, PA counsellors, and physiotherapists.

4.3 Intervention

The MSS training intervention consisted of six online sessions carried out over 12 weeks, each lasting approximately two hours. Participants were divided into 10 groups for the sessions, which were delivered by Puolamäki, a clinical psychologist with occupational and sports psychology background, with the help of a research assistant (Puolamäki et al., 2024). Sessions included short lectures, discussions, and small-group tasks and discussions. Additionally, participants were given homework tasks to do in between sessions and were divided into smaller peer-support groups and encouraged to meet outside of the sessions to further work on the topics. During the intervention participants were taught about motivation and interaction as noted by the SDT: the basic psychological needs, how interaction influences motivation, the four overarching interaction styles and nine different interaction techniques that are characteristic to autonomy supportive and structuring styles. The themes of the six sessions were, in order: 1) motivation and interaction, 2) autonomy supportive techniques, 3) structuring techniques, 4) motivating techniques in action, 5) challenging interaction situations (I), and 6) challenging interaction situations (II) and recap of the training. Throughout the sessions, participants were also taught BCTs and skills, such as planning, self-monitoring, and forming and enacting individual implementation intentions for changing their interaction behaviour. These interaction and behaviour change techniques were practiced via different exercises and tasks throughout the intervention (see Puolamäki et al., 2024 for more detailed description).

4.4 Data collection

Data was collected with electronic questionnaires at three timepoints: before the training (T1), half-way through the training (T2), and after training (T3). The questionnaires consisted of multiple quantitative measures and open-ended qualitative questions, with different profession-congruent versions for the three different professional groups (Puolamäki et al., 2024). In this study, only quantitative data from T1 and T3 was utilized.

4.5 Measurements

(De)motivating style. Self-reported (de)motivating interaction styles were measured at T1 and T3 with three versions of the Situations-in-Schools (SIS; Aelterman et al., 2019) questionnaire,

all translated and culturally adapted from English to Finnish (Puolamäki et al., 2022). PE teachers' (de)motivating styles were measured with Escriva-Boulley and colleagues' (2021)SIS-PE questionnaire. For HCPs, a slightly modified version of Duprez and colleagues' (2021) Situations in Self-management support – Health care (SIS-HCP) questionnaire was used. Coaches' (de)motivating styles were measured with the SISQ-Sport questionnaire (Delrue et al., 2019). These questionnaires are similarly structured, consisting of vignette items of scenarios which professionals may encounter in their work environment and four ways how they might behave in each scenario. These four ways to behave reflect autonomy support, structure, control, and chaos. Table 2 below shows an example vignette from Delrue and colleagues' (2019) original SISQ-Sport questionnaire for coaches. In this vignette, the 1st item measures abandoning practices (i.e., chaotic style), the 2nd attuning practices (i.e., autonomy supportive style), the 3rd domineering practices (i.e., controlling style), and the 4th guiding practices (i.e., structuring style) (Delrue et al., 2019).

Table 2.

Example Vignette from SISQ-SPORT Questionnaire, from Delrue et al., 2019.

Situation 1: An athlete is dissatisfied because of not being selected to play. You notice that an athlete is dissatisfied because s/he is not selected to play in a competition. How do you respond?							
	1	2	3	4	5	6	7
1. You do not provide an explanation and leave him/her to it.							
2. You have a conversation with him/her and acknowledge his/her frustration and give a meaningful explanation for the non-selection.							
3. You say: "You need to learn to accept this. This is my decision".							
4. You indicate which steps s/he needs to take in order to be selected in the future.							

Note. 1 = Describes me not at all, 7 = Describes be extremely well

As seen from Table 2, participants answer on a 7-point Likert scale, how well each behaviour describes how they would act, where 1 = describes me not at all, and 7 = describes me extremely

well. The three questionnaires differ in their scenarios to fit different professions and have different numbers of items (10 in SIS-HPC, 12 in SIS-PE, and 15 in SISQ-Sport). In this study, sum mean variables were formed for each (de)motivating style, so that four new variables were formed (SIS-autonomy, SIS-structure, SIS-chaos, and SIS-control), combining results from all professional groups.

Quality of motivation. Participants' quality of motivation toward using motivating styles was measured at T3 with two questions. On a 5-point Likert scale (1 = not true at all, 5 = fully true) participants responded to the item stem: "I want to use a need-supportive (autonomy supportive and/or structuring) interaction style because…", with the items a) "… I understand why it is important" (i.e., autonomous motivation), and b) "…because they feel pressured to do so" (i.e., controlled motivation). Given theoretical notions of autonomous and controlled motivation not being mutually exclusive (e.g., Ryan & Deci, 2017), participants' autonomous and controlled motivation towards using motivating styles were measured as separate variables, rather than combining them into one variable. It has been widely debated whether such single-item Likert-scale variables should be treated as ordinal or continuous (Harpe, 2015). In the present study, regression analyses using these two variables were ran both with them as continuous and with dummy-coded categorical versions of them. Only results from the former are reported in the present study, because it was deemed more appropriate to treat the variables as continuous. Based on recommendations put forth by Harpe (2015), individual rating items with numerical answer options with at least five categories can generally be treated as continuous variables. It was seen that dummy-coding the variables either led to having too many variables to use in the regression analyses or led to losing relevant information via simplifying the data into only two categories of responses (e.g., 0 = response value 5, 1= response values 1-4).

Implementation intentions. Participants' creation of implementation intentions to form or break their habits of using (de)motivating interaction techniques was measured at T3, with the question: "Have you done the following during or after the training? I have made an if-then plan(s) for the automatic use of interaction techniques or to inhibit/replace automatic demotivating behaviour". Answers were given on a 5-point Likert scale, where 1 = I have not made a plan, 2 = I have made a plan for the use of one or two techniques, 3 = I have made a plan for the use of 3-4 techniques, 4 = I have made a plan for the use of 5-6 techniques, and 5 = I have made a plan for the use of 7 or more techniques. Participants' intentional enactment of imple-

mentation intentions was measured at T3 with the question “Have you done the following during or after the training? I have intentionally enacted the interaction technique that I have defined in my if-then plan when the cue was present”. Answers were given on a 5-point Likert scale, where 1 = not once, 2 = once when the cue was present, 3 = sometimes when the cue was present, 4 = often when the cue was present, and 5 = always when the cue was present. In this study, a sum mean variable was formed based on these two Likert-scale questions to form a sum score of making and enacting implementation intentions. The scale of this new variable ranged from 1 to 5, where higher scores indicated higher creation and enactment of implementation intentions.

4.6 Data analysis

All analyses were carried out using the IBM SPSS Statistics version 28.0.1.1 programme.

To answer the first research question and to test hypotheses H1-H4, participants’ (de)motivating styles at T1 and T3 were first analysed using descriptive statistics (i.e., mean, standard deviation, standard error). Hypotheses H1-H4 were assessed using t-tests for null hypothesis testing (Agresti, 2018), with the null hypothesis being that there was no difference in (de)motivating styles at pre-and post-training. Paired-samples t-test were used to assess whether on average (de)motivating styles were significantly different at T1 and T3. The P-value of $p \leq .05$ was used to assess statistical significance throughout this study, indicating a 5 % chance of rejecting a true null hypothesis (Type I error) (Field, 2018). Although misinterpretations and overreliance on P-values has been widely debated (e.g., Dahiru, 2008; Lakens, 2013), the conventional significance level used in social sciences was used in this study (Agresti, 2018). More specifically, to test hypotheses H1-H4, one-tailed paired-samples t-tests were used, because deviation from the null hypothesis was expected in a specific direction: upper-tailed for H1 and H2, lower-tailed for H3 and H4. Although generally two-tailed t-tests are more often used due to allowing detection of changes in both directions, one-tailed tests were chosen because of interest in whether (de)motivating styles had changed in specific directions, rather than whether they had changed in general (Agresti, 2018). Where one-tailed t-tests were statistically non-significant, two-tailed tests were run post hoc to explore possible changes to the unexpected direction. Reporting effect sizes in addition to p-values was important because null hypothesis testing does not tell about the importance of an effect and because standardised effect sizes are useful for

comparing results across studies (Field, 2018; Lakens, 2013). Effect sizes for t-tests were assessed with Cohen's *d*, following their widely used interpretation where $d = .2$ indicates a small effect size, $d = .5$ a medium effect size and $d = .8$ a large effect size (Cohen, 1988; Field, 2018). Despite following these standard benchmarks for interpretation, it was acknowledged that they are arbitrary and should not be interpreted rigidly, as even small effect sizes can have large real-life consequences depending on their context (Lakens, 2013). In their 2013 article, Lakens suggested that Cohen's *d* should be interpreted by relating it to other effects found in relevant literature, and by explaining the practical consequences of the detected effects. Nevertheless, Lakens also stated that there are no clear recommendations for how to do this, and thus the standard values were used as the basis of interpretation in the present study, whilst also acknowledging these issues in interpreting the results (Lakens, 2013).

To answer the second research question concerning differences between professions in the interventions' effects, two-way ANOVA with repeated measures (i.e., mixed ANOVA) was used to assess both within-subject and between-subject factors (Field, 2018). The analysis was run separately for all four (de)motivating styles, where the dependent variable was the given style, and the independent variables were time (within-subjects variable with two levels) and professional group (between-subjects variable with three levels). Results of the mixed ANOVA were used to determine whether there was a statistically significant effect or interaction between the independent variables on the dependent variable. Additionally, effect sizes were examined with partial eta squared (η^2), where $\eta^2 = .01$ indicated a small effect size, $\eta^2 = .06$ indicated a medium effect size and $\eta^2 = .14$ indicated a large effect size (Cohen, 1988). As with Cohen's *d,* the use of η^2 for reporting effect sizes has been debated (e.g., Lakens, 2013), but due to the scope of the present study, these standard ways for reporting and interpreting results of ANOVA were used. Additionally, possible statistically significant main effects of time or profession or interaction effects of the two were explored more closely with post-hoc tests (Agresti, 2018).

Standard linear regression was used to analyse Q3 regarding whether quality of motivation and implementation intentions predicted changes to participants' motivating styles. The analyses were run for autonomy supportive and structuring styles, thus excluding controlling and chaotic styles, primarily due to the limited scope of this study and because they were deemed theoretically most interesting. Additionally, the questions measuring participants' motivation toward changing their interaction styles only mentioned autonomy supportive and structuring styles and for implementation intentions, participants were advised to replace demotivating practices

with motivating ones. Furthermore, results from analyses conducted for Q1 and Q2 showed that although changes to structuring style over time were not statistically significant, there was variation between participants in structuring style scores. This raised the question of whether further insight into the predictors of structuring style may shine light on why this variation may occur. Regression analyses were run separately for the two styles, with the post-training motivating style (i.e., autonomy support or structure score at T3) as the dependent variable and implementation intentions, autonomous motivation, and controlled motivation as independent variables. For the results reported in this study, independent variables were entered into the regression models using the enter method, where all variables are entered into the equation at the same time, because due to the exploratory nature of the analyses, no clear theoretical reasons were seen for entering variables in a specific order (Field, 2018). Nevertheless, other entry methods were also tried out, but not reported in the results. Pre-training (T1) motivating style was used as a control variable, which allowed for examining whether the independent variables explain variance in changes to motivating styles between T1 and T3. For the results reported in this study, the control variable was entered into the equation at the same time as the independent variables to perform standard multiple regression analyses. However, the analyses were also conducted as hierarchical regression analyses by entering the control variable into the model first with block-wise selection (Field, 2018). This method had the benefit of giving results on the predictive power of the regression model based solely on the independent variables, separately from the control variable. Nevertheless, results of the standard multiple regression model were chosen for reporting, mainly due to the preregistered intent of performing standard regression analyses. Overall, the regression analyses included three independent variables and one control variable, which was deemed an appropriate number of variables to include in the regression model in relation to the sample size and theoretically interesting constructs to analyse. According to Field (2018), there should be approximately 10-15 observations for each variable in the regression model, so the sample size of the current study would have allowed for 5-6 variables without overly compromising statistical power of the analysis.

4.7 Ethics

All data used for the current study was gathered by Puolamäki and colleagues (2024) and their procedures were reviewed by an ethical committee, which gave a positive statement. According to Puolamäki and colleagues (2024), all participants gave informed consent for participation in the intervention and study. Within the present study, ethical considerations were considered

when analysing, reporting, sharing, and storing data, following guidelines discussed by Creswell (2014). To improve the transparency and accountability of this study, I preregistered all research questions and hypotheses prior to gaining access to the data or doing any analyses (see Appendix A), following recommendations for improving scientific practices (e.g., Nosek et al., 2012). Anonymity of participants was ensured prior to this study, as the data used had been cleared of any personal details from the participants. I stored and handled data responsibly. During data analysis I acknowledged all results, including insignificant results and those disproving hypotheses. In reporting the results, I did not falsify evidence, data, findings, or conclusions.

5. Results

First, sum mean variables were formed for the four (de)motivating styles for each version of the SIS-questionnaire (SIS-PE, SISQ-Sport, and SIS-HCP). The reliability of these sum variables was assessed using Cronbach's alpha, where values over .7 were interpreted as acceptable and lower values were interpreted as indicating unreliability of the scale (Field, 2018). As seen from Table 3, for most subscales, reliability was acceptable ($\alpha > .7$) at both time points. However, for SIS-HCP items for chaotic style reliability was suboptimal at T1 ($\alpha = .68$) and poor at T3 ($\alpha = .49$).

Table 3.

Cronbach's Alpha for Subscales of SIS-PE, SISQ-Sport, and SIS-HCP.

	Autonomy support		Structure		Control		Chaos	
	T1	T3	T1	T3	T1	T3	T1	T3
SIS-PE	.83	.88	.88	.77	.80	.74	.71	.81
SISQ-Sport	.88	.86	.81	.85	.85	.86	.72	.77
SIS-HCP	.84	.86	.81	.83	.82	.81	.68	.49

After this, new sum mean variables combining all three professions were formed for each motivating style. Missing data was present for participants who had no answered the T3 questionnaires (n = 58). As discussed in Section 4.2., these 58 participants were excluded from further analyses in the present study. Nevertheless, to see whether these excluded participants significantly differed from the included, associations between T3 nonresponse and demographic variables were analysed using contingency tables, Pearson's chi-square test, and Fisher's exact test (Field, 2018).

Based on contingency tables and Pearson's chi-square tests, T3 nonresponse was not associated with profession ($p = .320$), gender ($p = .939$), or work experience ($p = .767$). For associations by age and educational background, assumptions of the chi-square test were not met: for age, one expected count was less than 1 and for educational background more than 20 % of expected counts were less than 5 (Field, 2018). According to Field (2018), in such cases Fisher's exact test should be used. Based on Fisher's exact test, there was no statistically significant association between educational background and nonresponse ($p = .277$). For age, there was a statisti-

cally significant association between age group and T3 nonresponse (p = .046). Based on standardised residuals (Agresti, 2018), this association was strongest for 40 – 49- and over 60-year-olds, so that belonging to these age groups was more common among the excluded participants than the included participants. This association was acknowledged when interpreting the results of other analyses. The 87 participants included in the present study had answered all questionnaire items, so there was no missing data in terms of individual items. Descriptive statistics for T1 and T3 motivating style scores are shown below in Table 4 and Figure 4.

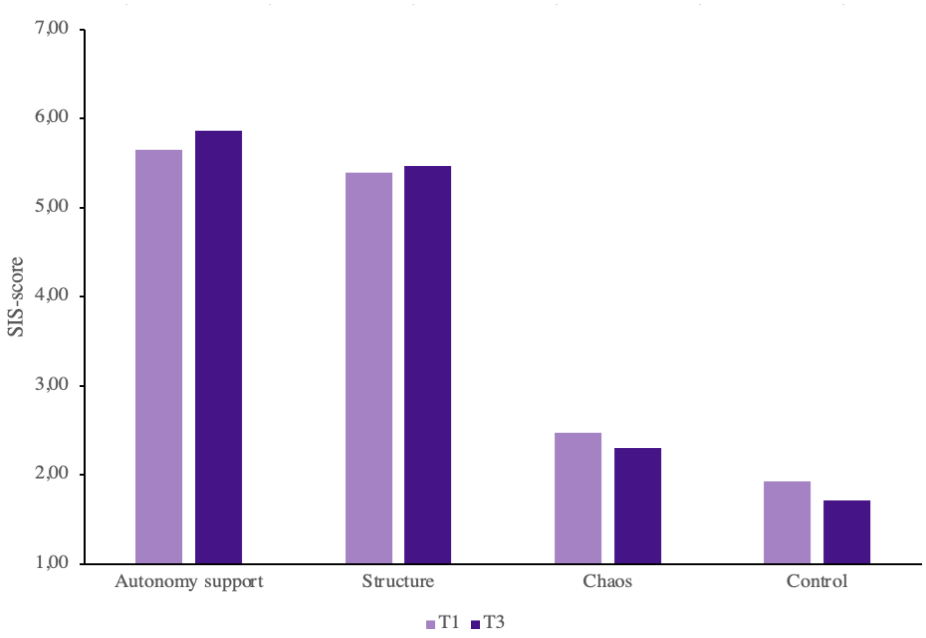
Table 4.

Mean and Standard Deviation of (De)motivating Style Scores Pre- and Post-training.

Measurement	T1		T3	
	M	*SD*	*M*	*SD*
Autonomy support	5.65	.72	5.87	.69
Structure	5.40	.76	5.47	.76
Chaos	2.47	.71	2.30	.71
Control	1.93	.70	1.72	.58

Figure 4.

Mean Scores of (De)motivating Styles Pre- and Post-training.



5.1 Q1: Effects of the intervention

To answer the first research question, it was hypothesised that the use of autonomy supportive and structuring styles would increase (H1 and H2), whilst the use of controlling and chaotic styles would decrease (H3 and H4). These hypotheses were tested using one-tailed paired-samples t-tests.

First, assumptions of the t-test (i.e., normality and outliers) were assessed. Normality was assessed based on skewness and kurtosis scores for each (de)motivating style. All skewness and kurtosis scores fell between -1 and +1, suggesting that the variables were approximately normally distributed (Hatem et al., 2022). Outliers were identified using boxplots. One outlier was identified in T3 scores for controlling style, on which one PE teacher scored 3.33. After assessing the items from which this score came, it seemed unlikely that the outlier was due to a data entry error. The outlier was left in the data because it seemed to be caused by natural variation and keeping it in did not significantly alter results of the t-test (Bhandari, 2024). Results of the one-tailed paired-samples t-tests are shown in Table 5.

Table 5.

Results of One-tailed Paired-samples T-tests on (De)motivating Styles.

Measure	*M*	*t*(86)	*p*	Cohen's *d*
Autonomy support	.22	-3.78	< .001	.54
Structure	.08	-1.43	.078	.54
Chaos	-.18	2.79	.003	.59
Control	-.20	4.10	< .001	.47

The first hypothesis (*H1: Participants' scores of autonomy supportive style are higher after the training than before the training)* was supported, as there was a statistically significant increase in participants' autonomy supportive style from before the training ($M = 5.65$, $SD = .72$) to after the training ($M = 5.87$, $SD = .69$), $t(86) = -3.78$, $p < .001$. The change showed a moderate effect size, $d = .54$.

The second hypothesis (*H2: Participants' scores of structuring style are higher after the training than before the training)* was not supported, as the null hypothesis was not rejected. Although participants' scores for structuring style increased from pre-training ($M = 5.40$, $SD = .76$) to post-training ($M = 5.47$, $SD = .76$), this change was not statistically significant, $t(86) = -1.43$, $p = .078$. Despite not being statistically significant, the change was to the expected direction, i.e., the scores increased during training and two-tailed t-test did not show significant effects in the opposite direction ($p = .155$). Effect size was moderate at $d = .54$, which might indicate that the sample size was too small for the detected effect to reach statistical significance, as statistical significance is influenced by sample size, whereas effect sizes are not influenced as much (Field, 2018).

The third hypothesis (*H3: Participants' scores of controlling style are lower after the training than before the training*) was supported, as participants' scores for controlling style decreased from pre-training ($M = 1.93$, $SD = .70$) to post-training ($M = 1.72$, $SD = .58$) and the change was statistically significant, $t(86) = 4.10$, $p < .001$. The effect size was close to moderate at $d = .47$.

The fourth hypothesis (*H4: Participants' scores of chaotic style are lower after the training than before the training*) was also supported, as participants' chaotic style decreased from before training ($M = 2.47$, $SD = .71$) to after it ($M = 2.30$, $SD = .71$), and the change was statistically significant, $t(86) = 2.79$, $p = .003$. The effect size was moderate, $d = .59$.

As such, to answer the first research question, there were statistically significant changes in participants' autonomy supportive, controlling, and chaotic interaction styles. As expected, after the training participants reported higher scores of autonomy supportive style whilst also having lower scores of controlling and chaotic styles. Changes in structuring style were not statistically significant. However, effect sizes for all four styles were moderate, suggesting that the intervention had an effect on changing all (de)motivating styles.

5.2 Q2: Differences between professions in effects of the intervention

The second research question concerned whether there were differences between the three professional groups in changes to participants' (de)motivating styles. This was assessed using

mixed factorial ANOVA. The dependent variable was interaction style, the independent within-subjects variable was time (T1 and T3) and the independent between-subjects variable was profession (PE teacher, coach, HCP).

First, assumptions of mixed ANOVA (i.e., normality of the dependent variable, homogeneity, sphericity) were checked. As shown earlier, the assumption of normality was met for (de)motivating styles. Homogeneity was assessed with Levene's test of homogeneity, which was statistically nonsignificant for all styles at both T1 and T3, suggesting that the assumption was met (Field, 2018). The assumption of sphericity refers to equality of variance for combinations of within-subjects independent variables (Field, 2018). Because the within-subjects variable (time) had only two levels (T1 and T3), sphericity could not be assessed and the assumption was automatically met, as there were no multiple pairs of within-subjects variables which could have had unequal variances. Descriptive statistics for interaction styles at T1 and T3 across professional groups are shown below in Table 6.

Table 6.

Mean and Standard Deviation of (De)motivating Styles at T1 and T3 by Profession.

	Autonomy support				Structure				Chaos				Control			
	T1		T3		T1		T3		T1		T3		T1		T3	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Teacher [a]	5.49	.69	5.58	.77	5.52	.76	5.62	.68	2.06	.56	1.98	.73	2.22	.70	1.96	.57
Coach [b]	5.56	.76	5.84	.67	5.42	.86	5.43	.82	2.06	.59	1.82	.53	2.11	.73	1.68	.63
HCP [c]	5.77	.71	6.03	.62	5.32	.73	5.43	.79	2.85	.61	2.66	.58	1.70	.60	1.62	.55

Note. [a] n = 22, [b] n = 20, [c] n = 45.

5.2.1. Differences between professions in effects on autonomy supportive style

Results of the mixed ANOVA for autonomy supportive style are shown below in Table 7. The analysis showed a statistically significant main effect of time on autonomy support with large effect size ($F(1, 84) = 11.19$, $p = .001$, $\eta_p^2 = .118$), where mean scores were lower at T1($M = 5.65$, $SD = .72$) than at T3 ($M = 5.87$, $SD = .69$). This means that regardless of profession, participants' autonomy supportive style increased over time. The main effect of profession on

autonomy support was non-significant ($F(2, 84) = 2.57$, $p = .082$, $\eta_p^2 = .056$), and no statistically significant interaction effect was found for time and profession ($F(2, 84) = 0.93$, $p = .399$, $\eta_p^2 = .022$). This indicates that the effect of time on autonomy supportive style was not significantly different across the three professions. Despite the effect of profession not being statistically significant, it had a medium effect size, which might indicate that the sample size was too small to detect a significant effect. Based on participants' mean autonomy scores, HCPs had higher use of autonomy supportive style than other professions, coaches had the second highest and teachers had the lowest (see Figure 5).

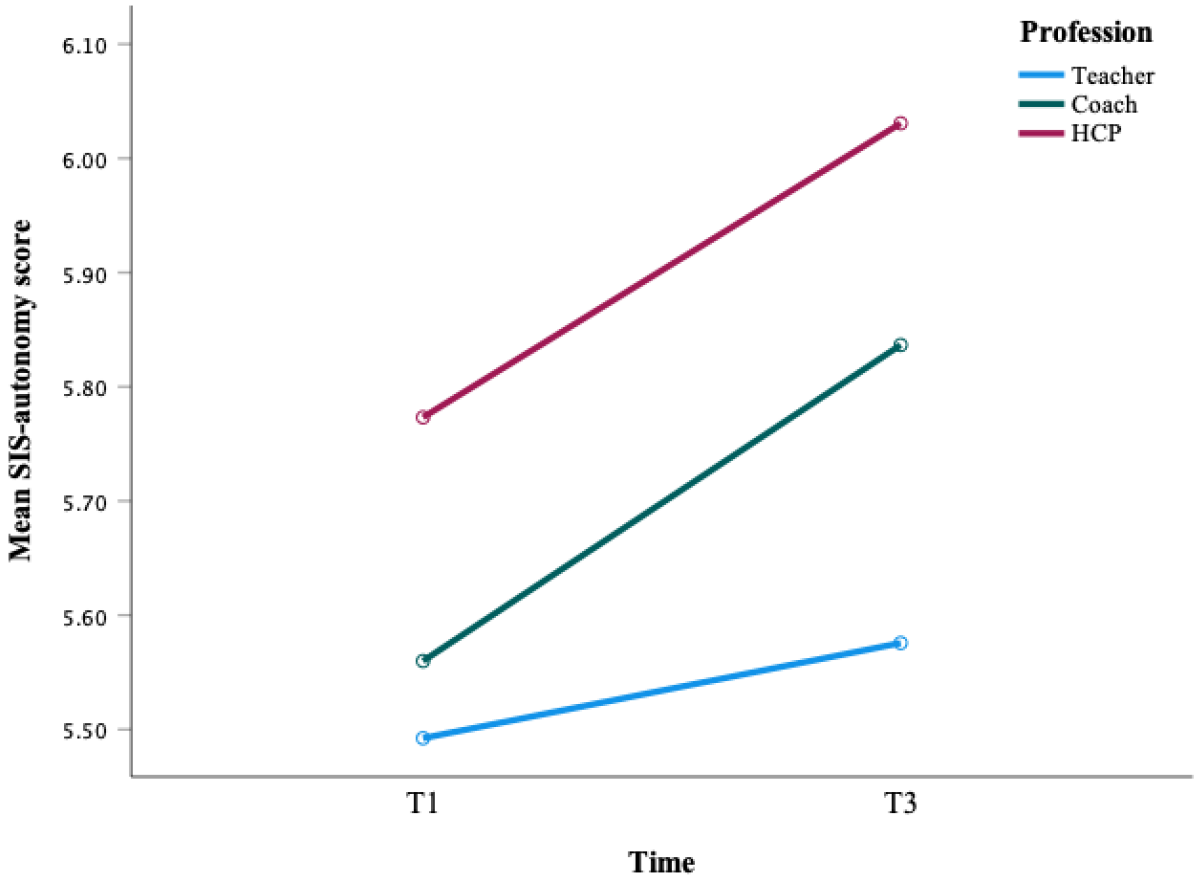
Table 7.

Combined ANOVA-table for Between- and Within-subject Effects on Autonomy Supportive Style.

Source	Sum of Squares	df	Mean Square	*F*	*p*	η_p^2
Time	1.620	1	1.620	11.191	.001	.118
Time*Profession	0.269	2	0.134	0.929	.399	.022
Error (Time)	12.157	84	0.145	-	-	-
Profession	4.213	2	2.106	2.573	.082	.058
Error	68.774	84	0.819	-	-	-

Figure 5.

Estimated Marginal Means for Autonomy Supportive Style by Profession.



Overall, these results indicate that participants' autonomy supportive style improved during the training program regardless of their profession. HCPs had consistently slightly higher levels of autonomy supportive style than other professionals and PE teachers' autonomy supportive style was the lowest, but these differences were not statistically significant, nor were there significant differences among professions in changes over time.

5.2.2. Differences between professions in effects on structuring style

Results of the mixed ANOVA on structuring style are shown below in Table 8. The analysis did not show a significant main effect of time on structuring style, ($F(1, 84) = 1.31$, $p = .255$, $\eta_p^2 = .015$), indicating that even if differences in profession were ignored, structuring style did not significantly change over time. The main effect of profession on structure was also non-

significant ($F(2, 84) = 0.57$, $p = .566$, $\eta_p^2 = .013$), and no significant interaction effect was found ($F(2, 84) = 0.24$, $p = .788$, $\eta_p^2 = .006$). Effect sizes for all variables were small.

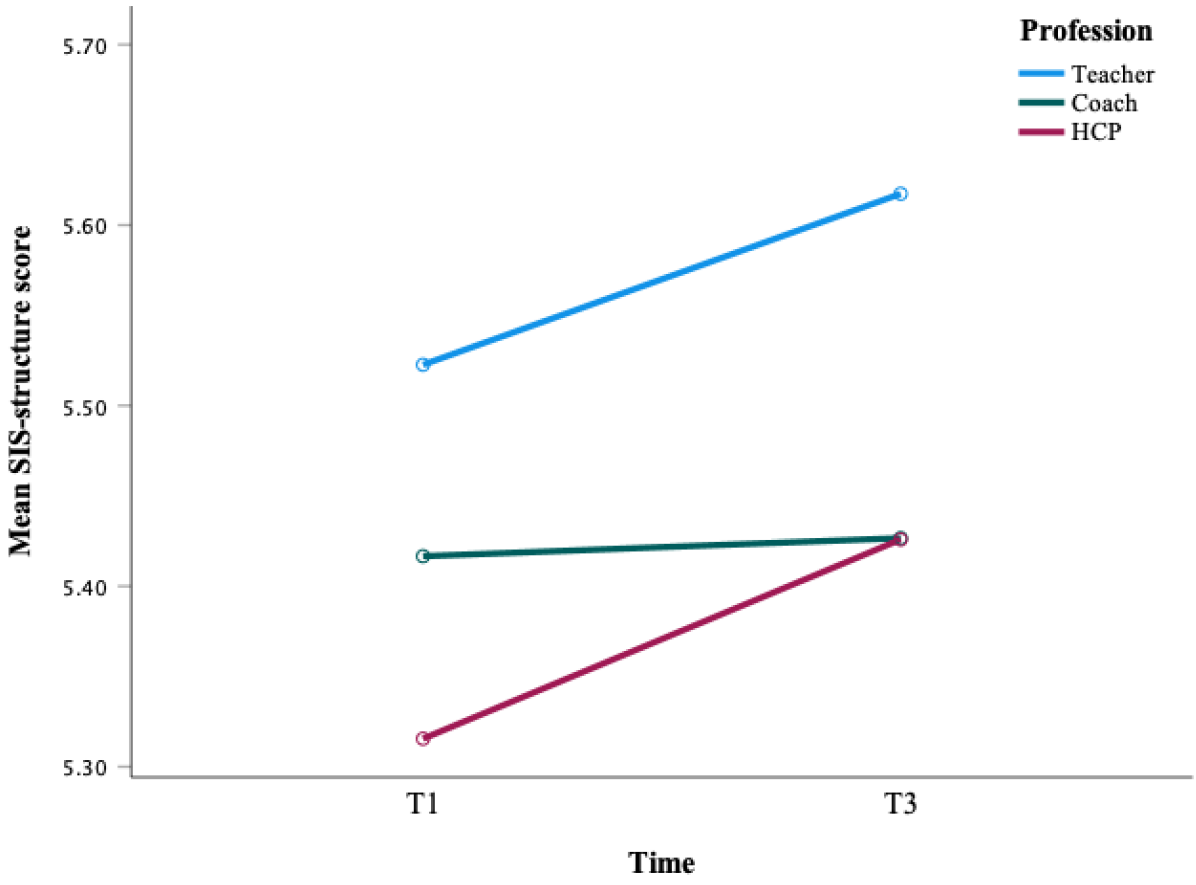
Table 8.

Combined ANOVA-table for Between- and Within-subject Effects on Structuring Style.

Source	Sum of Squares	df	Mean Square	F	*p*	η_p^2
Time	0.197	1	0.197	1.314	.255	.015
Time*Profession	0.072	2	0.036	0.240	.788	.006
Error (Time)	12.564	84	0.150	-	-	-
Profession	1.181	2	0.590	0.573	.566	.013
Error	86.500	84	1.030	-	-	-

Figure 6.

Estimated Marginal Means for Structuring Style by Profession.



These results indicate that the training did not significantly improve structuring style for any professional group. As seen in Figure 6, PE teachers had consistently slightly higher scores of structuring style than the other professionals, but this difference was not statistically significant.

5.2.3. Differences between professions in effects on chaotic style

Results of the mixed ANOVA on chaotic style are shown below in Table 9. The analysis showed a significant main effect of time on chaotic style with moderate effect size ($F(1, 84) = 6.41$, $p = .013$, $\eta_p^2 = .071$), where on average, chaotic style decreased from T1 ($M = 2.47$, $SD = .71$) to T3 ($M = 2.30$, $SD = .71$). This means that regardless of profession, participants' use chaotic style decreased over time. The main effect of profession on chaos was also significant and showed a large effect size ($F(2, 84) = 23.80$, $p = <. 001$, $\eta_p^2 = .362$), where profession explained 36.2 % of variance in chaotic style. On average, PE teachers had higher chaos scores ($M = 2.02$, $SE = .11$) than coaches ($M = 1.94$, $SE = .12$), but lower than HCPs ($M = 2.76$, $SE = .08$). As seen from Figure 7, HCPs' scores for chaotic style were consistently higher than the other professionals'. Post hoc comparisons were conducted using Bonferroni correction. The difference between teachers and coaches, 0.79 95 % CI [-0.32, 0.47], was not statistically significant ($p = 1.00$), but the difference between HCPs and teachers, 0.74 95 % CI [0.40, 1.07], and HCPs and coaches, 0.81 95 % CI [0.47, 1.16], was ($p < .001$). No significant interaction effect of time and profession on chaotic style was found ($F(2, 84) = 0.37$, $p = .692$, $\eta_p^2 = .009$).

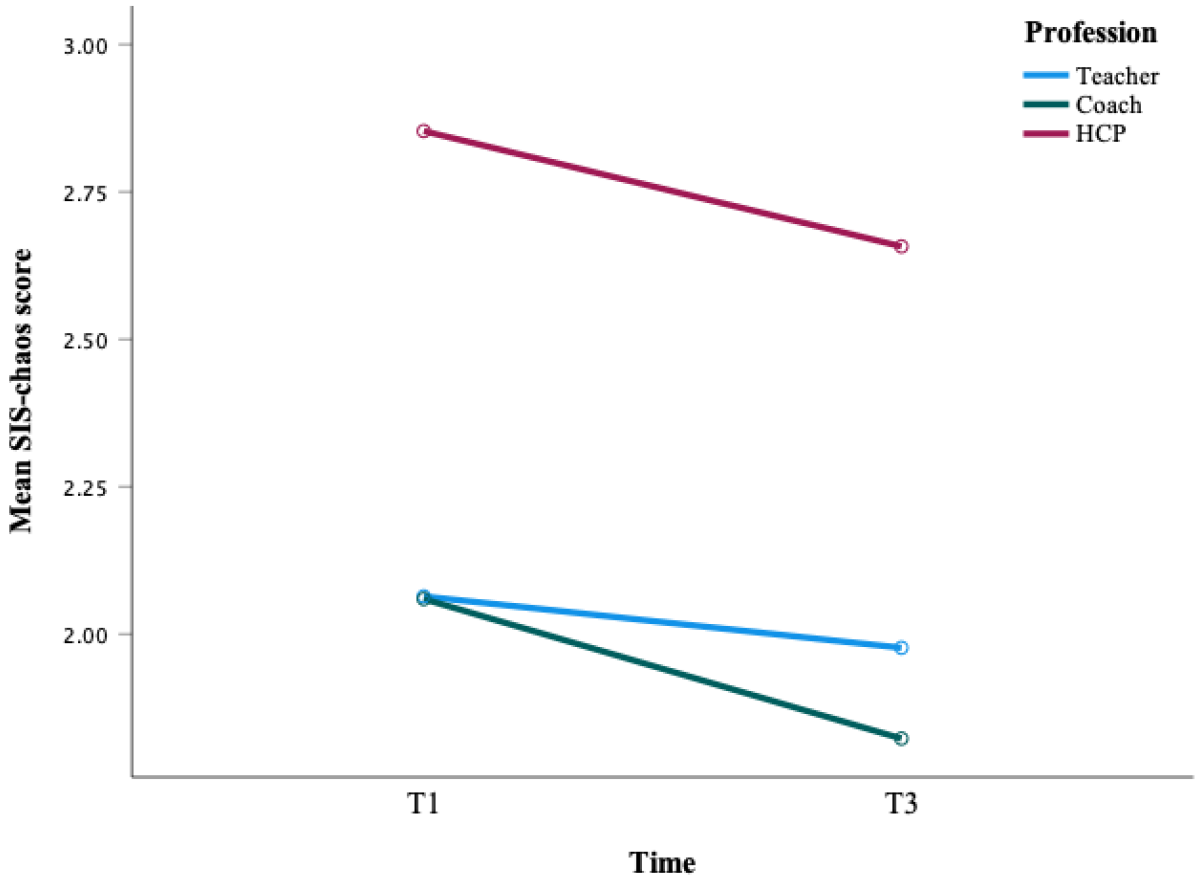
Table 9.

Combined ANOVA-table for Between- and Within-subject Effects on Chaotic Style.

Source	Sum of Squares	df	Mean Square	F	*p*	η_p^2
Time	1.146	1	1.146	6.406	.013	.071
Time*Profession	0.132	2	0.066	0.369	.692	.009
Error (Time)	15.027	84	0.179	-	-	-
Profession	26.054	2	13.027	23.804	<.001	.362
Error	45.971	84	0.547	-	-	-

Figure 7.

Estimated Marginal Means for Chaotic Style by Profession.



Together these results indicate that overall, the participants' chaotic style decreased during the intervention and there were significant differences between professional groups in their use of chaotic style. HCPs consistently reported higher use of chaotic style than other professionals and these differences were statistically significant. However, differences in chaotic style between PE-teachers and coaches were not statistically significant and time and profession did not have a significant joint effect on chaotic style.

5.2.4. Differences between professions in effects on controlling style

Results of the mixed ANOVA on controlling style are shown below in Table 10. The analysis showed a significant main effect of time on controlling style with large effect size ($F(1, 84) = 25.01$, $p < .001$, $\eta_p^2 = .229$), where mean scores for controlling style decreased from T1 ($M = 1.93$, $SD = .70$) to T3 ($M = 1.72$, $SD = .58$). This means that if the profession of participants

was ignored, their controlling style still decreased over time. Profession also showed a significant main effect on controlling style with medium-to-large effect size ($F(2, 84) = 4.50$, $p = .014$, $\eta_p^2 = .097$). On average, PE teachers had the highest scores for controlling style ($M = 2.09$, $SE = .12$), coaches had the second highest ($M = 1.90$, $SE = .13$), and HCPs the lowest ($M = 1.66$, $SE = .09$). As seen from Figure 8, this ranking was true at both T1 and T3. The mixed ANOVA also showed a significant interaction effect of time and profession on controlling style with medium-to-large effect size ($F(2, 84) = 4.57$, $p = .013$, $\eta_p^2 = .098$). This means that time had a different effect on control scores for participants in different professional groups. As seen visually from Figure 8, coaches' scores for controlling style decreased more over the intervention, than teachers' or HCPs'. Post hoc comparisons were conducted using Bonferroni correction. The difference between teachers and coaches, 0.19 95 % CI [-0.24, 0.63], was not statistically significant ($p = .825$), nor was the difference between coaches and HCPs, 0.24 95 % CI [-0.14, 0.62], $p = .364$. The only statistically significant difference was between teachers and HCPs, 0.44 95 % CI [0.07, 0.80], $p = .013$.

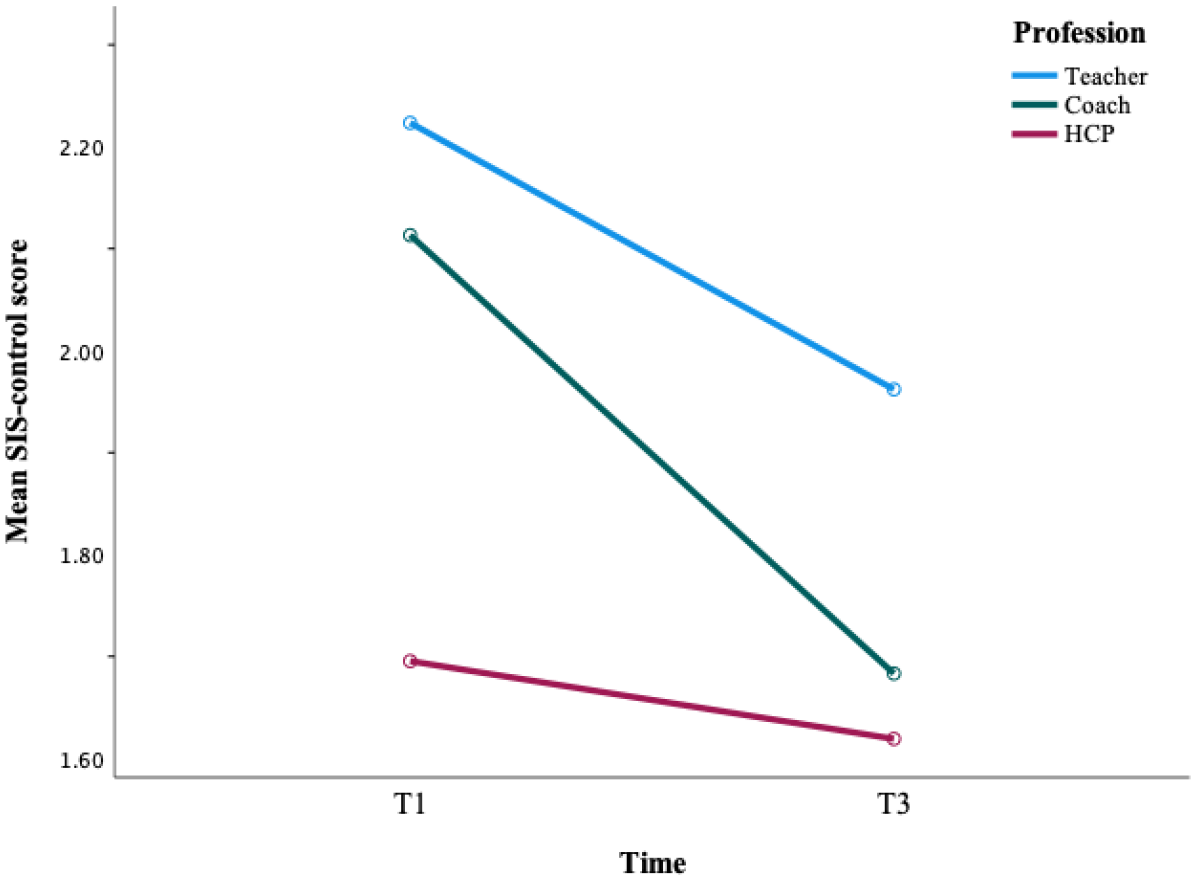
Table 10.

Combined ANOVA-table for Between- and Within-subject Effects on Controlling Style.

Source	Sum of Squares	df	Mean Square	F	*p*	η_p^2
Time	2.504	1	2.504	25.013	<.001	.229
Time*Profession	0.914	2	0.457	4.565	.013	.098
Error (Time)	8.409	84	0.100	-	-	-
Profession	5.898	2	2.949	4.490	.014	.097
Error	55.168	84	0.657	-	-	-

Figure 8.

Estimated Marginal Means for Controlling Style by Profession.



These results indicate that participants' controlling style decreased during the training among all professional groups. Additionally, there were consistent differences between professional groups in controlling style, where only differences between HCPs and PE-teachers were statistically significant. Time and profession also had a statistically significant joint effect on controlling style, where the decrease over time in controlling style was the strongest for coaches and weaker for other professionals.

5.3 Q3: Predictors of changes to autonomy supportive and structuring styles

The third research question concerned whether participants' quality of motivation toward using motivating styles and their use of implementation intentions to break or form habits predicted changes to motivating styles. This was assessed using standard multiple regression analysis. The analyses were conducted separately for the two motivating styles, with the style (i.e., au-

tonomy support or structure score at T3) as the dependent variable and implementation intentions, autonomous motivation, and controlled motivation as independent variables. Motivating style at T1 was used as a control variable.

First, the sum mean variable for measuring implementation intentions was made. This new variable had weak reliability (Cronbach's alpha, $\alpha = .580$), but its two items were positively related ($r = .43$, $p < .001$). Descriptive statistics of the independent and dependent variables and correlations (Pearson's *r)* between them are shown in Table 11.

Table 11.

Means, Standard Deviations, and Correlations of Dependent and Independent Variables.

	M	*SD*	1.	2.	3.	4.
1. Autonomy support T3	5.87	.70				
2. Structure T3	5.47	.68	.636***			
3. Implementation Intentions	2.62	.79	.026	.035		
4. Autonomous motivation	4.53	.68	.355***	.051	.339***	
5. Controlled motivation	1.81	.98	- .183	- .133	- .100	- .240*

Note. * p < .05, ** p < .01, *** p < .001.

Secondly, assumptions of the standard multiple regression model were tested: multicollinearity, independent errors, outliers, influential cases, linearity, normal distribution of errors, and homoscedasticity. Despite some independent variables correlating with each other (see Table 11), the assumption of multicollinearity was not violated. This means that there was no perfect linear relationship between the predictors (Field, 2018). VIF values were not substantially greater than 1 at scores between 1.062 and 1.188, which indicated that the regression models were not likely biased (Field, 2018). Tolerance values ranged between 0.842 and 0.942, and thus did not have values under 0.2 (Field, 2018). Assessment of eigenvalues also indicated no multicollinearity, as variance proportions on small eigenvalues loaded unto different dimensions (Field, 2018). For both regression models, the assumption of independent errors was also met, as Durbin-Watson tests showed values close to 2 (2.194 for autonomy support and 2.347 for structure) (Field, 2018). Outliers and influential cases were assessed through computing residuals, which mean "the differences between the observed values of the outcome and the values predicted by the model" (Field, 2018, p.381). For both regression models Mahalanobis distance had no values over 15 and for no cases was Cook's distance over 1, which indicate that no case seemed

to have undue influence on the model (Field, 2018). Similarly, DFBeta values were between -1 and 1 and covariance ratios were close to 1, further indicating that the assumption was met (Field, 2018). The assumption of normal distribution of errors and linearity was also met for both models, as assessed with histograms and P-P plots (Field, 2018). However, partial regression plots showed that the assumption of homoscedasticity was not fully met, as scatterplots did not show a fully random distribution of cases, thus indicating heteroscedasticity (Field, 2018). Violation of the assumption of homoscedasticity was acknowledged in interpreting the results of the analyses.

Regression model for autonomy supportive style

To perform a standard multiple regression all independent and control variables were entered into the model at the same time, using forced entry. Results of the regression analysis for autonomy supportive style are reported in Table 12 below. The four variables together explained 59 % of the variance in T3 autonomy support scores ($R^2 = .586$, $F(4,80) = 28.29$, $p < .001$). Primarily, this was due to the strong predictive value of pre-training interaction style (see Table 12). Out of the three independent variables, only autonomous motivation toward using motivating styles significantly predicted T3 autonomy supportive style ($\beta = .27$, $p < .001$). Implementation intentions and controlled motivation did not significantly predict autonomy support.

Table 12.

Linear Model of Predictors of T3 Autonomy Supportive Style.

Effect	*b*	SE B	β	*p*
Constant	0.922	.551		.098
Autonomy support T1	0.682	.074	.699	<.001
Autonomous motivation	0.283	.080	.279	<.001
Controlled motivation	0.052	.054	.074	.337
Implementation Intentions	-0.104	.067	-.119	.124

Regression model for structuring style

As seen from Table 11, structuring style at T3 did not significantly correlate with any independent variables, indicating that there was no significant linear relationships between them. Results of the regression analysis for structuring style are reported in Table 13 below. The four variables

together explained 57 % of variance in T3 structuring style, which was statistically significant ($R^2 = .567$, $F(4,80) = 26.20$, $p < .001$). This was due to the strong predictive value of T1 structuring style, as none of the predictors significantly predicted the dependent variable (see Table 13). These results suggest that there were no suppression effects between the variables used in the regression analysis which would have made correlations between variables statistically non-significant but would have been significant in a multivariate analysis.

Table 13.

Linear Model of Predictors of T3 Structuring Style.

Effect	*b*	SE B	β	*p*
Constant	0.942	.629		.138
Structure T1	0.751	.075	.752	<.001
Autonomous motivation	0.114	.091	.101	.214
Controlled motivation	-0.006	.060	-.008	.915
Implementation Intentions	-0.008	.076	-.008	.921

5. Discussion

The aim of this study was to examine effects and processes of the MSS intervention in improving PA promotion and sports professionals' (de)motivating styles. This was done by assessing changes in participants' interaction styles pre- and post-training, assessing whether there were differences in these changes between professional groups, and exploring whether certain novel aspects of the intervention predicted changes to motivating styles. This section offers further insight into the results and their interpretation, as well as discussion on the limitations and strengths of this study and its implications for future research.

6.1 Changes to (de)motivating styles

Firstly, it was hypothesised that participants' autonomy supportive and structuring styles would increase during the training whilst controlling and chaotic style would decrease. These hypotheses were mostly supported, as participants' scores of autonomy supportive style increased and scores of chaotic and controlling styles decreased. However, hypothesis H2 was not supported, as changes to structuring style were statistically nonsignificant. Beyond statistical significance, all (de)motivating styles showed moderate effect sizes. Thus, these results offer support for the claim that the MSS intervention program can be successful in improving participants' (de)motivating styles.

These results are in accordance with previous studies, in which SDT-based interventions have been generally found effective in increasing sports professionals' autonomy supportive interaction and decreasing controlling interaction (Raabe et al., 2019). Similarly to the present study, other intervention studies have found statistically significant changes to some, but not all four (de)motivating styles (e.g., Conesa et al., 2023; Duprez et al., 2022). Thus, it seems like different training programmes, focusing on different professions, have been effective in significantly improving different motivating styles. For instance, compared to Vancampfort and Mugisha's (2022) study on HCPs in Uganda, the effect sizes attained in the present study were smaller, although in their study significant changes were detected for all four styles. Duprez and colleagues' 2022 study focusing on improving nurses' interaction practices on the other hand found statistically significant changes to only controlling style, although clinically significant changes were detected for all styles (Duprez et al., 2022). There could be many reasons for why

different interventions have had differing effects, for example differences in intervention delivery (i.e., online or in-person), target group, and intervention content. Furthermore, intervention aspects such as fidelity of delivery, participant receipt, and enactment may influence the effects of behaviour change interventions (Hankonen, 2021). These differences and often lacking descriptions of intervention content in research articles, such as the BCTs used (Palsola et al., 2023), can make it difficult to compare studies.

In terms of the present study, no statistically significant changes were found in structuring style, differentiating it from the other three styles. Many explanations may be given for why the expected increase in participants' structuring style was not found. For one, the sample size might have been too small for real changes detected, as suggested by the moderate effect size, to reach statistical significance. Statistical significance is strongly influenced by sample sizes, so that in small samples even large differences may be statistically nonsignificant (Field, 2018). Nevertheless, when inspecting statistical significance, the results indicate that compared to other styles, structuring style did not change during the intervention as much as others. Based on Aelterman and Vanteenkiste's (2023) account of the (de)motivating styles, this result could be explained by the fact that social agents often find it difficult to combine autonomy support and structure in practice. Professionals might be worried that supporting autonomy undermines structure and leads to an overly permissive climate where students, patients, and athletes feel overwhelmed (Aelterman & Vansteenkiste, 2023). On the other hand, professionals may feel like providing too much structure can turn into rigid pressure and control (Aelterman & Vansteenkiste, 2023). In terms of the present study, the latter of these scenarios could explain why structuring style did not significantly increase: perhaps it felt too similar to controlling style. According to Aelterman and Vansteenkiste (2023), these concerns are legitimate because in daily practice poorly timed or poorly applied structuring techniques may be seen as controlling by some. Thus, although the MSS intervention explicitly focused on teaching both autonomy supportive and structuring interaction techniques, it may be that structuring practices were not for example practiced as much or learnt as well as autonomy supportive ones. According to Puolamäki and colleagues' (2024) feasibility study, in the present MSS intervention structuring interaction techniques were well used, but there was more variation in their use compared to autonomy supportive techniques. Based on these results, future reruns of the MSS intervention could benefit from focusing more on improving participants' structuring practices. For instance, allocating more time towards structuring style or discussing structuring techniques earlier on during the intervention could perhaps influence changes to this style.

In the present study changes to (de)motivating styles were assessed only on the level of the four overarching styles. A more fine-grained examination of the eight subareas within the circumplex model (Aelterman et al., 2019) could have showed more nuance in changes to the styles. In terms of structuring style for instance, it could be that participants' self-reported use of guiding approaches, which are more proximal to autonomy support within the model, improved more during the training than their clarifying approaches. Clarifying practices are located next to demanding approaches within the circumplex, meaning that they generally correlate positively with controlling interaction practices, rather than autonomy supportive ones (Aelterman & Vansteenkiste, 2023). Such differences between the subareas of (de)motivating styles could theoretically in part dampen changes to the overarching style. Due to the scope of the present study, examining possible differences in the interventions' effects among the eight subareas was not possible. However, future research on the MSS intervention and other SDT-based interventions could benefit from giving more attention to these subareas, as currently most studies have only focused on the four overarching styles (e.g., Duprez et al., 2022; Vancampfort & Mugisha, 2022).

6.2 Changes to (de)motivating style over time among different professions

A novel aspect of the MSS programme was its sample, which consisted of participants working in multiple professions within the field of PA promotion and sports. As discussed in Section 2.1.4, previous SDT-based intervention studies have generally only targeted one professional group, which raises the question of whether the same intervention may have different effects on different professional groups. In this study, the effects of time on (de)motivating styles were similar regardless of participants' profession. This means that regardless of participants' profession, their autonomy supportive style increased, and controlling and chaotic styles decreased, with medium and large effect sizes. These results support the notion that the MSS intervention can be an effective way to improve professionals' (de)motivating styles among multiple professions.

In addition to time, participants' profession also showed main effects on demotivating styles, indicating consistent differences among professional groups in controlling and chaotic styles. These results suggest that on average, HCPs used a more chaotic interaction style than other PA and sports professionals, whereas PE teachers generally used a more controlling style than

HCPs. These differences between professions might be caused by many factors, such as differences in education and culture in different fields within sports and PA (e.g., Ntoumanis & Mallett, 2014). For example, it has been stated by Taylor and colleagues (2009) that Western educational cultures are generally based on teacher-centred controlling practices, which influences many PE teachers' views on power and authority. Additionally, PE teachers may be under a lot of pressure from student assessments, performance evaluations, conformity pressures, cultural norms, and time constraints, which increase their use of controlling strategies (Ntoumanis & Standage, 2009). In terms of sports coaches, for example youth coaches often do not coach full-time or receive in-depth education for coaching which would include addressing the motivating role of coaches (Reynders et al., 2019). Because of this, coaches' interaction behaviour may often rely on their personal beliefs, experiences, and role models, such as elite sports coaches who generally tend to be highly controlling and directive (Reynders et al., 2019). In terms of HCPs on the other hand, in health care professions it may be highlighted that patients should be met with a highly emphatic interpersonal tone (e.g., Söderlund et al., 2011), which could lead to HCPs using more chaotic techniques to avoid being overly controlling. Thus, the contextual differences, traditions, cultures, and work characteristics are likely to lead to differences in motivating interaction techniques used by professionals. Aelterman and Vansteenkiste (2023) state in their account of the circumplex model that in addition to using motivating interaction styles and avoiding demotivating ones, it is important that professionals know how to use motivational tailoring and calibrate their use of different motivational approaches based on the situation and people at hand. Based on this, some interaction practices could be better suited for certain situations than others, making it possible that the occupational characteristics discussed above could lead to differences in which approaches are most adaptive in each profession.

In addition to main effects of profession on controlling and chaotic style, a significant interaction effect of time and profession was found for controlling style. The mixed ANOVA showed that sports coaches' scores for controlling style decreased from pre-training to post-training more than the other two professional groups'. This suggests that the MSS intervention might have been especially successful in improving coaches' controlling style. Interestingly, despite showing the biggest decrease in controlling style over time, overall coaches' scores for controlling style were lower than teachers', higher than HCPs', and not statistically significantly different from the other two groups. Thus, the bigger change to coaches' interaction style was not linked to them for example having higher pre-training levels of controlling style. It could have

been expected that those who reported using controlling practices more before the training, i.e., PE teachers, would have showed the biggest decrease in controlling style over time, as the intervention included learning about the negative influence of demotivating interaction.

Many explanations could be behind why coaches' controlling style seemed to change more during the intervention than others', and why such joint effects of profession and time were not found for other styles. For instance, it could be that the MSS intervention programme happened to utilise content, techniques, or practices that were most suitable for improving coaches' controlling interaction behaviours, such as information and homework that fit especially well into coaches' work environment or professional training. It could also be that coaches' work environment or social atmosphere had features which supported lessening use of controlling interaction. Furthermore, it is possible that instead of reflecting larger changes to coaches' actual interaction behaviour, the detected difference among professional groups may reflect differences among the three SIS-questionnaire versions or the influence of social desirability bias (Van De Mortel, 2008). Perhaps coaches felt more social pressure to answer in less controlling ways compared to other professions or perhaps the SISQ-Sport questionnaire was more sensitive to detecting changes in controlling style than the other questionnaires. Additionally, many confounding factors could be behind this interaction effect. For example, in a 2011 meta-analysis of the effectiveness of interventions to support autonomy, Su and Reeve found that professionals' work experience and causality orientation influenced training effects. They stated that interventions were generally more effective if participants were inexperienced and had more autonomy-oriented causality orientations (Su & Reeve, 2011). It could be that in the present study, coaches differed from others in such ways, thus explaining the larger change to their controlling style. Nevertheless, based on the analyses of this study such explanations are only guesswork. To better understand reasons behind differences among professions, future studies would benefit from using control groups, controlling for confounding variables, and looking more closely at factors influencing participants' (de)motivating styles.

6.3 Predictors of changes to motivating styles

Lastly, other novel aspects of the MSS programme were assessed in terms of their predictive power on changes to autonomy supportive and structuring styles. For autonomy supportive style, only participants' autonomous motivation toward using motivating styles was predictive

of post-training scores when pre-training scores were controlled for. This means that autonomous motivation significantly predicted changes to autonomy supportive style, whilst controlled motivation and making and enacting implementation intentions did not. This result is partly in line with previous research, where social agents' own quality of motivation has been linked with the motivating practices they use (e.g.,, Reeve, 2009). In the present study participants' quality of motivation was measured in terms of their motivation toward using motivating styles, not towards their work itself. SDT states that individuals' quality of motivation influences the content of goals set, as well as pursuit towards them (Deci & Ryan, 2000). For instance, goals that support or satisfy the needs for autonomy, competence, and relatedness facilitate behavioural persistence (Deci & Ryan, 2000). Thus, it is in accordance with SDT that the more participants of the intervention felt like their motivation toward using certain interaction styles was autonomous and stemming from themselves, rather than controlled, the more successful they would be in changing their behaviour. However, autonomous motivation predicted only autonomy supportive style, whilst associations between quality of motivation and structuring style were nonsignificant. This could be due to the fact that the regression model assessed the predictive power of the independent variables in terms of changes to motivating style between pre- and post-training scores. As these scores for structuring style were not significantly different from each other, there was little variation left in post-training scores to predict after controlling for pre-training scores.

No significant associations were found between implementation intentions and motivating styles. There could be many reasons for this. For one, implementation intentions are narrow by nature, focusing on changing only certain specified reactions to certain contextual cues (Gollwitzer & Oettingen, 2016). It could be that even though participants made and consciously enacted if-then plans, the contents of these plans were such that they did not influence their overall interaction styles in scenarios such as those represented in the SIS-questionnaires. Furthermore, it has been found that implementation intentions may be more effective for outcomes measured with objective measures (i.e., device-based or task performance) than self-report measures (Sheeran et al., 2024). This suggest that the outcome measures of the current study may not have been optimal for detecting possible effects of implementation intentions. Additionally, not finding significant linear relationships between implementation intentions and motivating styles could be explained by possible nonlinear relationships between them. As discussed in Section 2.2, a recent meta-analysis by Sheeran and colleagues (2024) found that the number of implementation intentions made was not linearly associated with effect sizes, nor

did the amount of their rehearsal influence effect sizes in a linear manner. Overall, the method of measuring implementation intentions in the current study (i.e., a sum score of number of implementation intentions made and frequency of intentional enactment of them) may have been unsuitable for detecting the influence of implementation intentions, as the effects of these features may be complex. Future research on the influence of number of plans made and their rehearsal could help inform intervention studies and reruns of the MSS intervention on how to operationalise implementation intentions and what kinds of effects and relationships to expect. Lastly, implementation intentions were only one of many habit theory -based BCTs utilised in the MSS programme (Puolamäki et al., 2024). To get a better understanding of the role of implementation intentions as a tool for changing motivating styles, it would have been beneficial to compare different BCTs and their predictive power for changes to (de)motivating styles. Future studies of the MSS intervention could assess the impact of all utilised BCTs to better outline which techniques are most useful in motivating interaction behaviour change.

6.4 Limitations, strengths, and implications of this study

This study offers preliminary support for the MSS training intervention being effective in improving PA and sports professionals' motivating interaction styles. Nevertheless, due to multiple limitations, these results should be interpreted with care.

Firstly, a central limitation of this study was the lack of a control group due to its pre-experimental one-group pretest-posttest research design. Because all participants went through the same intervention and there were no control groups, it cannot be said definitely, whether the outcomes were influenced by the intervention itself or by other factors (Creswell, 2014). Thus, the lack of a control group may negatively influence the validity of the results. Validity refers to the extent to which meaningful and useful inferences can be drawn from the results of a study (Creswell, 2014). According to Creswell, experimental procedures, treatments, and experiences of participants can threaten the internal validity of a study (Creswell, 2014). For example, external events might have influenced participants during the intervention, or participants might have matured or changed during the experiment, both of which could lessen the validity of the results (Creswell, 2014). A pre-experimental design was used because this study was conducted during the feasibility phase of developing the MSS intervention. As such, the aim of this study

was to provide preliminary results on the effects of the intervention and to explore its mechanisms, in preparation for a possible later study focusing on evaluating the intervention (Skivington et al., 2021). A pre-experimental design was appropriate for these purposes, as it offers a relatively cost-effective and easy to implement way to assess the effects of an intervention, compared to a true experimental or quasi-experimental design (Creswell, 2014). Additionally, the longitudinal nature of this study's research design was its strength, as comparisons between pre-training and post-training scores allowed for assessing changes over time, even if the effect of other variables cannot be ruled out. Overall, the feasibility phase of intervention development is important in evaluating and developing complex interventions (Skivington et al., 2021). Results on the effects and processes of the MSS intervention attained during this feasibility phase can help in refining the intervention before a full-scale evaluation study (Skivington et al., 2021). Additionally, results on effect sizes attained in this study can be used to calculate sample sizes necessary to achieve a certain level of statistical power in future reruns of the MSS intervention (Field, 2018).

Secondly, the sample of this study may pose some limitations to the validity and generalisability of its results. Importantly, 58 participants were excluded from this study due to not answering necessary post-training questionnaires, which may have led to nonresponse bias (Agresti, 2018). Nonresponse bias refers to biased results caused by differences between the respondents and nonrespondents (Agresti, 2018). Based on analyses of associations between demographic variables and post-training nonresponse, the included and excluded participants did not differ in terms of most demographic variables, except for age. This suggests that participants' age might have influenced whether they dropped out during the intervention or whether they chose to answer the post-training questionnaire, which may have caused biased results (Agresti, 2018). The rate of nonresponse was substantial (i.e., 58 out of 145; Agresti, 2018). It could be, that the MSS intervention had different effects on nonrespondents than the included participants, which decreases the generalisability of the attained results (Agresti, 2018).

Because the data came from the feasibility phase of developing the MSS intervention, assessing the effects of the intervention was not the main goal when delivering the intervention, choosing the sample size, or gathering the data. Thus, the sample size was relatively small for running complex analyses, which may have negatively influenced the statistical power of the analyses done (Field, 2018). A larger sample size would have likely influenced the results attained, as in general larger sample sizes lead to increased statistical significance (Field, 2018). Nevertheless,

effect sizes attained in the present study suggest that the intervention was moderately effective in improving participants' (de)motivating styles, regardless of statistical significance of p-values. Additionally, compared to many other SDT-based intervention studies the sample of this study was relatively large: in Raabe and colleagues' review of 21 articles, most had less than 20 social agents as participants (Raabe et al., 2019).

Nevertheless, the sample of this study may have influenced the external validity of the results. External validity refers to the extent to which correct inferences can be drawn from the sample data to other settings, people, and future or past situations (Creswell, 2014). A strength of this study was its use of a multidisciplinary sample, with participants from multiple professions. The results suggested that the MSS intervention was successful in improving (de)motivating styles across different professions, which supports the generalisability of these effects. However, sampling methods used may have negatively influenced the validity and generalisability of the results. Participants were volunteers recruited via convenience sampling, so assumably all participants were already interested in the topic of motivating interaction and were motivated to improve their professional skills. Generally, participants also reported relatively high use of motivating styles and low use of demotivating ones throughout the training. Results on the effects and processes of the intervention could be different if participants used extremely controlling styles before training, for example.

Thirdly, the measurements used in this study had certain strengths and limitations. The outcome variables in all analyses were based on self-report questionnaires. Overall, the SIS-questionnaires have been shown to have good psychometric properties (e.g., Aelterman et al., 2019; Duprez, Vansteenkiste, et al., 2021) and the use of self-report data has its benefits. For one, self-report questionnaires are relatively easy and quick to administer, as opposed to for example observational measures (e.g., Evans et al., 2015). Nevertheless, self-report questionnaires are known to be liable to many biases, such as social desirability bias, where respondents tend to portray a favourable image of themselves (Van De Mortel, 2008). For example, post-training answers might have been influenced by social desirability bias, as after going through the training participants may have wanted to present a positive image of themselves doing the "right" thing (i.e., using motivating styles and not using demotivating ones). To detect and control for the influence of social desirability, social desirability scales could have been used to improve the validity of the results, as even measures with good psychometric properties can be susceptible to these biases (Van De Mortel, 2008). Despite the good and acceptable psychometric

properties of the SIS-questionnaires (Delrue et al., 2019; Duprez, Vansteenkiste, et al., 2021; Escriva-Boulley et al., 2021), in general professionals' self-reported behaviour does not necessary correspond with their actual interaction practices. For instance, Mageau and Vallerand (2003) have stated that coaches do not necessarily notice their own controlling interpersonal style and may have limited awareness of their interaction behaviour, as seen in low or nonsignificant correlations between coaches' self-reports and observers' ratings. However, vignette-based questionnaires have been shown to have many benefits over other self-report measures (Duprez, Vansteenkiste, et al., 2021). For example, people's responses to vignettes have been shown to strongly reflect real-life behaviour (Hainmueller et al., 2015), making them ideally highly generalisable whilst avoiding the practical, ethical, and scientific limitations of many other methodologies (Evans et al., 2015). Still, use of multiple outcome measurements has been recommended (e.g., Su & Reeve, 2011). In their meta-analytic study on the effects of SDT-based interventions Su and Reeve (2011) concluded that using objective raters to assess effectiveness of interventions is warranted, although self-report measures can be a valid supplement. Ideally, multiple measures would have been used to assess changes to (de)motivating styles, such as ratings from colleagues, clients, students, athletes, or trained observers (e.g., Duprez, Haerens, et al., 2021; Su & Reeve, 2011). For example, observation tools such as the SDT-based COUNDEL-CCE tool for assessing HCPs counselling style, could be utilised in future studies to move research beyond mere self-report measures (Duprez, Haerens, et al., 2021). Additionally, future studies on the MSS intervention should include measurements from follow-ups after the intervention. A central aim of the MSS intervention was to create long-term behaviour change through incorporating novel features from habit theory and behaviour change science (Palsola et al., 2023), so assessing long-term changes would have been important for seeing whether the programme had its aimed effects. To examine these effects, future research should include data from multiple time-points after completing the programme. As such, more robust research into the MSS training programme is needed to make strong claims on its effects.

Lastly, in addition to the research design and data used, limitations regarding the statistical analyses and properties of the data may have influenced the statistical conclusion validity of this study (Creswell, 2014). In terms of the measures used, SIS-HCP showed suboptimal (T1) and poor (T3) reliability for assessing HCPs' chaotic style. This could decrease the reliability of the results attained from the mixed ANOVA, where HCPs were found to have higher scores on chaotic style than other professionals. For most of the analyses, assumptions of the tests were met. However, in the regression analyses the assumption of homoscedasticity of errors

was not fully met, which may have caused bias in results of the regression models (Field, 2018). According to Field, if the assumption of equal variance of residuals (i.e., homoscedasticity) is very clearly not met, the variable is heteroscedastic. Heteroscedasticity can make confidence intervals and significance tests invalid (Field, 2018), but in the present study violations of the assumption of homoscedasticity were small. Nevertheless, results of the regression analyses should be interpreted with caution and more vigorous tests with larger sample sizes should be done in future studies to assess predictors of changing (de)motivating styles within the MSS intervention.

Regardless of the limitations of this study, the results attained could have important implications for future research and practice. Most importantly, these results can be used to inform future phases of developing the MSS intervention, such as calculating necessary sample sizes for a full-scale RCT trial (Field, 2018). Furthermore, based on this study, future research on both the MSS intervention and other SDT-based training programmes could focus on examining the mechanisms of changing structuring style and its subareas more closely, as overall research on structuring interaction is still sparse (Aelterman & Vansteenkiste, 2023). It could be beneficial to put even more emphasis on training social agents in using structuring interaction whilst avoiding its controlling aspects. For instance, in a meta-analytic study on teachers' provision of structure in education, it was stated that certain structuring practices, such as giving feedback, have a greater potential of being experienced as controlling than others (Patall et al., 2024). Although in general the meta-analysis showed that classroom structure was positively associated with student achievement, engagement, and competence beliefs, the authors stated that minimizing the use of need-thwarting aspects of structure should be emphasized in future interventions (Patall et al., 2024). According to Patall and colleagues (2024), it is important to maintain a holistic view of supporting students' motivation and well-being when using structuring techniques. In the MSS intervention this was acknowledged as instilling a compassionate general philosophy of supporting others was a key objective of the intervention (Palsola et al., 2023).

Additionally, future research could benefit from looking more closely at determinants of PA promotion and sports professionals' (de)motivating styles, such as the influence of professional background and work experience. Conducting more research comprising of multiprofessional participant groups could offer new insights into how participants' profession influences behaviour change processes and effects of interventions. Furthermore, future studies on MSS and

other SDT-based interventions would benefit from measuring long-term changes to participants' interaction behaviour. A central novel aspect of the MSS intervention is its implementation of habit theory into SDT-based training, and to truly assess the benefits of this approach follow-up measurements of should be used. Additionally, as the MSS intervention aimed to have a distal influence on students', patients', and athletes' PA and sports participation and psychological well-being (Palsola et al., 2023), future studies on the intervention could look at whether changes to (de)motivating styles translate to these distal outcomes. Lastly, based on the results of this study, future behaviour change interventions aiming to change participants' interaction styles may benefit from focusing on supporting participants' autonomous motivation toward change. By incorporating principles of SDT and need-supportive interaction within implementation and delivery the training programmes themselves, participants may feel more autonomously motivated to incorporate learnt practices into their everyday lives.

This study focused on motivating interaction and behaviour change in the context of PA promotion and sports. However, the results of this study can be applicable to other professional contexts as well. For instance, (de)motivating styles can be seen to have a large role in education and organisational performance (e.g., Deci et al., 1991; Slemp et al., 2018). Future intervention research could benefit from applying practices used in the MSS programme to other fields. For example, incorporating behaviour change practices and aspects of habit theory into leadership training programmes could help managers change their interaction styles to improve employees' need-satisfaction, autonomous motivation, work performance and organisational well-being. The possible applications of SDT-based interventions are near endless and further research into this field offers promising avenues for improving individual-, group- and societal level outcomes (Ryan & Deci, 2017). In addition to the impact of proximal social contexts, such as schools or sports teams, the influences of broader cultural, economic, and political contexts on are acknowledged in SDT (Ryan & Deci, 2017). For instance, cultural socialisation practices, political systems, and economic inequalities have significant influence on not just individuals, but also societies, the human race, and the environment (Ryan & Deci, 2017). Due to this social-psychological lens, SDT can be used to improve not only proximal social contents, but also to make policy recommendations to change broader social systems for the better (Ryan & Deci, 2017). Ultimately, future research on SDT can improve understanding of environmental and social factors that influence people's motivation and well-being and ultimately improve quality of life and advance the flourishing of humanity (Ryan & Deci, 2017). Based on the results of this study, the MSS intervention could be a step towards this direction.

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List of figures and tables

Appendices

Appendix A
Preregistration form of the study, sent by email to Nelli Hankonen on October 13th, 2023.

Information about the study

Title
Improving professionals' motivational interaction styles: A study of preliminary results on the effects of the MotiStyleSport training intervention

Author:
Katarina Kohonen

Date of preregistration
19.10.2023

Research questions and hypotheses
Q1: Are there differences in professionals' motivational interaction styles before and after the training and if there are, what are the differences like?

H1: Participants' scores of autonomy-supportive interaction style are higher after the training than before the training.
H2: Participants' scores of structured interaction style are higher after the training than before the training.
H3: Participants' scores of controlling interaction style are lower after the training than before the training.
H4: Participants' scores of chaotic interaction style are lower after the training than before the training.

Q2: Are there differences between the three professional groups in changes to professionals' motivational interaction styles before and after the training?

Q3: Are participants' quality of motivation towards using motivating interaction styles and the amount of implementation intentions made and enacted to form or break habits predictive of participants' interaction styles after the training?

Description of data
MotiStyleSport feasibility study (Puolamäki et al., in prep.).

Is the data openly accessible?
[ ] Data is fully openly accessible
[x] Data has limited access
[ ] Data is not openly accessible

Where is the data archived?
-

Origin of the data
MotiStyleSport-project, year 2022.

Description of the timing of preregistration:
[ ] Preregistration before gathering the data
[ ] Preregistration before anybody has had access to the data

[ ] Preregistration before anybody in the research group had access to the data
[x] Preregistration before I have had access to the data
[ ] Preregistration before doing analyses
[ ] Preregistration before doing the main analyses

Is the data…
[ ] Gathered by another research group
[ ] Gathered by a private organisation, released for research purposes
[x] Gathered by own research group
[ ] Meta-analysis
[ ] Gathered by multiple research group in co-operation
[ ] Other, what?

Codebook of data:
-

Data sampling and collection methods
The data was gathered by Puolamäki and colleagues (in prep.) to investigate the feasibility and acceptability of the MotiStyleSport intervention. Their aims were to determine the feasibility and acceptability of a novel online group training intervention for Finnish physical activity (PA) and sport professionals and to investigate the feasibility of the intervention and trial procedures in preparation of a later full-scale randomized controlled trial.

The eligibility criteria for participants were that they 1) were currently working in some of the target professional groups (PA counsellor, PE teacher, physiotherapist, sports coach, or health nurse) for at least 50 % of their weekly work hours, and 2) had had at least six months of work experience. However, coaches who did not meet the 50 % paid working time criterion were included in the sample, based on their work experience, and working time, which is often unpaid in Finland.

Participants were recruited by Puolamäki and colleagues via multiple avenues: emails sent by national unions of PA and sports professionals to their members, stakeholders' social media posts, emails to target groups via the city of Helsinki, and mentions by members of the research group in talks to relevant audiences. 237 potential participants showed interest, from whom 146 participants were chosen based on balancing the professional group proportions and levelling gender differences. The participants represented a wide range of age groups, 75 % were women (n = 107) and 26 % men (n = 38). 74 participants were health care professionals, 39 coaches, and 32 PE teachers. Participants who belonged to multiple professional groups were placed into one group, based on their own view of their main profession. The data was gathered in the spring of 2022 at three time points: before the training (T1), mid-way through the training (T2) and after the training (T3).

Previous knowledge on the data, studies:
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Previous knowledge on the data, analyses:
[x] I have not analysed this data previously
[ ] I have analysed this data previously, but not the variables or measurements that I plan on analysing now
[ ] I have analysed this data before, including some of the planned variables. However, the data I use now is from a different section of data, from what I have analysed before (different participants or gathered at a different time)
[ ] I have used the same variables in previous analyses, but from a different part of the data (data divided in two)
[ ] I have used some variables from this data in previous analyses
[ ] I have used all variables from this data in previous analyses

Previous knowledge on the data, analyses:
I have not done or seen previous analyses with the data.

Previous knowledge on the data
This data has been gathered and used by Puolamäki and colleagues (in prep.) in their feasibility study of the MotiStyleSport intervention. I have read the 19.1.2023 version of their study's unpublished manuscript. From this manuscript, I have knowledge of the methods with which the data was gathered and descriptive statistics on some demographic variables (i.e., gender, age, professions). The version I have read did not include any results, and thus I have no knowledge of other descriptive statistic or relationships between any variables.

Variables used in the study and their conversions:

Professional groups: PE teachers, coaches, health care professionals (physiotherapists, health nurses, physical activity counsellors).

Motivational interaction styles. Self-reported motivational interaction styles were measured at T1 (pre-training) and T3 (post-training) with three versions of the Situations-in-Schools (Aelterman et al., 2019; SIS) questionnaire, all translated from English to Finnish. PE teachers' motivational interaction styles was measured with Escriva-Boulley and colleagues' (2021) SIS-PE questionnaire. For health care professionals, a slightly modified version of Duprez and colleagues' (2021) Situations in Self-management support – Health care (SIS-HCP) questionnaire was used. Coaches' interaction styles were measured with the SISQ-Sport questionnaire (Delrue et al., 2019). These questionnaires are similarly structured, consisting of descriptions of possible scenarios which professionals may encounter and four ways how they might behave in each situation. The four ways to behave reflect four distinct motivational interaction styles. Participants answer on a 7-point Likert scale, how well each behaviour describes how they would act, where 1 = does not describe me at all, and 7 = describes me extremely well. The three questionnaires differ in their scenarios to fit different professions. Additionally, the questionnaires have a different number of items (10 in SIS-HPC, 12 in SIS-PE, and 15 in SISQ-Sport). In this study, sum mean variables will be formed for each of the four motivational interaction styles, so that four new variables are formed (SIS-autonomy, SIS-structure, SIS-chaos, and SIS-control). After forming these variables, their frequencies and reliability (Cronbach's alpha) will be assessed, and necessary alterations made.

Making implementation intentions. Participants' making of implementation intentions to form or break their habits of using (de)motivating interaction techniques was measured at T3, with the question "Have you done the following during or after the training? I have made an if-then plan(s) for the automatic use of interaction techniques or to stop or replace automatic de-motivating behaviour". Answers were given on a 5-point Likert scale, where 1 = I have not made a plan, 2 = I have made a plan for the use of one or two techniques, 3 = I have made a plan for the use of 3-4 techniques, 4 = I have made a plan for the use of 5-6 techniques, and 5 = I have made a plan for the use of 7 or more techniques.

Enacting implementation intentions. Participants' intentional enactment of implementation intentions was measured at T3 with the question "Have you done the following during or after the training? I have intentionally enacted the interaction technique that I have defined in my if-then plan, when the cue was present". Answers were given on a 5-point Likert scale, where 1 = not once, 2 = once when the cue was present, 3 = sometimes when the cue was present, 4 = often when the cue was present, and 5 = always when the cue was present.

Quality of motivation. Participants' quality of motivation toward changing their motivational interaction styles was measured at T3 with two questions, where on a 5-point Likert scale, where 1 = not true at all, 5 = fully true, participants reported to what extent they want to use a need-supportive (autonomy-supportive and/or structuring) interaction style because they understand its importance, and to what extent because they feel pressured to do so. These two questions will be analysed as separate variables (autonomous motivation, controlled motivation).

Sections of the data used for analysis
Only some sections of the data will be used. I will use all measures from T1 (demographic variables, SIS-scores pre-training), and T3 (SIS-scores post-training, making and enacting implementation intentions, quality of motivation).

Outliers
Outliers can be identified and dealt with in multiple ways. I will begin by aiming to identify them visually with boxplots. If needed, other ways to identify outliers will be used in addition to this. How detected outliers are managed, depends on their nature and influence. Outliers can be left in the data if it seems like they do not influence the results substantially. In terms of Q1, this could mean comparing results of the t-test with and without the outliers included, and keeping the outliers, if the results do not change. Outliers may also be removed if they seem to represent faulty data points or data entry errors. If this is not the case, and the outliers seem to have a strong influence on test results, Wilcoxon Signed-Rank test can be used instead of the t-test.

Sample size:
The sample consists of N= 145 participants, who completed the pre-training baseline questionnaire. The original sample size of was determined by Puolamäki and colleagues (in prep.) based on their assessment of a sufficient sample size to answer their research questions related to the acceptability and feasibility of the intervention. In this study, only responses from participants who completed both the baseline survey and the end survey will be included. The small sample size influences the statistical power of this study. Because of this, the results of this study will offer only a preliminary account on the effects of the intervention.

Missing data
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Analyses
To answer Q1, I will use one-tailed repeated-measures t-test for analysing differences in participants' interaction styles pre- and post-training. For hypotheses H1-H4, the null hypothesis (H0) is that there is no difference between pre- and post-training SIS-scores. Separate t-tests will be run for each interaction style, showing whether there is a statistically significant difference in SIS-scores for each motivational style, in the expected direction. Upper-tailed t-tests will be used for H1 and H2, whilst lower-tailed t-tests will be used for H3 and H4. Descriptive statistics (mean, standard deviation, standard error) will be used to further assess differences in SIS-scores. Additionally, Cohen's d will be calculated for effect sizes if the null hypothesis is rejected.

Further analyses
If one-tailed t-tests do not support the hypotheses, explorative two-tailed t-tests will be used to assess whether changes to SIS-scores in the opposite direction took place.

Criterion for interpretation of results
I will use the p-value of $p < .05$ as criterion for statistical significance.
Cohen's d will be calculated to examine effect sizes, with $0.2 < d < 0.5$ interpreted as a small effect, $.5 < .8$ as a medium effect, and $d > .8$ a large effect.

Sensitivity analyses
Bonferroni correction can be used to reduce the likelihood of false positives (type I error) in testing the hypotheses H1-H4. Using Bonferroni correction reduces the likelihood of family-wise error rate (FWER). However, the Bonferroni correction may heighten the likelihood of false negatives (type II error) too much. This is especially true given the correlated nature of hypotheses H1-H4, which assess theoretically closely related phenomena. Another possibility could be using Tukey's method to calculate adjusted p-values, to ensure that a familywise error rate of 0.05 remains.

Back-up plans for analyses
The repeated-measures t-test assumes that the dependent variable (here, SIS-scores) is approximately normally distributed. Normality will be assessed first visually with histograms and Q-Q plots. From the histograms, skewness and kurtosis can be visually assessed. Additionally, skewness and kurtosis can be checked with descriptive statistics. If the assumption of normality is violated, then the Wilcoxon Signed-Rank test can be used instead of the t-test.

Explorative analyses
To answer Q2, I will run a mixed ANOVA separately for all four interaction styles, where the dependent variable is the SIS-score for a given interaction style, and the independent variables are time (within-subjects variable with two levels) and professional group (between-subjects variable with three levels). The results of the mixed ANOVA will be used to determine whether there is a statistically significant interaction between the independent variables on the dependent variable. If there is a significant interaction, meaning a difference between professional groups in the interaction's effects, post-hoc tests can be run to explore group differences more closely. Assumptions of the ANOVA will be assessed (e.g., normality, homoscedasticity, sphericity) and necessary adjustments will be made.

To examine Q3, a standard multiple regression analysis will be run with T3 SIS-scores as the dependent variable. It's still undecided, whether the analysis will be run for a combined score for multiple interaction styles (e.g., autonomy-supportive and structuring combined), or whether multiple analyses will be run, one for each motivational interaction style. If it's seen fit to examine Q3 in terms of change in participants' interaction styles (as opposed to just their post-training styles), SIS-scores at T1 will be used as a control variable. Professional group may also be used as a control variable. The independent variables will be 1) making implementation intentions 2) enacting implementation intentions 3) quality of motivation (autonomous), and 4) quality of motivation (controlled). Assumptions of the regression model will be assessed (e.g., homoscedasticity, multicollinearity, normality) and necessary adjustments will be made.

Other
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