A COMPARISON OF THE EFFICACY OF NEED-SUPPORTIVE AND NEED-THWARTHING INSTRUCTION ON SKILL PERFORMANCE, MOTIVATION, AND AFFECT

by

YONGJU HWANG

(Under the Direction of Sami Yli-Piipari)

ABSTRACT

This dissertation aimed to develop and validate a need-supportive and -thwarting instruction observation scale and to perform psychometric testing of the validity and reliability of the scale to assess instructors' instructional behaviors in the physical activity context. An additional aim of this dissertation was to compare the effects of Self Determination Theory-centered need-supportive and -thwarting instruction on participants' motivational, behavioral, and affective outcomes.

The questionnaire development and validation showed strong inter-rater reliability, with intra-class correlation coefficients and (95% CI based on a mean-rating, k = 3, absolute-agreement, 2-way random effects) ranging between .80 and .95. Factorial validity was excellent, factor loading ranging between .88 and .99, with 92% (CI 95% [.89, .95]) of the total variance explained. Confirmatory factor analysis supported the one-factor solution ($\chi 2(27) = 35.45$; CFI = .99; TLI = .99; RMSEA = .07). The findings showed that the need-supportive and -thwarting instruction observation scale had the desired validity and reliability to measure instructor's need-supportive and -thwarting behaviors in physical activity.

The cluster-randomized trial showed that need-supportive instruction improved participants' skill performance (F[2,106] = 4.15, p = .044, $\eta p2$ = .04), intrinsic motivation

(F[2,106] = 8.87, p = .004, $\eta p2$ = .08), introjected regulation (F[2,106] = 6.06, p = .012, $\eta p2$ = .06), extrinsic regulation (F[2,106] = 9.45, p = .003, $\eta p2$= .08), and amotivation (F[2,106] = 12.29, p < .001, $\eta p2$ = .12). Also, there was a significant between-group effect on enjoyment (F[2,106] = 24.23, p < .001, $\eta p2$ = .19) and state anxiety (F[2,106] = 3.17, p = .020, $\eta p2$= .05), with the participants of the need-supportive instruction having more preferable development in enjoyment and state anxiety that the students in the need-thwarting group. The results suggest that the need-supportive instruction was a superior instructional strategy compared to need-thwarting instruction when aiming to improve participants' motor skill performance, motivation, and positive affect.

INDEX WORDS: Need-supportive instruction, skill performance, intrinsic motivation, enjoyment, state anxiety, observation scale

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DEDICATION

I am dedicated to my parent, Sungim Lee and Sunghyun Hwang. Your unwavering love and support have been the foundation of my academic journey.

My dearest Zeezoo, your tenderness, intelligence, and strength have been a constant source of inspiration for me. Thank you for being there for me through the good times and the bad, and for always supporting me in everything I do.

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TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1

INTRODUCTION

Motivation is a driving force in human behavior. Motivation can be defined as a direction and intensity of one's effort (Sage, 1977). Motivation is essential in predicting human performance and learning contributing to achievements in different life domains (Weiner, 1990). Many studies have emphasized the positive effect of motivation on learning performance (Law & Breznik, 2017; Law & Geng, 2018; Law et al., 2010; Ngan & Law, 2015). Similarly, individual and contextual motivational factors are argued to be crucial in predicting human behavior (Ryan & Deci, 2017). In physical activity (PA), motivation has found to relate to exercise and PA adoption (e.g., PA participation) (Gagne 2003; Vallerand, 1997), engagement (e.g., PA intensity) (Cheon et al., 2012; Lonsdale et al., 2009; Ntoumanis, 2005; Reeve et al., 2004; Tessier et al., 2010), adherence (positive affective response) (Ryan et al., 1997; Teixeira et al., 2012), and performance (Cerasoli et al., 2014; Charbonneau et al., 2001; Manninen et ., 2022). Although the positive benefits of the quantity and quality motivation have been found to relate to these positive outcomes and human functioning, one of the central questions pertaining to human performance is how we can better nurture human motivation to harness these aforementioned positive consequences and avoid negative ones (Ryan & Deci, 2000).

In recent decades, the social-cognitive approach has dominated research in the pursuit of recognizing the most effective theory-based instructional strategies and characteristics in

yielding favorable participant PA-related outcomes (Hastie, Rudisill, & Wadsworth, 2013). Self-Determination Theory (SDT) is one of the most prominent social-cognitive theories to examine the impact of instruction on motivation, performance, and well-being (Deci & Ryan, 1985, 2000; Ryan & Deci, 2017). SDT postulates that need-supporting instruction will positively influence and nurture self-determined motivation and impact people's optimal development and well-being (Ryan & Deci, 2017). Centered around the SDT, need-supportive instruction (NSI) can be defined as an instruction that supports the three basic psychological needs of competence, autonomy, and relatedness as theorized by the SDT (Manninen et al., 2022; Manninen & Yli-Piipari, 2021; Tessier et al., 2010). For example, NSI supports students' needs by e.g., offering choice and flexibility on how to practice a skill, allowing students to choose drills at an optimal skill level, and calling students' names frequently and systematically (Table 1.1) (Manninen et al., 2022; Van den Berghe et al., 2013).

Need-thwarting instruction (NTI), on the other hand, represents an extreme condition that violates participants' psychological needs (Bartholomew et al., 2011a, 2011b). Typical instructional practices are the usage of solely extrinsic goals and/or controlling language, a lack of choice and ownership, a lack of dialogue relating to different ways to perform tasks, and rigidness toward participants' opinions and desires (Bartholomew et al., 2011a, 2011b). SDT theorizes that a need-thwarting psychological environment and instruction increases ill-being (Ryan & Deci 2017).

Table 1.1

The Need-Supportive or -Thwarting Strategy

Instructional Dimensions	Need-Supportive Instruction	Need-Thwarting Instruction
Goals	Instructor provides tangible goals of the lesson and lays out reasonable expectations relating to participants' individual development and/or growth.	Instructor provides inadequate goals and unrealistic or extrinsic (e.g., being better in than others) expectations.
Task difficulty	Instructor provides chances to choose drills at an optimal skill level.	Instructor provides same tasks for everyone at the same time and rejects any differentiation or pressures participants to participate her/his way.
Feedback	Instructor provides positive and informational feedback that signifies competence or improves competence.	Instructor makes all decisions, provides simple tasks requiring lower level of cognitive engagement, and no time to work independently. Instructor provides no opportunities for participant ownership.
Structure	Instructor provides new guidelines, tips and advice for participants leading to more engagement and higher-level learning.	Instructor provides new guidelines, tips and advice for participants leading to more engagement and higher-level learning.
Provision of choice	Instructor provides meaningful choice within the skill drills and flexibility with appropriate techniques.	Instructor forces participants to follow instructor's decision and offers no choice.
Value	Instructor offers participants a rationale and expected learning outcomes for tasks and exercises.	Instructor pushes participants to perform tasks without explaining why they should do what the instructor asks them to do. Instructor ignores participants' efforts to understand the tasks.
Encouragement	Instructor encourages participants to persist (e.g., "come on, you can do it").	Instructor does not put any effort and energy into the lesson.
Interpersonal involvement	Instructor asks participants questions about their interests, problems, values, or wishes addressing them by their first name.	Instructor detaches from the participants and ignores their opinions or questions (acting cold).

Physical distance	Instructor is close to the participants, moves around, and interacts with participants.	Instructor does not move around the space and physically distances (her)himself from the participants.

Empirical evidence has shown that need-supportive environment positively relates to students' PA intensity and effort (Ntoumanis, 2005; Lonsdale, Sabiston, Raedeke, Ha, & Sum, 2009), and performance (Barkoukis et al., 2010; Manninen et al., 2022; Valentini & Rudisill, 2004a; 2004b). Similarly, on the affective outcomes, research has shown NSI to relate positively to psychological outcomes (Lochbaum & Jean-Noel, 2015). More specifically, NSI has shown to improve enjoyment in exercise settings (Edmunds et al., 2008; Manninen et al., 2022; Mouratidis et al., 2011). On the other hand, NTI has been found to be associated with maladaptive outcomes, e.g., disordered eating, depression, burnout, negative affect, and physical symptoms, as well as elevated levels of secretory immunoglobulin A (Bartholomew et al., 2011b). Also, NTI in the PA context has been shown to predict higher state anxiety (Quested et al., 2011), sport anxiety (Haraldsen et al., 2020), and somatic anxiety (Papaioannou & Kolli, 1999).

Although motivation has shown to be an important agent in factor driving human behaviors, there is very little experimental evidence comparing different instructional styles in the area of SDT. In addition, very little is known about whether NSI is beneficial or NTI is detrimental to psychological states, such as lower state anxiety in PA. Manninen et al. (2022) study showed that need-neglecting instruction (i.e., instruction that does not nurture nor violate

the psychological needs) did not significantly impact participants' anxiety when performing a novel motor skill. Second, the current evidence on NSI is largely correlational and derived from quasi-experimental intervention research. One of the few rigorously conducted experimental studies by Manninen et al. (2022) showed NSI to be superior compared to need-neglecting instruction in participants' skill performance, adaptive motivation, and enjoyment. However, the study did not detect any statistically significant differences in state anxiety (Manninen et al., 2022). The authors of the study concluded that the need-neglecting instruction is not likely strong enough to elicit a response in participants' state anxiety.

Therefore, the first aim of this dissertation was to develop and validate a need-supportive and -thwarting instruction observation scale (NSTI) to assess instructors' need-supportive and -thwarting instructional behaviors simultaneously in PA context and carry out psychometric testing of the validity and reliability of the scale. The second aim was to compare the effect of SDT-centered NSI and NTI on motivational, behavioral, and affective outcomes. It was hypothesized that participants who will receive NSI would report higher levels of participants' intrinsic motivation (Kirby et al., 2015; Manninen et al., 2022; Vasconcellos et al., 2019), skill performance (Barkoukis et al., 2010; Manninen et al., 2022; Valentini & Rudisill, 2004a; 2004b), and enjoyment (Edmunds et al., 2008; Manninen et al., 2022; Mouratidis et al., 2011) when compared to NTI. In addition, it is assumed that NTI will increase state anxiety (Quested et al., 2010) negatively impact subjective well-being as postulated in the SDT (Deci & Ryan, 2000).

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CHAPTER 2

LITERATURE REVIEW

1. Overview of Self-Determination Theory

1.1 Theoretical Premise of the Self-Determination Theory

Self-determination theory (SDT) is a comprehensive theoretical framework that is widely used in exercise, physical education, and PA settings to explain human behaviors (Deci & Ryan, 1985a, 2000; Ryan & Deci, 2017). SDT postulates that being active, curious, and socially connected are inherent characteristics of humans affecting people's intrinsic tendencies to participate in activities of interest, being proficient, and learning about the world around them (Ryan & Deci, 2017). Specifically, SDT suggests that there are three basic psychological needs, namely the needs for autonomy, relatedness, and competence. Humans' natural propensity to explore, manipulate, and understand without rewards or external prompts is associated with intrinsic motivation, which experiences of competence and autonomy relating to behavior maintenance and enhancement (Deci & Ryan, 1980, 1985b; Ryan & Deci, 2017). According to the SDT, need-satisfaction and -frustration refers to whether the three basic needs are satisfied or not. Need satisfaction positively affects optimal development, integrity, and well-being, while need frustration negatively affects optimal human functioning (Ryan & Deci, 2017).

SDT identifies, not only the quantity of motivation but the quality of human motivation (Deci & Ryan, 2000). Based on the SDT framework, humans have different types of

motivational regulations which range along the continuum from intrinsic motivation to more external regulations (Deci & Ryan, 1985, 2000; Ryan & Deci, 2017). At one end of the continuum, there is intrinsic motivation which is defined as a highly autonomous motivation. When intrinsically motivated, an individual chooses to engage in an activity for the pleasure and inherent satisfaction derived from the participation. At the middle of the continuum are located the three levels of extrinsic motivation: integrated regulation (i.e., behaviors that are performed within individual's goals and values), identified regulation (i.e., behaviors that are performed as valuable and important to an individual), and introjected regulation (i.e., behaviors that are performed to achieve others' approval or avoid internal pressures and feeling guilty). The most extrinsic form of external motivation is extrinsic regulation, which refers to activities performed for external reasons, e.g. reward, wealth, grades, status, appearance, or avoiding negative consequences. Finally, at the far end of the continuum of autonomy is amotivation, which can be defined as a total lack of motivation. Individuals with amotivation do not have any goal or purpose to engage in activities, and they often experience feelings of incompetence (Deci & Ryan, 1985). SDT hypothesizes that the most autonomous (self-determined) motivations (intrinsic motivation, integrated regulation, and identified regulation) are adaptive motivations with positive affective, cognitive, and behavioral outcomes, whereas controlling (non-self-determined) motivations (introjected, extrinsic, and amotivation) are maladaptive with negative outcomes (Deci & Ryan, 1985; Vallerand, 1997).

SDT operationalizes psychological needs as *nutrients essential to growth, integrity, and well-being* (Deci & Ryan, 2000; Ryan, 1995). SDT posits universal and innate psychological

needs for optimal human functioning regardless of cultural setting, learning experience, or developmental epoch (Deci & Ryan, 2000). When individuals' three basic psychological needs, i.e., needs of competence, autonomy, and relatedness, are satisfied, their psychological growth and well-being are nurtured (Ryan & Deci, 2002). In the SDT perspective, social environments that support satisfaction of the three psychological needs facilitate autonomous motivation and undermine controlling motivation, which, in turn, nurtures optimal functioning. However, deprivation of the three needs through socially alienating, overwhelming, and controlling environment, e.g., extreme threats of punishments, evaluative pressures, the use of contingent rewards, and conditional rewards can lead to extrinsic motivation, amotivation, and general ill-being (Deci & Ryan, 2000).

1.2 Psychological Needs

The need for autonomy refers to the sense of being the initiator of one's actions which is associated with feeling congruent, volitional, and integrated (deCharms, 1968; Friedman, 2003; Ryan, 1993; Shapiro, 1981). Autonomy does not have the same meaning as self-reliance or independence, because people can be independent, interdependent, heteronomously dependent, or autonomously dependent depending on external sources or context (Ryan, 1993; Ryan & Deci, 2002; Ryan & Linch, 1989). When behaviors are acting with autonomy, it involves authentic interests, self-endorsement, and integrated values, whereas a person experiences conflict and incongruence when one's behavior is contrary to one's own sense of volition or influence by external force (Ryan & Deci, 2006).

In psychology, competence is one of the constructs which is frequently studied and considered as a core element in motivated actions (Bandura, 1989; Deci, 1975; Harter, 2012; White, 1959). In the SDT, competence is operationalized as a need of being successful and effective to express one's ability, to express confidence in achievement, and to master one's desired goals and outcomes (Deci & Ryan, 2000; White, 1959; Skinner & Belmont, 1993). The need for competence is revealed through inherent striving, manipulation, a manifested curiosity, and a wide range of epistemic motives (Deci & Moller, 2005). Also, person's desire to maintain and enhance skills and abilities as well as optimal challenges are essential characteristics of the need for competence (Csikzenmihalyi, 1990; Deci & Ryan, 2000). Although competence stimulates various positive behaviors in different contexts, it is easily thwarted when people encounter too difficult challenges, negative feedback, blunt criticism, and frustration of effectiveness (Deci & Ryan, 2000; Ryan & Deci, 2017).

Relatedness, on the other hand, is a need to experience a sense of connectedness and belonging to others (Bowlby, 1979; Baumeister & Leary, 1995; Deci & Ryan, 1985a, 2000; Ryan, 1995). People feel related when they feel connected with other people and they feel cared for by others (Ryan & Deci, 2017). Also, it is essential to help others for being a significant member of social groups (Deci & Ryan, 2014a). Therefore, the perceptions of attachment, belongingness, intimacy, security, and contributing are crucial elements for optimal human functioning (Baumeister & Leary, 1995; Deci & Ryan, 2014a).

1.3 Mini Theories of Self-Determination Theory

The formulation of SDT (Deci & Ryan, 1985a, 2000) began with Edward Deci's social-psychological experiments in the 1970s studying how rewards, feedback, or opportunity for choice affected intrinsic motivation (Deci, 1971; Ryan & Deci, 2017). Based on this early work, six mini theories were developed over time which constitute the formal proposition of SDT to explore and reveal various aspects of human being (Ryan & Deci, 2017).

1.4 Cognitive Evaluation Theory

Cognitive evaluation theory evaluates the dynamic relationship between intrinsic motivation and social environment which, in turn, relates to performance and well-being (Deci, Cascio, & Krusell, 1975; Deci & Ryan, 1980a). According to the SDT, intrinsic motivation refers to actions that are pursued as ends in themselves, i.e. due to the inherent satisfaction of the behavior itself and not for external contingencies or reinforcements separate from the activity. Intrinsically motivated people engage in activities freely out of interest, stimulation, and enjoyment. These behaviors provide usually novel experiences, are optimally challenging, or have aesthetic value (Deci & Ryan, 2000).

Early studies on intrinsic motivation found that expected and controlling tangible rewards decreased intrinsic motivation but that verbal praise enhanced intrinsic motivation (e.g., Deci, 1971). These findings imply that contextual factors influence intrinsic motivation through two cognitive processes (Deci & Ryan, 1980). Firstly, if an event shifts the perception of the behavior towards a more external locus, intrinsic motivation is undermined, whereas events that change the perception towards an internal locus, the outcome is reversed. Secondly, when an event improves perceived competence, intrinsic motivation will be improved. Moreover, environments

tend to have different degrees of controlling and informational characteristics. Controlling aspects lead to perceptions of pressure and external locus of causality. Informational features of the environment on the other hand support people's competencies. The relative salience of these two features relating to the environment largely determines the measure of intrinsic motivation. In addition, the interpersonal climate that surrounds events like rewards and positive feedback influence people's perceptions (Ryan & Deci, 2002).

2.1.5 Organismic Integration Theory

Organismic Integration Theory focuses on the development of extrinsic motivation and changes via the process of integration (Connell & Deci, 1985; Ryan & Connell, 1989). Changes in motivation depend here on internalization - a process in which external values and requirements are transformed into personal, autonomous values (Ryan, 1993). SDT posits that people have a natural tendency to integrate their ongoing experiences and internalize external regulations because humans want to integrate the content of the outside world to be coherent with the self (Deci & Ryan, 2000). The more the behavior or the underlying value is internalized the more that it becomes part of the integrated self (Ryan & Connell, 1989). However, external pressures, controls, and evaluations are suggested to be maladaptive, and thus hinder and thwart integration (Deci & Ryan, 2000).

Internalization is vital to human functioning, as people have to carry out essential but uninteresting activities each day (Deci, Eghari, Patrick, & Leone, 1994). Internalization can happen in two different ways resulting in two different self-regulation styles – introjection and integration. Introjection means recognizing the value of behavior but not accepting it as one's

own. These types of behaviors are acted upon because one has to, not because one wants to. Integration, on the other hand, means assimilating a behavior into one's core sense of self. The main contextual factors that lead to integration are the provision of meaningful rationales, acknowledgment of feelings, and provision of choice (Deci et al., 1994).

SDT differentiates different types of motivations as its primary focus is the quality, not quantity, of motivation (Deci & Ryan, 2008). To distinguish different qualities of motivation, the theory posits a taxonomy of motivation according to what degree regulations are internalized and how they vary in perceived locus of causality-or, in other words, how much their regulation is autonomous and self-determined (Ryan & Connell, 1989). The different types of motivations and extrinsic behavioral regulations are amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic motivation.

External regulation is the least autonomous form of extrinsic motivation and is exemplified by behaviors performed to obtain rewards or avoid punishments (Deci & Ryan, 2008). These externally regulated behaviors are typically enacted to satisfy an extrinsic demand or a socially constructed contingency. This type of behavior is not maintained after the contingencies disappear and thus, is not typically sustainable and long-lasting (Deci & Ryan, 2000).

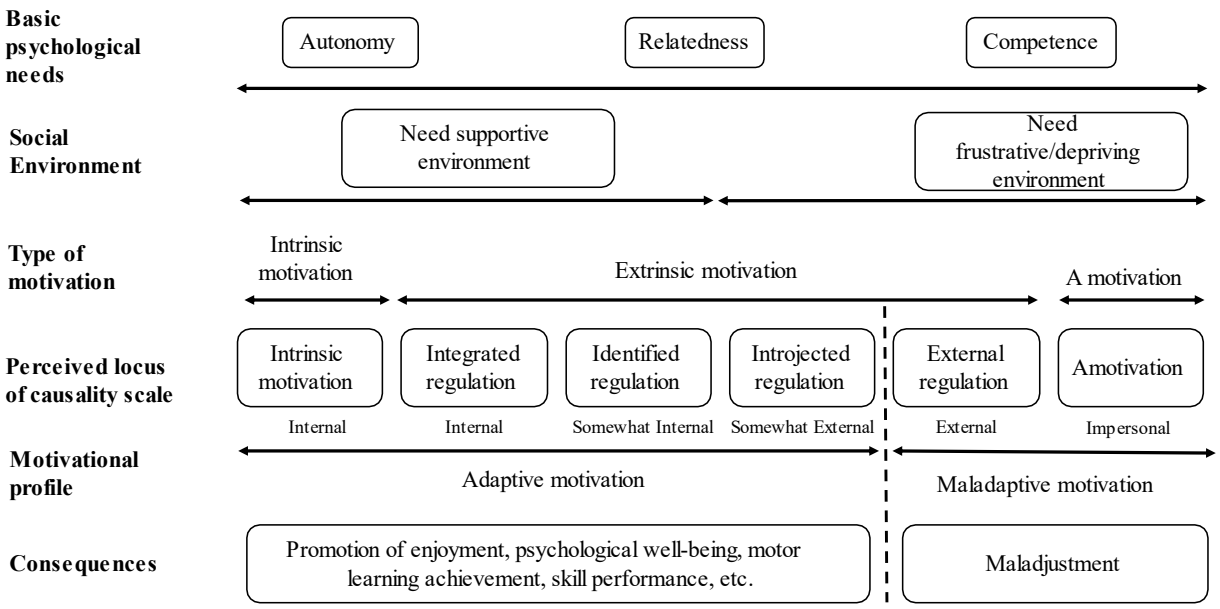

Figure 1. Schematic representation of features and relationship among basic psychological needs, social environment, type of motivation, perceived locus of causality scale, motivational profile, and consequences (Figure adapted from Hagger & Chatzisarantis, 2007)

In introjected regulation, the external regulation is internalized but not accepted as one's own, and thus not part of the integrated self (Ryan & Deci, 2002). This means that the contingent consequences of behavior are governed by the individuals themselves. For example, shame and threats of guilt are a form of introjection, in which the motivation of behavior has not entirely become a part of the sense of self (Deci & Ryan, 2000). These behaviors are within the person, but not assimilated with self as they might include a feeling of pressure to avoid anxiety, guilt or to attain ego- and pride outcomes (Ryan & Deci, 2000).

Identified regulation is involved with behaviors whose underlying value is recognized (Deci & Ryan, 2000). This form of extrinsic motivation is internalized because the behavior is part of the individual's identity, although it is, to some degree, separated from one's other beliefs and values. In identified regulation, the behavior is still externally motivated as it is instrumental and set to attain goals secondary to the activity. The maintenance of such behaviors is hypothesized to be long lasting and lead to positive outcomes (Deci & Ryan, 2000; Ryan & Deci, 2000).

Integrated regulation is the most autonomous form of extrinsically motivated behavior and is present when the behavior is integrated with personally important values, goals, and needs (Ryan & Deci, 2000). Integrated regulation entails a recognition of the value of the behavior and the integration of that behavior to other aspects of personal values and the self. In this form, external regulation is transformed into self-regulation, and the result is highly self-determined extrinsic motivation (Deci & Ryan, 2000, Ryan & Deci, 2000).

The aforementioned four regulatory styles can be placed on an empirically tested continuum (Ryan & Connell, 1989) that represents the amount of autonomy in each regulation (Ryan & Deci, 2000). As introduced, external and introjected regulation are impoverished forms of motivation, whereas identified and integrated regulation are active and relatively autonomous states. However, the prototype of self-determined behavior is intrinsic motivation, which can be contrasted with amotivation – the lack of motivation leading to a lack of intention and passive behavior. People tend to be amotivated when they lack a sense of efficacy or control in terms of behavioral outcome. As such, the four forms of extrinsic motivation fall between these two

extremes. The line between autonomous and controlled motivation is thought to lie between introjected regulation and identified regulation (Deci & Ryan, 2000).

1.6 Causality Orientation Theory

Causality orientation theory describes people's differences in motivational orientations (Deci & Ryan 1985b) and seeks to explain how people in general initiate and regulate their behavior. The theory separates three orientations with different levels of self-determination: autonomous, controlled, and impersonal causality orientations. The autonomy orientation includes behavior regulation that stems from interests and self-endorsed values, and thus reveals personal inclinations toward intrinsic motivation and autonomous forms of extrinsic motivation. The controlled orientation is concerned about control and directives on how to behave, and it relates to controlled forms of motivation. The impersonal orientation relates to lack of motivation and non-intentional behavior, which prevails when all the basic needs are thwarted (Deci & Ryan, 2008). SDT assumes that all people behave in some degree with regard to all of the orientations, but the relative salience of the different orientations varies along with different activities and people. According to the theory, all individuals can be scored on each of these dimensions reflecting their personality towards different types of motivation (Ryan & Deci, 2002).

1.7 Basic Needs Theory

The basic psychological needs theory posits that humans naturally strive for vitality, integration, and well-being, but this is only possible if the three basic needs of autonomy, competence, and relatedness are satisfied (Ryan & Deci, 2002). The needs are hypothesized to be

universal, and consequently, the relationship between the needs and well-being is the same across cultures, ages, and genders. However, the mechanisms in which the needs become satisfied across cultures, ages and genders differ, and thus it may be possible that the same behavior can be at the same time need-satisfying and need-thwarting for different people. In other words, the three needs can be satisfied in a variety of ways, and these behaviors might be different among individuals and cultures as specific goal contents will not most likely have the same meaning and outcomes in all cultures (Deci & Ryan, 2000).

The importance of need satisfaction is well supported across different cultures and life-domains. For example, the importance of autonomy need satisfaction is linked to subjective well-being similarly in Russia, the United States, Turkey and South-Korea (Chirkov, Ryan, Kim, & Kaplan, 2003) as well as Brazil and Canada (Chirkov, Ryan, & Willness, 2005). Fluctuations in well-being have also shown to covary with need satisfaction among adults (Ryan, Bernstein, & Brown, 2010) and college students (Niemiec et al., 2006) in the US.

1.8 Goal Contents Theory and Relationship Motivation Theory

The last two mini-theories of SDT are the goal contents theory and relationship motivation theory. The goal contents theory focuses on the interplay of different goals, basic need satisfaction, and well-being (Kasser & Ryan, 1996), and categorizes people's life goals as either intrinsic or extrinsic based on their intrinsic and extrinsic attributes (Deci & Ryan, 2000). Intrinsic goals include affiliation, generosity, and personal development, whereas extrinsic goals include wealth, fame, and attractiveness (Deci & Ryan, 2008). Intrinsic life goals are theorized to be connected with need satisfaction and well-being more than extrinsic goals, which, according

to the theory, are unrelated or even antagonistic to human well-being (Deci & Ryan, 2000; Kasser & Ryan, 1996). Moreover, framing goals as intrinsic rather than extrinsic has resulted for example in better test performance and behavioral persistence in education (Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004).

Relationship motivation theory concentrates on human relationships and the role that need satisfaction plays in their cultivation (Deci & Ryan, 2014). The theory suggests that the satisfaction of the relatedness need alone is not enough for a high-quality relationship, but that the satisfaction of competence and autonomy are also needed. Thus, relationships are proposed to flourish when people feel connected, non-contingently valued, and supported in their autonomy.

2. Need-Supportive and -Thwarting Instruction

Centered around SDT, NSI can be defined as instruction that supports the three basic psychological needs of competence, autonomy, and relatedness (Manninen et al., 2022a; Manninen & Yli-Piipari, 2021; Tessier et al., 2010). Following the theoretical postulations of the SDT, NSI should have a positive influence nurturing self-determined motivation and impacting people's optimal development and well-being. For example, need-supporting instruction supports students' needs for autonomy by affording choice and flexibility on how to practice a skill, competence by allowing students to choose drills at an optimal skill level, and relatedness by using students' names frequently and systematically (Table 2.1) (Manninen et al., 2022a; Van den Berghe et al., 2013).

Instruction can be also need-neglecting or -thwarting (Bartholomew et al, 2011). NTI represents an extreme case of violating participants' psychological needs (Bartholomew et al, 2011a). These violations can be directed toward autonomy (e.g., coercive demands and reward contingencies or instruction based on guilt or degrading one's ego). This kind of experience can lead to participants' compensatory motives or need substitutes and rigid behavior patterns that may, over time, lead to mental ill-being (Ryan, Deci, Grolnick, & La Guardia, 2006). Compensatory motives oftentimes represent need substitutes that do not really satisfy the thwarted basic need but provide some collateral satisfaction (Deci, 1980). For example, if basic relatedness need is thwarted during childhood, one may later compensate earlier experiences by attempting to gain approval or a sense of worth by pursuing external outcomes, e.g., money and status (e.g., Kasser, Ryan, Zax, & Sameroff, 1995). Similarly, a thwarted autonomy and competence needs may result in the development of rigid behavior patterns protecting individuals from the inner hurt but preventing individuals from dealing with their inner experiences (Deci & Ryan, 2000). Although need thwarting can happen everywhere, typically PE teachers and coaches are engaging in behaviors that constitute as need neglect, that is a lack of awareness toward need-support. Typical instructional practices are usage of extrinsic goals or controlling language, a lack of choice and ownership, or a lack of dialogue relating to different ways to perform tasks (Bartholomew et al., 2011a, 2011b). It has a negative impact on self-determined motivation and well-being and can be theorized to increase controlling motivation and ill-being (Ryan & Deci 2017). On the other hand, oftentimes instructors, teachers, and coaches do not intentionally violate the basic needs of their participants, but they just neglect the needs. This can be defined

as need-neglecting instruction (Manninen & Yli-Piipari, 2021). Need-thwarting differs from need-neglect as it involves instructors to more actively and directly thwart participants' psychological needs (Vansteenkiste & Ryan, 2013).

Table 2.1

The Need-Supportive or -Thwarting Strategy

Instructional Dimensions	Need-Supportive Instruction	Need-Thwarting Instruction
Goals	Instructor provides tangible goals of the lesson and lays out reasonable expectations relating to participants' individual development and/or growth.	Instructor provides inadequate goals and unrealistic or extrinsic (e.g., being better in than others) expectations.
Task difficulty	Instructor provides chances to choose drills at an optimal skill level.	Instructor provides same tasks for everyone at the same time and rejects any differentiation or pressures participants to participate her/his way.
Feedback	Instructor provides positive and informational feedback that signifies competence or improves competence.	Instructor makes all decisions, provides simple tasks requiring lower level of cognitive engagement, and no time to work independently. Instructor provides no opportunities for participant ownership.
Structure	Instructor provides new guidelines, tips and advice for participants leading to more engagement and higher-level learning.	Instructor provides new guidelines, tips and advice for participants leading to more engagement and higher-level learning.
Provision of choice	Instructor provides meaningful choice within the skill drills and flexibility with appropriate techniques.	Instructor forces participants to follow instructor's decision and offers no choice.
Value	Instructor offers participants a ration and expected learning outcomes for tasks and exercises.	Instructor pushes participants to perform tasks without explaining why they should do what the instructor asks them to do. Instructor ignores participants' efforts to understand the tasks.

Encouragement	Instructor encourages participants to persist (e.g., "come on, you can do it").	Instructor does not put any effort and energy into the lesson.
Interpersonal involvement	Instructor asks participants questions about their interests, problems, values, or wishes addressing them by their first name.	Instructor detaches from the participants and ignores their opinions or questions (acting cold).
Physical distance	Instructor is close to the participants, moves around, and interacts with participants.	Instructor does not move around the space and physically distances (her)himself from the participants.

3. Measuring Need-Supportive and -Thwarting Instruction

Researchers have examined and formulated that teacher's NSI behavior to facilitate learner's partial or all three psychological needs in the PE setting (Chen et al., 2012; Haerens et al., 2013; Ntoumanis & Standage, 2009; Manninen et al., 2022a; Standage, Duda, & Ntoumanis, 2005, 2006; Taylor & Ntoumanis, 2007). Also, it has been previously shown that in-service teachers can learn and improve their instructional skills to better nurture student motivation if provided with training in need-supportive teaching (Mandigo et al., 2008; Mouratidis et al., 2011; Prusak, Treasure, Darst, & Pangrazi, 2004; Tessier et al., 2010; Ward et al., 2008). These improvements are well warranted as need-frustration has been shown to be related to ill-being and various forms of maladaptive outcomes (Vansteenkiste & Ryan, 2013). Due to the detrimental nature of humans' need-thwarting experiences, the impact of these negative experiences may be stronger than the impact of positive experiences (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Van den berg et al., 2013). Naturally and to improve participants outcomes, it is beneficial to focus on helping teachers, instructors, and coaches to use more NSI

behaviors over NTI behaviors. To assess success of these need-supportive trainings and interventions, it is important that we can measure these instructional behaviors validly (Haerens et al., 2013).

To date, I was able to identify only few validated observational scales measuring instructional behaviors in the area of SDT (Chen et al., 2012; Reeve, 2004; Sarrazin et al., 2006; Tessier, Sarrazin, & Ntoumanis, 2008; 2010). Cheon et al.'s (2012) autonomy-supportive teaching practices observation scale measures autonomy-supportive and controlling (only one need out of three needs) behaviors using a 1–7 bipolar response system. On the other hand, Haerens et al.'s (2013) observation scale measured all three psychological needs recognizing 21 specific NSI behaviors. The behaviors were coded from 0 (never observed) to 3 (observed all the time) (Haerens et al., 2013). In addition, Hearens et al. (2013) scale divided teaching situations for the 5-min increments, each evaluated separately in the need-supportiveness. This scale failed, however, to measure real-life instructional situations (Hearens et al., (2013). Although the scale of Haerens et al. (2013) focused on measuring NSI practices, Van den Berghe and colleagues (2013) shed light on the NTI. Their scale comprised a set of 16 items of need-thwarting behaviors with the specific dimensions of control, coldness, and chaotic instruction and was coded on a 4-point scale ranging from 0 to 3 for every five minutes of the lesson (e.g., Bartholomew, Ntoumanis, Ryan, Bosch, et al., 2011; Belmont, Skinner, Wellborn, & Connell, 1988; Ryan & Deci, 2006) All those scales have shown to display good intra- and inter-rater reliability, but a strong internal validity is yet to be demonstrated.

4. Empirical Evidence on Need-Supportive Instruction in Physical Activity Contexts

Although there has been an increasing interest in examining NSI, most of the intervention research in PE and PA has utilized autonomy-support as the main independent variable (Manninen et al., 2022a). Lately, research focusing on autonomy-support has begun incorporating all three psychological needs to form a concept of psychological NSI (e.g., Aelterman, Vansteenkiste, Van den Berghe, De Meyer, & Haerens, 2014; Tessier, Sarrazin, & Ntoumanis, 2010). Tessier et al.'s (2010) study was one of the first to use all three needs in a quasi-experimental design using non-randomized intervention study in the PE domain. In the study, autonomy-supportive behaviors focused on providing participants with autonomy, structure, and PE teachers supported interpersonal involvement (Tessier et al., 2010). This framework of supporting all of three needs through structure, autonomy-support, and interpersonal involvement has since been used more frequently in studies promoting students' optimal learning motivation (e.g., Aelterman et al., 2014). Critically, Haerens et al. (2013) found that pupils in the same class environment can perceive need-support in very different ways. It is thus possible that students perceive teacher behaviors differently and/or that teachers behave differently with different students.

Kirby, Byra, Readdy, and Wallhead (2015) examined the effects of NSI among college students using a quasi-experimental design. A sample of college students (N = 149) from the US were taught badminton in either practice or inclusion style derived from the spectrum styles teaching (Mosston & Ashworth, 2002). Theoretically, the inclusion style allows more decision making to the students compared to the more commanding practice style and, thus, the inclusion style is argued to be similar to autonomy-supportive teaching. The results showed that both

styles positively impacted students' need-satisfaction and identified regulation. However, there were no differences between the students' perception of the different teaching styles.

A correlational study in sport setting by Adie et al. (2008) found that coaches' autonomy-support predicted adult club sport participants' (N = 539) three basic psychological needs, which in turn, supported greater subjective vitality when engaged in sport. Similarly, another correlational study revealed that elite Canadian athletes' (N = 201) need satisfaction from need-supportive coaching impacted their athletes' positive engagement and flow (Hodge, Lonsdale & Jackson, 2009). In addition, another study examined how need satisfaction and need-frustration related to the indicators of well- and ill-being on 289 student athletes aged between 12 and 17 years old (Bartholomew et al., 2011a). This correlational study found that perceived autonomy support related to need satisfaction, which, in turn, related to positive outcomes, such as vitality and affect. On the other hand, controlling coaching behaviors predicted need-thwarting, which in turn, predicted maladaptive outcomes, e.g., disordered eating, depression, burnout, negative affect, and physical symptoms. Also, athletes' perceptions of psychological need-thwarting prior to the training were significantly associated with elevated levels of secretory immunoglobulin A (Bartholomew et al., 2011a). In other research, Bartholomew et al (2011a) discussed that need satisfaction and need-thwarting can co-occur because of dynamics within sport settings.

4.1 Need-supportive instruction and motivation in physical activity context

To date, I was able to track three systematic meta-analytic reviews conducted on NSI in the PA domain (Lochbaum & Jean-Noel, 2015; Manninen et al., 2022b; Vasconcellos et al., 2019). The first meta-analyses focused on autonomy-supportive teaching in PE (Lochbaum &

Jean-Noel, 2015). The study showed that perceived autonomy support had a large positive correlation with intrinsic motivation and identified regulation and a small-sized correlation with introjected regulation (Lochbaum & Jean-Noel, 2015). Similarly, Vasconcellos et al. (2019) showed that teachers' need-support correlated positively with students' intrinsic motivation, identified regulation, and introjected regulation, whereas a negative correlation with external regulation and amotivation were reported.

Recently, our research team conducted a meta-analysis examining the effectiveness of the NSI in the PA context (Manninen et al., 2022b) advancing the correlational evidence of Lochbaum & Jean-Noel (2015) and Vasconcellos et al. (2019). The research systematically assessed the effectiveness of peer-reviewed SDT-centered intervention with experimental and control conditions on participants' motivation. The study showed that NSI positively impacted identified regulation and intrinsic motivation in PA settings, while negatively impacting external regulation and amotivation. Results of the published meta-analytic reviews are presented in table 2.2

Table 2.2

Summary of the Results of the Published Meta-Analyses

Meta-Analyses	**Hedge's g (95% CI)***				
	Intrinsic k g(95% CI)	Identified k g(95% CI)	Introjected k g(95% CI)	External k g(95% CI)	Amotivation k g(95% CI)
Lochbaum & Jean-Noel, 2015	39 .54(.52,.55)	39 .50(.48, .52)	39 .20(.17, .23)	39 -.15(-.18, -.12)	39 -.19(-.21, -.18)
Manninen et al., 2022b	24 .23(.10, .36)	20 .19(.05, .32)	15 .05(-.07, .17)	17 -.39(-1.02, .25)	17 -.12(-.26, .03)

Manninen et al., 2022b	11 .42(.20, .65)	8 .27(.03, .51)	8 -.07(-.28, .14)	8 -.12(-.41, .17)	9 -.21(-.46, .05)
Vasconcellos et al., 2019	62 .25(.16, .34)**			62 .20(.05, .34)	62 .19(-.05, .21)

*Note. * For the study by Lochbaum & Jean-Noel (2015) and Vasconcellos et al. (2019) instead of Hedge's g correlation coefficients (r) are presented.*
*** Only aggregated value for adaptive motivation including intrinsic motivation and identified regulation are reported.*

2.3.2 Need-thwarting and -neglecting instruction in physical activity context

Conversely, authorities may utilize coercive or seductive instructional strategies, which can encompass implicit or explicit rewards or punishments to enforce others to behave in certain ways (Deci & Ryan, 1985). For example, controlling teachers pressure students to think, feel or behave in particular ways and dismiss student's viewpoints (Reeve, 2009). Controlling teaching is expressed in at least two different ways (Ryan, 1982; Soenens & Vansteenkiste, 2010). First, externally controlling teaching involves the use of overtly observable controlling tactics, e.g., punishments, pressuring, rewards, yelling and explicitly controlling languages (e.g., Assor, Kaplan, Kanat, Maymon & Roth, 2005; Reeve & Jang, 2006; Vansteenkiste, Simons, Lens, Sheldon & Deci, 2004). Second, internal control of teaching involves the use of less directly observable tactics, e.g., teachers appealing to learner's feelings of guilt, shame, anxiety and self-worth (Vansteenkiste, Dochy & Goossens, 2012).

According to the SDT, the consequences of autonomy-supportive and controlling teaching on student's behavior can be represented through the process of need-satisfaction and need-frustration or -thwarting. Specifically, while the satisfaction of the three needs for autonomy, competence and relatedness is hypothesized to promote high-quality motivation, the

frustration of the three needs for autonomy, competence and relatedness is assumed to face maladjustment (Deci & Ryan, 2000; Vansteenkiste & Ryan, 2013).

5. Participant Outcomes

5.1 Need-supportive instruction and affective outcomes

5.1.1. Anxiety

Anxiety is a negative psychological and physiological state characterized by feelings of worry, arousal, apprehension, fatigue, tension and the activation of the autonomic nervous system elicited by a threatening (Spielberger, 1972a; 1989). The experience of anxiety evoked by a stimulus that is perceived as dangerous, harmful, or otherwise detrimental to them (Spielberger, 1972b). Experiencing anxiety may include physical symptoms, e.g., heart palpitations, trembling, sweating, muscle weakness and tension, nausea, headaches, or chest pain (Hausenblaus & Rhodes, 2016). Anxiety is defined as a mental health disorder in the Diagnostic and Statistical Manual of Mental Disorders, which includes distinct diagnoses for panic disorder, agoraphobia, generalized anxiety disorder, posttraumatic stress disorder, and obsessive-compulsive disorder (American Psychiatric Association, 2013).

Anxiety can be divided into state anxiety and trait anxiety (Spielberger, 1972a). State anxiety is an immediate and a fleeting response to a perceived threat, whereas trait anxiety refers to relatively stable individual differences in personality to perceive life events more threatening in general (Spielberger, 1989). In other words, anxiety can be split into worry, which refers to the cognitive elements of anxiety like negative expectations and concerns of failure, and emotionality, which denotes the physiological and affective features of anxiety like autonomic

arousal and nervousness (Liebert & Morris, 1967; Morris, Davis, & Hutchings, 1981). Moreover, some measures of anxiety in sporting settings differentiate anxiety into three parts: worry, somatic anxiety and concentration disruption (e.g., not thinking clearly and difficulties to focus) (Smith, Smoll, Cumming, & Grossbard, 2006).

The definition of anxiety shares similarities with fear and stress, though with some key distinctions. One prominent difference between fear and anxiety is that the cause of fear is typically clear and identifiable, while the cause of anxiety can be vague or even unknown (Öhman, 2008). Moreover, fear is accompanied by an urge to cope with the situation either by removing oneself or removing the fear-evoking stimulus in some way, while coping with anxiety is harder as the threat is more opaque and harder to control (Epstein, 1972). Anxiety differs also from stress in a few important ways. A standard definition of stress suggests it to be a combination of physical, psychological, and emotional reactions emanating when the known and unknown factors of the environment disrupt the psychological balance of the individual by exceeding the abilities and capabilities of the individual (Lazarus & Folkman, 1984). In this sense, stress is a broader term than anxiety, and although anxiety can be one manifestation of stress, the terms are separate (Spielberger, 1972a).

There were several studies have been demonstrated a significant relation between need-satisfaction and anxiety. It has been shown that employees' need-satisfaction in the workplace (each of the three needs) contributes to the lower levels of anxiety somatization (Baard, Deci, & Ryan, 2000; Ilardi, Leone, Kasser, & Ryan, 1993). Deci et al. (2001) showed a similar pattern of relations with anxiety in a sample of Bulgarian workers. In the PA setting, Quested et al. (2011)

revealed that the three basic psychological needs relate to lower cognitive anxiety. In the study examining 61 English dancers indicated that participants perceived basic psychological needs before the performance were associated with lower levels of anxiety. In addition, Cox, Duncheon, and McDavid (2009) found that perceived relatedness with their teachers and peers negatively affected the feeling of worry among junior high school students. Also, Smith, Smoll, Cumming, and Grossbard (2006) conducted peer relationship research in youth PA settings demonstrating greater associations of perceived peer acceptance to lower anxiety. Moreover, Sebire, Standage, and Vansteenkiste (2009) revealed that psychological need-satisfaction in the exercise goal content was negatively predicted to exercise anxiety among English governmental employees.

There were also several studies that have been conducted to find a negative relationship between NSI and anxiety. Black and Deci (2000) examined 137 US college students' perceptions of their teachers' autonomy support on state anxiety in a chemistry course. The instructors' autonomy supports predicted reductions in students' state anxiety. Regarding teacher's relatedness support, Yin, Lee, and Zhang (2009) revealed that teacher support and involvement have positive effect on reducing 1,037 primary school students' test anxiety. Moreover, 238 seventh-grade native Dutch students' perception of their math teacher's support was negatively linked to math anxiety (Ahmed, Xiang, McBride, & Su, 2010). In terms of the motivational climate studies, 239 Greek high school students who participated in task-involving tasks showed higher state self-confidence, lower somatic anxiety than in the lesson consisting of the ego-involving tasks in a PE lesson (Papaioannou & Kolli, 1999). Providing partial support for this

result, performance-oriented climate significantly predicted 181 English dance students' ego orientation, elements of cognitive trait anxiety (Carr & Wyon, 2003). Contradicting this result, Barkoukis et al.'s (2010) motivational climate intervention (N = 317 Greek high school students)' showed no significant differences in participants' state anxiety. This study compared a T.A.R.G.E.T framework (Task, Authority, Recognition, Grouping, Evaluating, Time; Ames, 1992; Epstein, 1988), which is similar to need-supportive teaching, instructional style to command style.

On the other hand, only a few studies have been demonstrated a significant relationship between need frustration and anxiety. Meirinhos, Suarez, Brenning, Vansteenkiste, and Olivia (2020) examined the link between satisfaction and frustration of the three basic psychological needs and adolescents' well-being and psychological maladjustment. The authors revealed that need frustration negatively affected Spanish adolescents' symptoms of anxiety and somatization (N = 1,047). Sport studies has shown female athletes' (N = 303) perceptions of psychological need thwarting are significantly correlated to anxiety and depression (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011). Similarly, Quested et al. (2011) found that 61 English dancers who felt that they basic psychological needs were not met before a performance, experienced threat and challenge perceptions during their dance performance. These experiences, in turn, predicted higher state anxiety. Moreover, Haraldsen et al.'s (2019) study (N= 239) showed that high-achieving Norwegian elite juniors in the area of sports and performing arts, who experienced moderate levels of competence and autonomy frustration, showed higher levels of anxiety. Finally, it has shown that ego-involving PE lessons relate to lower state self-

confidence and higher somatic anxiety in Greek high schoolers (*N* = 239; Papaioannou & Kolli, 1999).

5.1.2 Enjoyment

Enjoyment has been described as a "positive affective response to the sport experience that reflects generalized feelings such as pleasure, liking, and fun" (Scanlan & Simons, 1992, pp. 203-204). Although some researchers have argued that enjoyment is in fact a form of intrinsic motivation as conceptualized by the SDT, Scanlan and Simons (1992) addressed that sport enjoyment and intrinsic motivation is a different concept because of the existence of extrinsic sources. The authors also argued that enjoyment is a more inclusive and broader concept because it comes from both internal and external origins.

There is a strong body of research suggesting that there was positive relationship among basic psychological needs, autonomous motivation, and enjoyment in the PE context (Huhtiniemi et al., 2019; Laptokaridou et al., 2015; Ntoumanis, 2002; Ommundsen & Kvalo, 2007; Puente & Anshel, 2010; Rodrigues et al., 2019; Yli-Piipari, et al., 2009). In addition to a direct, positive correlation between psychological needs and enjoyment, autonomous motivation has shown partially mediate this relationship (Cox, Smith, & Williams, 2008). Similar partial mediation has been found between perceived relatedness and enjoyment (Cox, Duncheon, & McDavid, 2009).

Although the aforementioned research has shown needs, autonomous motivation, and enjoyment to be positively correlated, few studies have tested experimentally whether need-supportive instruction improves participants' enjoyment. Black and Deci (2000) investigated the

students' levels of perceived need-satisfaction, perceived autonomy-support from the teacher, and enjoyment in a 13-week organic chemistry course. The result indicated that students who had higher autonomous motivation and perceived more autonomy-support displayed more enjoyment on the course. In the PE setting, a Mouratidis, Vansteenkiste, Sideridis, and Lens (2011) study (N = 155 Greek elementary school students) showed that students who were exposed need-supportive instruction showed higher enjoyment than their peer enrolled in a nonneed-supportive class. Moreover, need-supportive teaching provided more benefits to students e.g., higher autonomous motivation. Recently, a randomized control study (N = 59) was published examining the effect of need-supportive instruction on series of outcome variables including enjoyment (Manninen et al., 2022a). The study showed that students who participated in the need-supportive condition showed increased intrinsic motivation and enjoyment compared to the students' who participated in the need-neglecting group.

5.2 Need-supportive instruction and behavioral outcomes

5.2.1 Training time and intensity/effort

Although autonomous motivation has shown to relate positively to exercise/task intensity and efforts (Cheon et al., 2012; Reeve et al., 2004), few studies have examined the direct evidence between NSI and intensity and efforts. Reeve, Jang, Carrell, Jeon, and Barch (2004) tested whether 20 American high school math, economics, English, and science teachers' autonomy-supportive behaviors positively affect students' engagement (e.g., attention, effort, verbal participation, persistence, and positive emotion). The result showed that autonomy

support positively impacted students' task engagement. Similarly, research investigating the effectiveness of teachers' autonomy-supportive and -structured instructional styles on 1,584 US high school students' behavioral and subjective engagement in the classroom found that autonomy-support had a positive effect on students' engagement (Jang, Reeve, & Deci, 2010). In the PE domain, PE teachers' autonomy-support has been found to increase 1,158 Korean secondary school students' behavioral, emotional, cognitive, and agentic classroom engagement through (Cheon et al., 2012). In regard to the NSI, similar effects have been shown (Ntoumanis, 2005; Tessier, Sarrazin, & Ntoumanis, 2010). Tessier, Sarrazin, and Ntoumanis (2010) tested whether teachers' need support training program affect 185 France senior high school students' cognitive, affective and behavioral engagement in learning tasks. The result showed that teachers' success in need-supportive teaching improved students' need-satisfaction, self-determined motivation, and class engagement. In the similar study by Ntoumanis (2005) examining British 15-year-old PE students (N = 302) showed that students' need satisfaction in PE class positively predicted students' class concentration and effort In addition, a free-choice basketball section during PE positively related to secondary school PE students' self-determined PE motivation and in-class PA (N= 528 student in Hong Kong; Lonsdale, Sabiston, Raedeke, Ha, & Sum, 2009).

5.2.2 Performance

There is a lack of evidence linking need-supportive teaching practices to motor performance. Barkoukis, Koidou, and Tsorbatzoudis (2010) tested T.A.R.G.E.T strategies,

emphasizing making tasks fun and delightful, meaningful choices, informational feedback, diminishing social comparison, and organizing lessons according to students' needs and improvement like need-supportive teaching. The sample of 317 Greek high school students were assigned either to an intervention group or a control group. Regarding the performance indicators, the researchers found that the intervention group demonstrated a positive interaction effect for the technical execution of shot put. In line with this result, more studies reported the positive effect of T.A.R.G.E.T strategies on motor skill performance of children with and without disabilities (Valentini & Rudisill, 2004a; 2004b). Regarding the relationship between autonomy-supportive teaching behaviors and performance, there are a few studies that had been conducted. Behzadnia, Mohammadzadeh, and Ahmadi (2018) investigated whether autonomy-support impacted 30 male college PE students' badminton skills and game performance. The results showed that the experimental group's badminton skills and gameplay performance were higher than the performance of the conventional teaching style group. Similarly, Vansteenkiste, Sheldon, and Deci (2004) tested whether intrinsic goals setting and autonomy-supportive learning climate would improve students' test performance. Belgian high school-aged adolescents (N = 224) were assigned to autonomy-supportive vs. controlling conditions and extrinsic vs. intrinsic goal conditions. In all of three studies, there were significant effects for students who were in both intrinsic goals and autonomy-supportive climate conditions demonstrating better performance compared to the students in control groups.

Previously, two studies examined the impact of competence support (one of the psychological needs) on athletes' performance. First, Fransen, Boen, Vansteenkiste, Mertens,

and Broek (2017) examined the impact of coaches' and athlete leaders' (i.e. captain of the team or similar) competence support on athletes' subjective and objective performance. In the result, there was a significant effect on athletes' objective performance when they received competence support from their coach and the athlete leader. Second, the same researchers investigated the impact of competence-support from coach and athlete leader on team members' performance. The findings revealed that there was a significant relationship between competence-support and performance (Mertens, Boen, Broek, Vansteenkiste, & Fransen 2018).

To our knowledge, the Manninen et al. (2022a) study is one of the few studies examining the role of NSI on human performance. Manninen et al. (2022a) tested the efficacy of the NSI (N = 59 college students) using juggling skills as a task performance. In the experiment, participants who did not know how to juggle were randomly allocated to either the need-supportive or -depriving condition, and their performance in juggling, motivation towards the juggling task, and affective outcomes were assessed (Manninen et al., 2022a). To test the role of instruction in the outcomes, the dose, content, and lesson structure were identical across both conditions. The result showed that the students in the need-supportive condition had superior performance compared to the participants in the need-neglecting condition (Manninen et al., 2022a). Authors argued that need-neglecting instruction is typical in PA contexts as PE teachers or PA /exercise instructors seldom intentionally thwart the participants' needs (Manninen et al., 2022a). The Manninen et al. (2022a) study revealed that NSI impacted performance primarily through intrinsic motivation (+), integrated regulation (+), and amotivation (-). In other words, when exposed to the NSI participants' intrinsic motivation and integrated regulation increased and

amotivation decreased, which in turn impacted positively their skill performance. It is noteworthy, that need-support seem to impact the end points of the motivational continuum (Deci & Ryan, 2000) but not impact the identified, introjected, or extrinsic regulation. Authors concluded that autonomous motivation and an absence of amotivation toward a task seem to instrumental mediators between the NSI and novel skill performance (Manninen et al., 2022a).

Empirical evidence has shown a negative relation between need satisfaction and anxiety in the PE setting (Quested et al., 2011; McDavid, 2009; Smith et al., 2006; Sebire et al., 2009). There was also a negative relation between NSI and anxiety in general (Black & Deci, 2000; Yin et al., 2009; Ahmed et al., 2010) and PE setting (Papaioannou & Kolli, 1999; Carr & Wyon, 2003; Barkoukis et al., 2010). On the other hand, need frustration positively affected participants' symptoms of anxiety (Bartholomew et al., 2011; Haraldsen et al., 2019; Meirinhos et al., 2020; Papaioannou & Kolli, 1999; Quested et al., 2011). Regarding to enjoyment, it has been shown that there is a positive relationship between NSI and enjoyment in general (Black & Deci, 2000) and PE setting (Mouratidis et al., 2011; Manninen et al., 2022a. In addition, NSI positively affects exercise/task intensity and efforts (Cheon et al., 2012; Reeve et al., 2004) and engagement (Reeve et al., 2004; Jang et al., 2010) in general. In the PE domain, NSI positively affects participants' engagement (Ntoumanis, 2005; Tessier, Sarrazin, & Ntoumanis, 2010), and self-determined PE motivation and in-class PA (Lonsdale et al., 2009). In regard to performance, although the intervention group using T.A.R.G.E.T framework (Epstein, 1988; Ames,1992) demonstrated a positive interaction with performance (Barkoukis et al., 2010) and motor skill performance (Valentini & Rudisill, 2004a; 2004b), there is a lack of evidence linking need-

supportive teaching practices to motor performance. Partially, autonomy-support instruction positively related to participants' badminton skills and game performance (Behzadnia et al., 2018), test performance (Vansteenkiste et al., 2004), and competence-support environment affects athletes' subjective and objective performance (Fransen et al., 2017) and team members' performance (Mertens et al., 2018). Manninen et al. (2022a) found that the need-supportive condition positively affected students' novel skill performance, which is one of the few studies examining the role of NSI on performance.

6. This study

My literature review shows that research efforts to determine the most favorable effects of NSI have increased in recent years. Based on the evidence, we know that NSI elicits positive effects on autonomous motivation (Kirby et al., 2015; Manninen et al., 2022a; Vasconcellos et al., 2019), skill performance (Barkoukis et al., 2010; Manninen et al., 2022a; Valentini & Rudisill, 2004a; 2004b), and enjoyment (Edmunds et al., 2008; Manninen et al., 2022a; Mouratidis et al., 2011), whereas need-neglecting or NTI elicit a positive effect on amotivation (Manninen et al., 2022a). There is also recent evidence suggesting that autonomous motivation and an absence of amotivation are the key mediators in relating to positive behavioral and affective outcomes (Manninen et al., 2022a). However, the following gaps in our understanding warrants the present study.

First, a scarce body of studies have examined the relationship between NSI and participants' behavioral, motivational, and affective outcomes, but there is lack of evidence

whether NSI is beneficial or NTI is detrimental on psychological states, such as lower state anxiety as hypothesized by the SDT. Previously, Manninen et al. (2022a) showed that compared to the need-neglecting instruction, NSI elicits positive affective outcomes, but there were no direct negative effects when neglecting participants' psychological needs. Second, the current evidence on NSI is largely correlational or derived from the quasi-experimental intervention research. Future experimental studies are needed to further test the role of NSI. Finally, the central question relating to the SDT and the practice of good instruction, teaching, and coaching in the PA context is how effective NSI is and how detrimental NTI can be. Better understanding of this topic is instrumental in improving instructional practices in PA contexts.

Therefore, the first aim of this proposed study is to develop and validate a NSTI observation scale and perform psychometric testing of the validity and reliability of the scale to assess instructors' instructional behaviors in PA context. The second purpose of this dissertation was to compare the effects of SDT-centered need-supportive and -thwarting instruction on participants' motivational, behavioral, and affective outcomes. It was hypothesized that participants who will receive NSI would report higher levels of participants' intrinsic motivation (Kirby et al., 2015; Manninen et al., 2022a; Vasconcellos et al., 2020), skill performance (Barkoukis et al., 2010; Manninen et al., 2022a; Valentini & Rudisill, 2004a; 2004b), and enjoyment (Edmunds et al., 2008; Manninen et al., 2022a; Mouratidis et al., 2011) when compared to NTI. In addition, it is assumed that NTI will increase state anxiety (Quested et al., 2011).

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CHAPTER 3

DEVELOPMENT AND VALIDATION OF A STRUCTURED OBSERVATION SCALE TO MEASURE PHYSICAL ACTIVITY INSTRUCTORS' NEED-SUPPORTIVE AND -THWARTING STRATEGIES

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Abstract

Due to an increasing amount of experimental studies examining the efficacy of psychological need-supportive instruction, valid scales to measure need-support are needed. This study aimed to develop a need-supportive and -thwarting instruction observation scale (NSTI) and perform psychometric testing of the scale. The content validity was established by using a Delphi method followed by the steps to establish factorial and construct validity. A sample of 20 PE classes and 540 observations consisting of 110 college-aged students were collected. Between-rater correlation (.80 to .95) suggested strong internal consistency. Factorial validity was excellent, factor loading ranging between .88 and .99, with 92% (CI 95% [.89, .95]) of the total variance explained. Confirmatory factor analysis supported the one-factor solution ($\chi 2(27) = 35.45$; CFI = .99; TLI = .99; RMSEA = .07). In conclusion, NSTI had a desired validity and reliability to measure instructor's need-supportive and -thwarting behaviors in PA.

Keywords: Self-determination, motivation, validity, reliability

Introduction

Motivation is one of the main factors driving humans' volitional behaviors (Ryan & Deci, 2017). This is especially true in the PA contexts, e.g., PE, exercise, or sport, as instructors' and learners' motivation do not always meet (Yli-Piipari, 2017). From the motivational perspective, one of the key questions pertaining to effective instruction is which instructional strategies are best in supporting participant motivation. More effectively instructor can support participant motivation the better learning outcomes will be. Self-Determination Theory (SDT) is a prominent theoretical framework to understand the quality of participant motivation (Deci & Ryan, 1985, 2000; Ryan & Deci, 2017). Based to the SDT, NSI is instruction that supports learners' three basic psychological needs of competence, autonomy, and relatedness, whereas NTI violates those needs (Manninen et al., 2022; Manninen & Yli-Piipari, 2021; Tessier et al., 2010). NSI improves people's optimal development and well-being by nurturing their self-determined motivation (Ryan & Deci, 2017). Although the relationships between NSI and positive outcomes have been evidenced in the experimental studies (Manninen et al., 2022), objective measures to assess need-supportive or -thwarting instruction are not fully developed. Thus, the aim of this study was to develop and validate a structured observation scale to measure participants' need-supportive and -thwarting strategies in the PA context.

According to the SDT, those three basic psychological needs are essential for human development and well-being, and those needs impact the quality of motivation (Ryan & Deci, 2002). SDT identifies six different types of motivational regulations based on one's perception of the locus of control, and these motivational regulations are hypothesized to range along with a

continuum of self-determination (Deci & Ryan, 1985, 2000; Ryan & Deci, 2017). Intrinsic motivation (i.e., behaviors that are performed within an individual's pleasure and inherent satisfaction) is located at the end of the continuum. Following the continuum of self-determination from fully internalized motive to external motive, extrinsic forms of regulations, integrated regulation (i.e., behaviors that are performed within an individual's goals and values), identified regulation (i.e., behaviors that are performed as valuable and important to an individual), introjected regulation (i.e., behaviors that are performed to achieve others' approval or avoid internal pressures and feeling guilty), and external regulation (i.e., behaviors that are performed to avoid negative consequences or achieve reward) are located at the middle of the continuum and are regarded extrinsic in nature. Finally, amotivation (i.e., a total absence of motivation) is located at the other far end of the continuum. SDT hypothesizes that intrinsic motivation, integrated motivation, and identified regulation are related to positive affective, cognitive, and behavioral outcomes, while introjected, extrinsic, and amotivation are related to negative outcomes (Deci & Ryan, 1985; Vallerand, 1997).

There have been several studies that have validated and used SDT-centered observational instruments to measure instructional behaviors (Chen et al., 2012; Reeve, 2004; Sarrazin et al., 2006; Tessier, Sarrazin, & Ntoumanis, 2008; 2010). Cheon et al.'s (2012) questionnaire focused on the autonomy-supportive teaching practices, including four autonomy-supportive and controlling behaviors on the 1–7 bipolar response scale. This scale evolved from the Reeve and colleagues' (2004) study, in which the most suitable instructional behaviors were selected from the existing SDT centered literature (Deci, 1995; Deci et al., 1991, 1994; Reeve, 1996, 1998;

Ryan & La Guardia, 1999). It is noteworthy, that this observation scale did not include two other dimensions of the NSI, namely competence- or relatedness-support. Haerens et al.'s (2013) validation work, on the other hand, included all three dimensions of psychological need-support. Their instructional practices were based on the literature and 21 need-supportive observed in PE teaching behaviors (e.g., Reeve et al., 2004; Reeve & Jang, 2006; Tessier et al., 2008; Vansteenkiste, Zhou, Lens, & Soenens, 2005). During their validation process, raters recorded the 21 need-supportive behaviors using a 4-point frequency scale at every five-minute (min) interval of the class. The scale ranged from 0 (never observed) to 1 (sometimes observed), to 2 (often observed), and to 3 (observed all the time) (Haerens et al., 2013). This scale measures solely need-supportive not need-thwarting instructional practices. Van den Berghe and colleagues' (2013) observation instrument, on the other hand, focused on need-thwarting behaviors. Specifically, the measurement comprised a set of 16 items of need-thwarting behaviors with the specific dimensions of control, coldness, and chaotic instruction (e.g., Bartholomew, Ntoumanis, Ryan, Bosch, et al., 2011; Belmont, Skinner, Wellborn, & Connell, 1988; Ryan & Deci, 2006). Similar to the Haerens et al. (2013) observation instrument, the 16 need-thwarting behaviors were coded on a 4-point scale ranging from 0 to 3 for every five min of the lesson (Van den Berghe et al., 2013). Both scales Hearens et al. (2013) and Van den Berghe et al. (2013) have shown to display good intra- and inter-rater reliability.

However, we argue that both scales are limited in measuring need-supportive and -thwarting instructional behaviors in a real-life instructional environment. First, due to learning environments being dynamic and interactive and instructors displaying different instructional

behaviors (sometimes repeating the same instructional behaviors) multiple times in one lesson, sliding scale recording these changes would be a more authentic measurement tool compared to the 5-min lesson interval strategy of Haerens et al.'s (2013) scale. Second, the scale by Van den Berghe et al. (2013) requires raters to use two different coding systems to simultaneously assess teachers' need-supportive and -thwarting behaviors, which does not represent the authentic nature of the instructional process. Instead, the need-supportive and -thwarting behaviors are occurring in the continuum, as represented in the Cheon et al. (2012) scale. E.g., a need-supportive instructional decision will move the instructional support towards need-support and away from need-thwarting. To our knowledge, there are no observational instrument measuring this authentic nature of teaching and learning. Thus, the aim of this study was to develop and validate need-supportive instruction observation scale (NSTI) to assess instructors' need-supportive and -thwarting behaviors simultaneously in PA context and carry out a psychometric testing of the validity and reliability of the scale.

Methods

Scale Development

In the scale development phase, a pool of items was formed completing an extensive review of the central databases (e.g., PUBMED and PsycINFO) to identify both qualitative and quantitative studies that have employed questionnaires focusing on need-supportive and -thwarting instructional strategies (including autonomy-support) (Bartholomew et al., 2011a, 2011b; Manninen et al., 2022; Manninen & Yli-Piipari, 2021; Tessier et al., 2010). In addition, we reviewed the existing questionnaires in the area of SDT (Cheon et al., 2012; Haerens et al.,

2013; Van den berg et al., 2013). After reviewing the existing evidence, 21 need-supportive teaching strategy items were selected. To accompany the need-supportive items, we drafted the bipolar need-thwarting items. In Phase 2, a Delphi technique was utilized to seek convergence on a topic from a panel of experts (Helmer, 1967; Hsu & Sandford, 2007). First, three members of the research group conducted a content analysis to determine the degree to which items are representing the need-supportive and -thwarting instructional strategies in the PA context. After the content analysis, 14 items were selected and submitted for the international experts' review. The inclusion criteria for the panelists was that they needed to a. be specialist in the area of SDT and b. have published peer-reviewed journal articles on either need- or autonomy-supportive instruction (Grant, & Davis 1997). The authors reviewed the curriculum vitae for each potential panelist to judge their level of expertise based on the inclusion criteria. Due to a limited amount of prominent SDT scholars that have conducted need- or autonomy-supportive intervention, a convenience sample of eight potential panelists was approached (Lynn, 1986). Three specialists did not respond to our inquiry, whereas two responded that they did not have time to perform the requested content analysis. Three experts agreed to participate, and they performed an accuracy analysis rating each item statement (1 = low accuracy … 5 = high accuracy) (i.e., separately for need-supportive and -thwarting strategies). In addition, they were asked to give additional commentary on the items, if their accuracy rating was below 4. Based on the experts' feedback, nine maximum scoring items were selected for the final phase. Finally, each item was transferred back to the bipolar format with the need-supportive behaviors on the left side (scored as 3) and

the need-thwarting behavior on the left side (scored as -3). Figure 2 presents a description of the specific teacher behaviors.

Participants

A sample consisted of 20 PE classes, 540 observations, and 110 college-aged students (M_{age} = 20.56 ± 2.25; 62.7% females) segregated to four separate classes (M_{size} = 27.5). These cases were part of the local university's basic PE courses. Students selected individually one out of four classes based on the classes' suitability to the overall study schedule. One teacher (male) with experience in teaching PE for eight years taught 20 (5 lessons for each group) 50 min lessons in two weeks. Nine raters (graduate and undergraduate research assistants) (3 raters per class) were randomly selected to observe and rate the instructional practices. The study protocol was approved by the Institutional Review Board of the local university, and all participants provided a written consent before the study.

Procedures

Before the observation, all raters received 90 minutes of training on using the NSTI scale with their personal mobile phones or smart devices. During the training, we guided the assistants to familiarize themselves with the concepts of need-supportive and -thwarting instructional behaviors. Next, we taught them how to use the NSTI scale to rate these behaviors. To practice, the observers independently rated an instructor teaching juggling skills using both NSI and NTI behaviors. After the practice session, we shared and compared the result to ensure reliability among observers. During the validation process, each observer scored all five lessons independently. A male instructor who had ten years of experience teaching public school PE

taught all the lessons. Lessons were conducted in September 2021 during the fall semester (met 3-times/week following the Mon, Wed, Fri schedule). Neither the teacher nor students were using facemasks. The content of the lesson was juggling, and each lesson lasted 45 min. The five 45-min lessons were held during 11 days, and all four groups followed the same content. The lessons commenced with a standardized 10-min warm-up segment followed by a 25-min skill-learning section, and a 10-min closure.

Each class was rated by three independent raters using the NSTI scale. The raters were unaware of the group (experimental or control) to which the class belonged. If a teacher observed conducted one NSI behavior, raters were advised to move sliding from 0 (default) to 1. Subsequently, if a teacher performed a NTI behavior, raters were advised to slide the rating one step towards the need-thwarting side.

Instrument

To measure need-supportive and -thwarting strategies, the NSTI scale consisting of nine need-supportive and need-thwarting teaching strategies was used. The NSTI scale comprised a 7-point frequency scale, ranging from 3 (need-supportive behavior observed three times), to 2 (need-supportive behavior observed two times), to 1 (need-supportive behavior observed once), to 0 (need-supportive behavior never observed), to -1 (need-thwarting behavior observed once), to -2 (need-thwarting behavior observed two times), to -3 (need-thwarting behavior observed three times) (see Figure 2). The NSTI observational scale consist of three need-supportive and –thwarting teaching dimensions of autonomy support (e.g. ‘Instructor provides chances to choose drills at an optimal skill level’) and autonomy thwarting (e.g. ‘Instructor provides same tasks for

everyone at the same time and rejects any differentiation or pressures participants to participate her/his way'), relatedness support (e.g. 'Instructor is close to the participants, moves around, and interacts with participants') and relatedness thwarting (e.g. 'Instructor detaches from the participants and ignores their opinions or questions (acting cold)'), and competence support (e.g. 'Instructor provides positive and informational feedback that signifies competence or improves competence') and competence thwarting (e.g. 'Instructor makes all decisions, provides simple tasks requiring lower level of cognitive engagement, and no time to work independently. Instructor provides no opportunities for participant ownership').

Statistical analyses

After cleaning the data, intra-class correlation coefficients (ICC) and their 95% confidence intervals based on a mean-rating (k = 3), absolute-agreement, 2-way random effects model were examined using the SPSS statistical package version 23 (SPSS Inc, Chicago, IL). When interpreting the findings, values less than .5 are indicative of poor reliability, values between .5 and .75 indicate moderate reliability, values between .76 and .90 indicate good reliability, and values greater than .90 indicate excellent reliability (Koo & Lee, 2016).

To identify a latent factor structure, an exploratory factor analysis (EFA) was conducted. Before the analysis, Bartlett's test of sphericity was used to confirm that the correlation matrix was not random, and the Kaiser-Meyer-Olkin (KMO) statistic was required to be at least .80 (Kaiser, 1974). A common factor analysis using principal axis factoring with 100 maximum converge iterations was chosen over a principal component analysis (Fabrigar et al., 1999). An iterated extraction method was employed with initial communalities estimated by squared

multiple correlations because it is tolerant of non-normality and can recover weak factors (Briggs & MacCallum, 2003; Guttman, 1956). Following the advice of Velicer et al. (2000), parallel analysis (Horn, 1965), MAP (Velicer, 1976), and the visual scree test (Cattell, 1966) were used to determine the number of factors to retain, along with parsimony and theoretical convergence considerations. Therefore, an oblimin rotation (Jennrich & Sampson, 1966) was employed (Carroll, 1978; Child, 2006). The goal was to ensure that the retained factors were appropriate and meaningful.

Criteria for determining factor adequacy were established a priori. Pattern coefficients ≥ .37 were considered salient (i.e., both practically and statistically significant as per Norman & Streiner, 2014). Factors with a minimum of three salient pattern coefficients, internal consistency reliability ≥ .70, and that were theoretically meaningful were considered adequate. Next, Cronbach's alpha coefficients to examine internal consistency of the scale were examined. To examine construct validity, a confirmatory factor analysis (CFA) using Mplus version 22 and 8.4 software was implemented. The following goodness-of-fit indices were used: Chi-square (χ^2 > .05), Bentler comparative fit index (CFI; > .95) and Tucker-Lewis index (TLI; > .95), Root Mean Squared Error of Approximation (RMSEA; < .06) (Hu & Bentler, 1999). Finally, a chi-squared difference test ($\Delta\chi^2$) was used to compare the competing hypothesized models (Rigdon, 1999). If the *p* value associated with the chi-square test is non-significant, H_0 is rejected and an alternative hypothesis H_1 accepted. In other words, a *p* value < .001 for the chi-square difference tests indicates statistically significant differences in the estimated models.

Results

Inter-rater agreement

ICC (2, k) coefficient was used to assess the consistency of item ratings with the mean correlation across all raters and rating dimensions indicating the extent of rating consistency. Between-rater correlation ranged between .89 and .90. Item mean was .28 ranging from minimum .08 to maximum .41. Analyses produced an ICC of .96(6.19), CI 95% (95, .97) with item ratings ranging from .80 to .95.

Internal consistency

Cronbach's alpha coefficient .99 showed high internal consistency of the scale, and omitting any items did not improve internal consistency.

Factorial Validity

To explore the factorial validity of the NSTI scale, all nine instructional strategies were subjected to an EFA. First, we did factor analyses with three factors to follow the theoretical assumptions of SDT (Deci & Ryan, 1985). Analyses produced the following values (KMO = .96, Bartlett's test of sphericity (45) = 1218.63, $p < .001$), with indication that correlation structure is adequate for factor analyses. For this 3-factors solution eigenvalues explained 92.60% (Factor 1), 2.17% (Factor 2), and 1.60% (Factor 3) of the variance. Unexpectedly, the eigenvalue of the Factor 4 was more than 1.00 (1.07) suggesting that four factor solution could be plausible. On the contrary, parallel analysis, MAP, and scree all suggested that one-factor structure should be retained. For instance, extracted factor loadings for the 1st factors were ranging between .891 and .987, whereas the highest loading for the Factor 2 was .234 and for the Factor 3 .215. When testing the 1-factors solution. The one-factor analyses showed eigenvalue 9.260 with the

explanatory percentage being 92.599. Initial and extracted communalities are presented in Table 3.1. The extracted factor loading ranged between .782 and .976. The one-factor solution was conceptually plausible as instructional strategies oftentimes impact not only say autonomy but relatedness as well.

Table 3.1

Factor loadings of the need-supportive and -thwarting teaching behaviors

Items	Extracted	Initial
1. Chances to choose drills at an optimal skill level.	.951	.921
2. Tangible goals of the lesson and lays out reasonable expectations relating to participants' individual development and/or growth	.782	.800
3. Offers participants a rationale and expected learning outcomes for tasks and exercises.	.951	.921
4. Positive and informational feedback that signifies competence or improves competence.	.956	.957
5. Meaningful choice within the skill drills and flexibility with appropriate techniques.	.944	.946
6. New guidelines, tips and advice for participants lead to more engagement and higher-level learning.	.937	.935
7. Instructor encourages participants to persist (e.g., "come on, you can do it").	.871	.917
8. Is close to the participants, moves around, and interacts with participants.	.976	.973
9. Asks participants questions about their interests, problems, values, or wishes addressing them by their first name.	.897	.906

CFA

CFA was conducted for each of the nine factors extracted through the EFA. The model fit indices for the Default Model showed an acceptable model fit: $\chi^2(27) = 35.45$, $p = .073$, CFI = .99, TLI = .99, RMSEA = .07, CI 90% [.01, .13]. However, the low factor loading for the instructional strategy nine ("…*asks participants questions about their interests, problems, values, or wishes addressing them by their first name"*) $\lambda^9 = .490$ ($p = < .001$) was distinctively smaller than other loadings lambda's ranging between .882 and .988 (Table 3.2). Thus, we tried to omit the ninth instructional strategy to test whether this modified eighth-factor model (Modified Model) improves the model fit. The new Modified Model fit indices showed a weaker model fit: $\chi2(20) = 31.76$, $p = .046$, CFI = .99, TLI = .98, RMSEA = .100, CI 90% [.01, .12] compared to the Default Model. To test whether the models differed in statistical significance, $\Delta\chi2$ test was employed. However, the $\Delta\chi^2$ test showed that the Modified Model was not statistically different from the Default Model 1 ($\Delta\chi^2 = 0.013$, $p = .846$). Thus, the final model parameters are presented in Table 3.2.

Table 3.2

Factor Loadings of the Need-Supportive Teaching Behaviors and Model Fit

Items	S.E.	Est./S.E.	*p*	R^2(S.E.)	*p*
Chances to choose drills at an optimal skill level.	.882	.029	.000	.78(.05)	.000
Tangible goals of the lesson and lays out reasonable expectations relating to participants' individual development and/or growth	.976	.007	.000	.95(.01)	.000

Offers participants a rationale and expected learning outcomes for tasks and exercises.	.956	.012	.000	.92(.01)	.000
Positive and informational feedback that signifies competence or improves competence.	.977	.007	.000	.96(.01)	.000
Meaningful choice within the skill drills and flexibility with appropriate techniques.	.973	.008	.000	.95(.02)	.000
New guidelines, tips and advice for participants lead to more engagement and higher-level learning.	.962	.010	.000	.94(.02)	.000
Instructor encourages participants to persist (e.g., “come on, you can do it”).	.937	.016	.000	.88(.03)	.000
Is close to the participants, moves around, and interacts with participants.	.988	.004	.000	.98(.01)	.000
Asks participants questions about their interests, problems, values, or wishes addressing them by their first name.	.490	.099	.000	.24(.10)	.014

Discussion

The present study aimed to develop and validate the NSTI observation scale for the PA context. The psychometric testing supported reliability and validity of the 9-item NSTI scale. Our analyses demonstrated excellent inter-rater reliability consistency with our three raters’ scores achieving a 96% agreement. EFA suggested either one or three factor solutions. Parallel

analysis, MAP, and scree all suggested that one-factor structure should be retained, but due to the theoretical postulation of the SDT (Deci & Ryan, 1985), also a three-factor structure was tested. Analyses, however, did not support the three-factor solution as internal reliability was very weak. It is noteworthy that one-factor solution is plausible as instructional strategies almost always impact simultaneously two or three psychological needs and not only one need. For example, positive and informational feedback nurtures not only participants' competence but can support their autonomy and relatedness as well, and thus are complementary (Tessier et al., 2010). Finally, one-factor model factor loadings were strong, with 92% of the total variance explained by the selected nine factors. The result suggested that nine factors in bipolar format presented instructors' need-supportive and -thwarting instructional behaviors well in the PA context.

Next, we conducted a CFA to test the construct validity of this nine-factor solution. Our analyses showed that the factor loadings of the CFA supported the nine-item solution. However, the item nine ("…asks participants questions about their interests, problems, values, or wishes addressing them by their first name") was distinctively smaller than other loadings with lambda being .490. Thus, we tried to omit the ninth instructional strategy to test whether this modified eighth-factor solution would be significantly better than the nine-factor solution. However, the chi-squared difference test showed that the eight-factor solution did not differ from the nine-factor model at the statistically significant level. Thus, we retrieved the nine-factor model as the best model to assess validly need-supportive and -thwarting instructional strategies.

Considering the plethora of experimental studies examining the impact of NSI in PA (e.g., Manninen et al., 2022a), there are very few published reliable and valid questionnaires to

measure SDT-centered concepts, e.g., autonomy-support and, especially, psychological need-support. A need for valid observation scales is imminent as measuring treatment fidelity (e.g., teachers' adherence to intended teaching practices) is a necessary component of rigorously designed and conducted experimental studies. Although the previous scales have demonstrated moderate reliability and validity (Cheon et al., 2012; Haerens et al., 2013) to date there are no validated observation scales that measure need-supportive and -thwarting instructional practices objectively. Most of the time, NSI practices have been assessed subjectively by asking participants' perceived experiences of autonomy, competence, and/or relatedness (Abula, 2018; Barkoukis, 2021; Chang, 2016; Edmunds, 2008; Franco, 2017; Gonzalez-Cutre, 2018; Leptokaridou, 2016; Mertens, 2018; Moreno-Murcia, 2016; Moustaka, 2012; Ntoumanis, 2017; Pulido, 2017; S´anchez-Oliva et al., 2017; Sebire, 2016; Tilga, 2019; Tilga, 2020; Ulstad, 2018; Zazo, 2018). Some studies have assessed instructors' need-support analyzing recorded video or audio from the teaching situations, relying on raters' interpretations of teaching guidelines (Fin, 2019; Franco, 2017; Langan, 2015; Lonsdale, 2013, 2019; Moreno-Murcia, 2016). Although Cheon and colleagues (2012) used a bipolar observation scale to assess teachers' autonomy-supportive behavior and controlling behavior on site, this scale targeted only instructors' autonomy-support excluding competence- and relatedness-support. This study responded to the need to have valid SDT-centered observation scale measuring psychological need-supportive and -thwarting instructional practices in organic, real-time PA sessions. Our nine-item study showed that the NSTI scale is a valid observation scale to measure all dimensions of need-supportive and -thwarting instructional behaviors.

Limitations and future studies

As a limitation, the sample comprised university PE students. Future studies should test the validity of the scale in K-12 PE context, as university physical students are conceptually different from K-12 PE students. In addition, future studies should further test the reliability of this scale using a different sample. Furthermore, additional comprehensive efforts to determine the validity of the NSTI scale are encouraged.

Conclusions

The main conclusion of this study is that this observation validation fills an important gap in SDT-centered literature and represents an advancement of the scientific literature focusing on how to measure NSI in PA validly and reliably. The findings of this study suggest desirable validity and reliability of the NSTI scale.

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Items	Rating	Items
1. Instructor provides tangible goals of the lesson and lays out reasonable expectations relating to participants' individual development and/or growth.	3 2 1 0 -1 -2 -3	1. Instructor provides inadequate goals and unrealistic or extrinsic (e.g., being better in than others) expectations.
2. Instructor provides chances to choose drills at an optimal skill level.	3 2 1 0 -1 -2 -3	2. Instructor provides same tasks for everyone at the same time and rejects any differentiation or pressures participants to participate her/his way.
3. Instructor offers participants a rationale and expected learning outcomes for tasks and exercises.	3 2 1 0 -1 -2 -3	3. Instructor pushes participants to perform tasks without explaining why they should do what the instructor asks them to do. Instructor ignores participants' efforts to understand the tasks.
4. Instructor provides positive and informational feedback that signifies competence or improves competence.	3 2 1 0 -1 -2 -3	4. Instructor makes all decisions, provides simple tasks requiring lower level of cognitive engagement, and no time to work independently. Instructor provides no opportunities for participant ownership.
5. Instructor provides meaningful choice within the skill drills and flexibility with appropriate techniques.	3 2 1 0 -1 -2 -3	5. Instructor forces participants to follow instructor's decision and offers no choice.
6. Instructor provides new guidelines, tips and advice for participants leading to more engagement and higher-level learning.	3 2 1 0 -1 -2 -3	6. Instructor ignores chances to provide guidance, tips, or advice.
7. Instructor encourages participants to persist (e.g., "come on, you can do it").	3 2 1 0 -1 -2 -3	7. Instructor does not put any effort and energy into the lesson.
8. Instructor is close to the participants, moves around, and interacts with participants.	3 2 1 0 -1 -2 -3	8. Instructor does not move around the space and physically distances (her)himself from the participants.
9. Instructor asks participants questions about their interests, problems, values, or wishes addressing them by their first name.	3 2 1 0 -1 -2 -3	9. Instructor detaches from the participants and ignores their opinions or questions (acting cold).

Figure 2. A Need-Supportive and -Thwarting Instruction Observation Scale

CHAPTER 4

A COMPARISON OF THE EFFICACY OF NEED-SUPPORTIVE AND -THWARTHING INSTRUCTION ON SKILL PERFORMANCE, MOTIVATION, AND AFFECT

Hwang, Y., Deng, Y., Kim, T., & Yli-Piipari, S. To be submitted to the Research Quarterly for Exercise and Sport

Abstract

Grounded in the self-determination theory, this study aimed first, to compare the efficacy of psychological need-supportive and -thwarting instruction on motor skill performance and motivation, and second, to test whether the interventions had differentiated impact on participants' enjoyment and state anxiety. A sample of 110 participants (M_{age} = 20.56 ± 2.25; 62.7% females) was randomly allocated to either a need-supportive or –thwarting condition. Five 50-minute juggling lessons were taught by one instructor following a structured lesson format with different instructional modality serving as an independent variable. Dependent variables were juggling performance, self-determined motivation, enjoyment, and state anxiety, with trait anxiety and task interest as covariates. The analysis of covariance showed a statistically significant between-group effect on skill performance (F[2,106] = 4.15, p = .044, ηp^2 = .04), intrinsic motivation (F[2,106] = 8.87, p = .004, ηp^2 = .08), introjected regulation (F[2,106] = 6.06, p = .012, ηp^2 = .06), extrinsic regulation (F[2,106] = 9.45, p = .003, ηp^2= .08), and amotivation (F[2,106] = 12.29, p < .001, ηp^2 = .12). Also, there was a significant between-group effect on enjoyment (F[2,106] = 24.23, p < .001, ηp^2 = .19) and state anxiety (F[2,106] = 3.17, p = .020, ηp^2= .05). In conclusion, need-supportive instruction was a superior instructional strategy compared to need-thwarting instruction when aiming to improve participants' motor skill performance, motivation, and positive affect.

Keywords: Need-supportive instruction, skill performance, intrinsic motivation, state anxiety, enjoyment, physical activity

Introduction

Motivation is a driving force in human behavior. Motivation can be defined as a direction and intensity of one's effort (Sage, 1977). In PA, motivation has found to relate to exercise and PA adoption (e.g., participation) (Vallerand, 1997; Gagne 2003), engagement (e.g., PA intensity) (Cheon et al., 2012; Lonsdale, Sabiston, Raedeke, Ha, & Sum, 2009; Ntoumanis, 2005; Reeve et al., 2004; Tessier et al., 2010), adherence (positive affective response) (Ryan et al., 1997; Teixeira et al., 2012), and performance (Cerasoli, Nicklin, & Ford, 2014; Charbonneau, Barling, & Kelloway, 2001; Manninen, Deng, Hwang, Waller, &Yli-Piipari, 2022a). Although the positive benefits of the quantity and quality motivation have been found to relate to these positive outcomes and human functioning, one of the central questions pertaining to human performance is how we can better nurture human motivation to harness these aforementioned positive consequences (Deci & Ryan, 2000; Ryan & Deci, 2017).

Self-Determination Theory (SDT) is one of the most prominent social-cognitive theories to examine motivation, performance, and well-being (Deci & Ryan, 1985, 2000; Ryan & Deci, 2017). According to the SDT, there are three basic psychological needs as essential factors for human growing and well-being which are autonomy (a sense of being the initiator of one's behavior), relatedness (a sense of connected and belonging to others), and competence (feelings of capability and mastering one's goals and outcomes) (Deci & Ryan, 1985, 2000. When individuals' three basic psychological needs are satisfied, their psychological growth, autonomous motivation, and well-being are nurtured (Deci & Ryan, 2000).

SDT identifies not only the quantity of motivation but also the quality of human motivation (Deci & Ryan, 2000). Based on the SDT framework, humans have different types of motivational regulations which range along the continuum of autonomy (Deci & Ryan, 1985, 2000; Ryan & Deci, 2017). At one end of the continuum, there is intrinsic motivation which is a fully autonomous state. When intrinsically motivated, an individual chooses to engage in an activity for the pleasure and inherent satisfaction derived from the participation. At the middle of the continuum are located the three levels of extrinsic motivation: integrated regulation (i.e., behaviors that are performed within individual's goals and values), identified regulation (i.e., behaviors that are performed as valuable and important to an individual), and introjected regulation (i.e., behaviors that are performed to achieve others' approval or avoid internal pressures and feeling guilty). The most extrinsic form of external motivation is extrinsic regulation, which refers to activities performed for external reasons, e.g. reward, wealth, grades, status, appearance, or avoiding negative consequences. Finally, at the far end of the continuum of autonomy is amotivation, which can be defined as a total lack of motivation. Individuals with amotivation do not have any goal or purpose to engage in activities, and they often experience feelings of incompetence (Deci & Ryan, 1985). SDT hypothesizes that the most autonomous (self-determined) motivations (intrinsic motivation and identified regulation) are adaptive motivations with positive affective, cognitive, and behavioral outcomes, whereas controlling (non-self-determined) motivations (introjected, extrinsic, and amotivation) are maladaptive with negative outcomes (Deci & Ryan, 1985; Vallerand, 1997).

Centered around the SDT, NSI can be defined as an instruction that supports the three basic psychological needs of competence, autonomy, and relatedness as theorized by the SDT (Manninen et al., 2022a; Manninen & Yli-Piipari, 2021; Tessier et al., 2010). Following the theoretical postulations of the SDT, NSI will positively influence nurturing self-determined motivation and impacting people's optimal development and well-being (Ryan & Deci, 2017). NTI, on the other hand, represents an extreme condition that violates participants' psychological needs (Bartholomew et al, 2011a, 2011b). NTI practices can include the usage of extrinsic goals, controlling language, a lack of choice and ownership, a lack of dialogue relating to different ways to perform tasks, and rigidness towards participants' opinions and desires (Manninen et al., 2022a). SDT theorizes that need-thwarting psychological environment and instruction increases ill-being (Ryan & Deci 2017).

A scarce body of studies have examined the relationship between NSI and participants' behavioral, motivational, and affective outcomes. Manninen et al. (2022a) found that NSI to be superior compared to need-neglecting instruction in participants skill performance and adaptive motivation. Also, empirical evidence has shown that NSI affects positively students' psychological outcomes with no correlation with negative psychological outcomes (Lochbaum & Jean-Noel, 2015). In relation to enjoyment, NSI has shown to improve enjoyment in exercise settings (Edmunds et al., 2008; Manninen et al., 2022a; Mouratidis et al., 2011). On the other hand, NTI has been found to be associated with maladaptive outcomes, such as disordered eating, depression, burnout, negative affect, and physical symptoms, as well as elevated levels of secretory immunoglobulin A (Bartholomew et al., 2011b). Also, NTI in the PA context has been

shown to predict higher state anxiety (Quested et al., 2011), sport anxiety (Haraldsen et al., 2020), and somatic anxiety (Papaioannou & Kolli, 1999).

Although previous research has shown the existence of positive relationship between NSI and participants' behavioral, motivational, and affective outcome, currently, there is a lack of empirical research of NTI on students' affective and behavioral outcomes. In addition, the current evidence on NSI is largely correlational or derived from the quasi-experimental intervention research. One of the few rigorously conducted experimental studies by Manninen et al. (2022a) showed NSI to be superior compared to need-neglecting instruction in participants skill performance, adaptive motivation, and enjoyment. However, they study did not detect any statistically significant differences in state anxiety (Manninen et al., 2022a). Authors of the study (Manninen et al., 2022a) concluded that the need-neglecting instruction is not likely strong enough to elicit negative responses, such as increased state anxiety.

Therefore, the first aim of this study is to compare the efficacy of need-supportive and -thwarting instruction on behavioral and motivational outcomes. It was hypothesized that participants who will receive NSI would report higher levels of participants' skill performance (Barkoukis et al., 2010; Manninen et al., 2022a; Valentini & Rudisill, 2004a; 2004b) and self-determined motivation (Kirby et al., 2015; Manninen et al., 2022a; Vasconcellos et al., 2020) when compared to students receiving NTI. The second aim of this study was to compare these two distinct instructional modalities and the affective responses they elicit. It is assumed that NSI would improve participants' affect, i.e., improve participants' enjoyment (Edmunds et al., 2008;

Manninen et al., 2022a; Mouratidis et al., 2011) and decrease their state anxiety (Quested et al., 2011).

Method

Study Design and Participants

This study was a cluster randomized controlled trial. All participants were blinded to their intervention condition. A sample of 110 undergraduate college students (M_{age} = 20.56 ± 2.25; 62.7% females) in four classes (M_{size} = 27.5) and enrolled in a university's basic PE course agreed to participate in this study. Prior to gathering the data, participants completed the skill level test during the first lesson. Only subjects who did not have prior juggling skills were eligible to participate.

Research Procedures

This intervention replicated the study protocol of Manninen et al. (2022a). All participants participated in the pre- and post-trial tests and intervention. A 36-year-old male instructor with six years of experience in teaching PE and sound comprehension of the SDT theory and need-supportive/thwarting instruction taught all 20 (5 lessons for each group) 50-minutes lessons during a two-week period. The intervention was conducted during the 2021 fall semester (met 3-times/week on Monday, Wednesday, Friday, Monday, & Wednesday). Each lesson followed the same structure and content with differences only in instructional delivery. First, the instructor led a standardized 10-minute warm-up, including static and dynamic stretching. After that, the instructor delivered a 25-minute juggling skill-learning portion. During this portion of the lesson, the instructor introduced techniques for different types of 3-ball juggling skills from basics to

advancing towards more complex ones. At the end of each lesson, the participants were provided 10 minutes of free practice time without the instructor's presence. At this time, the instructor and observers stayed outside of the practice facility (not visible to the participants) to measure practice frequency. All participants were given three tennis balls and used the same balls for the entire length of the study. Pre- and post-trial tests included tests for the primary and secondary outcomes, and pretrial tests included additional tests for the theory-based covariates.

Experimental Conditions

The need-supportive and need-thwarting conditions followed the same dose, content, and structure. The teacher demonstrated same skills, offered same technical cues, and followed same minute-to-minute schedule as it related to the task progression (Manninen et al., 2022a; Van den Berghe et al., 2013). Each interaction with participants followed either need-supportive or -thwarting strategy based on Table 4.1

Table 4.1.

The Need-supportive and -Thwarting Strategy

Instructional Dimensions	Need-Supportive Instruction	Need-Thwarting Instruction
Goals	Instructor provides tangible goals of the lesson and lays out reasonable expectations relating to participants' individual development and/or growth.	Instructor provides inadequate goals and unrealistic or extrinsic expectations (e.g., being better in than others).
Task difficulty	Instructor provides chances to choose drills at an optimal skill level.	Instructor provides same tasks for everyone at the same time and rejects any differentiation or pressures participants to participate her/his way.
Feedback	Instructor provides positive and informational feedback that	Instructor makes all decisions, provides simple tasks requiring lower level of cognitive

	signifies competence or improves competence.	engagement, and no time to work independently. Instructor provides no opportunities for participant ownership.
Structure	Instructor provides new guidelines, tips and advice for participants leading to more engagement and higher-level learning.	Instructor ignores chances to provide guidance, tips, or advice.
Provision of choice	Instructor provides meaningful choice within the skill drills and flexibility with appropriate techniques.	Instructor forces participants to follow instructor's decision and offers no choice.
Value	Instructor offers participants a ration and expected learning outcomes for tasks and exercises.	Instructor pushes participants to perform tasks without explaining why they should do what the instructor asks them to do. Instructor ignores participants' efforts to understand the tasks.
Encouragement	Instructor encourages participants to persist (e.g., "come on, you can do it").	Instructor does not put any effort and energy into the lesson.
Interpersonal involvement	Instructor asks participants questions about their interests, problems, values, or wishes addressing them by their first name.	Instructor detaches from the participants and ignores their opinions or questions (acting cold).
Physical distance	Instructor is close to the participants, moves around, and interacts with participants.	Instructor does not move around the space and physically distances (her)himself from the participants.

NSI Condition

The instruction was the independent variable of the study. NSI focused on nurturing the psychological needs of the participants based on the instructional strategies introduced in Table 5. E.g., the need-supportive instructor provides participants chances to choose tasks at their optimal skill level, the need-supportive instructor asks participants questions about their interests, problems, values, or wishes addressing them by their first name.

NTI Condition

NTI, on the other hand, was planned to intentionally violate psychological needs. E.g., the need-thwarting instructor provides same tasks for everyone at the same time and rejects any differentiation or pressures participants to participate her/his way, the need-thwarting instructor detaches from the participants and ignores their opinions or questions (acting cold).

Rater Training

Prior to the study, a 90-minute training for every nine raters (graduate and undergraduate research assistants) we conducted. During this training, we familiarized them with the concept of need-supportive and -thwarting instructional behaviors and instructed them on how to use the NSTI scale for rating these behaviors. The raters then practiced rating independently while an instructor demonstrated a juggling skill teaching using both NSI and NTI behaviors. Following the demonstration, we assessed the raters' reliability by comparing their ratings to ensure consistency.

Measures

Primary Outcomes

Juggling skill performance. To assess skill performance, traditional 3-ball juggling tests were used. Without warm-up and juggling skill practice to control the condition same for everyone participants performed the basic and reverse cascade juggling skill in order in a 1m x 1m designated area. The participants completed two trials with each technique, and the total of successful catches was recorded. The trial was done when a participant dropped the ball, rotate the ball in a wrong pattern, or move out of the designated area. After two trials, an average score was coded as a subtest score.

Exercise motivation. To measure participants' motivation in juggling, the Behavioral Regulations Questionnaire-3 (Markland & Tobin, 2004; Wilson, Rodgers, Loitz, & Scime, 2006) was used. The scale was developed to measure exercise motivation, but we revised exercise statements to focus on learning juggling skills. The participants answered the following stems: "I am going to take part in the basic PE course and its juggling module because (pretrialt)" / "Thinking about the five last lessons of the course (juggling), I have taken part in this PE course because (posttrial)." Twenty-four statements reflecting the participants' intrinsic motivation integrated, identified, introjected, and extrinsic regulation and amotivation were included in the questionnaire. Intrinsic motivation (e.g., "because it's fun"), integrated regulation (e.g., "because it is consistent with my life goals'), identified regulation (e.g., "it's important to me"), introjected regulation (e.g., "I feel guilty when I don't"), external regulation (e.g., "because other people say I should"), and amotivation (e.g., "I don't see why I should have to participate) represent the different motivational regulations of the scale. The participants completed all items using a 7-point Likert-scale ranging from 1 (very untrue for me) to 7 (very true for me). The factorial validity and the scale's internal consistency have been found to be acceptable (Markland & Tobin, 2004).

Secondary Outcomes

Enjoyment. The Physical Activity Enjoyment Scale (Kendzierski & DeCarlo, 1991) was used to assess the participants' enjoyment assuming a unidimensional structure of enjoyment that was developed for college students. The participants answered 18 items using a 7-point bipolar Likert scale after reading the statement "How do you think you are going to feel about the

juggling classes you are going to have in the next two weeks (pretest) "/ "how do you feel about the juggling classes you have been doing for the past two weeks (posttest)." Examples of the items include "It is not at all stimulating/it is very stimulating" and "I feel bored/I feel interested." The scale has demonstrated good internal consistency, test-retest reliability, and criterion validity among this population (Kendzierski & Carlo, 1991).

State anxiety. To assess the participants' levels of state anxiety toward the juggling lessons, an adapted 20-item version of the State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) was used. The scale contains self-report measures for state (e.g., "I feel nervous") anxiety. The participants were asked to rate their levels of anxiety using a 7-point Likert-scale (1 = very untrue for me; 7 very true for me). Examples of items include "Indicate how you feel at the moment about the upcoming juggling classes (pretest) / Indicate how you feel at the moment about the upcoming lessons of the course (posttest)." The scale has been found to have good concurrent and discriminant validity (Spielberger et al., 1983) as well as good internal consistency (Barnes, Harp, & Jung, 2002).

Exploratory outcome

In-class free-choice practice time. A modified version of the systematic observation method SOPLAY (System of Observing Play and Leisure Activity in Youth; McKenzie, Marshall, Sallis, & Conway, 2000) was used to observe participants' juggling practice time during the three randomly selected pre-meditated free-choice practice sessions (same lesson for each condition). To record participants' own practice, the SOPLAY utilizes momentary time sampling. Two observers independently conducted five concurrent scans of the participants' behavior

(practicing/not practicing) during the 10 minutes (every two minutes intervals) free-choice period. The interrater reliability was measured with an intra-class correlation (ICC [2,3]; two-way random effect; absolute agreement) over twelve observations. The rate of the participants' practice was calculated as two combined percentages (one for each condition) of active participants over the twelve observed lessons (six for each condition and three for each group).

Covariates

Trait anxiety. An adapted version of the trait anxiety section of the State-Trait Anxiety Inventory (Spielberger et al., 1983) was used to assess students' trait anxiety levels. The inventory includes 20-items (e.g., "I feel nervous and restless") representing the level of participants' trait anxiety. Participants will be rated themselves using a 7-point Likert-scale (1 = never; 7 = always) after reading the following stem: "Indicate how you generally feel." The scale has been found to have a good validity (Spielberger & Sydeman, 1994) and reliability (Barnes et al., 2002).

Situational interest. The Situational Interest Scale (Chen, Darst, & Pangrazi, 1999) was used to assess participants' interest in juggling. The scale consists of five subscales with four items each rated on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Examples of items include: novelty (e.g., 'what I did today was new to me'); instant enjoyment (e.g., 'what I did was enjoyable for me'); exploration intention (e.g., 'I wanted to analyze and have a better handle on what I was learning today'); attention demand (e.g., 'what I was learning demanded my high attention'); and challenge (e.g., 'what I was learning was hard for me to do'). For the between-group analyses, a composite situational interest variable was

created by calculating an aggerated mean using all five subdimensions. The scale has been shown to be internally consistent and to have good validity using confirmatory factor analysis (Chen et al., 1999).

Fidelity measure

Instructor adherence. To assess teacher's adherence to need-supportive and need-thwarting instructional strategies, NSTI scale was used (Hwang et al., submitted). The NSI observational scale consists of three need-supportive teaching dimensions of autonomy support (e.g. 'Instructor provides chances to choose drills at an optimal skill level.'), relatedness support (e.g. 'Instructor is close to the participants, moves around, and interacts with participants.'), and competence support (e.g. 'Instructor provides positive and informational feedback that signifies competence or improves competence.'). The NSI observation scale was coded for five consecutive 25min classes using a 7-point frequency scale, ranging from 3 (need-supportive behavior observed three times) to -3 (need-thwarting behavior observed three times) by three trained raters. Each class was observed by three raters who worked independently. The raters were blinded to the group (experimental or control) they were observing. Interrater reliability of the observation checklist over eight observed lessons was adequate (ICC [2,3]; two-way random effect model with absolute agreement; .71). Single scores for each of the ten behaviors were averaged together to create a score for each behavior for a single lesson for one observer. Given the adequate interrater reliability of the rating system, the aggregated scores from the two raters were further averaged together to create a score for each of the instructional behaviors and strategies for the analyses.

Perceived Need-support. The Perceived Environmental Supportiveness Scale (Markland & Tobin, 2010) was used to assess participants' perceived need-support. The scale comprises of 15 items with five items evaluating each of the three dimensions of need-support. The participants were asked to rate the items after the following stem "My teacher will… (pretest). Based on the five last lessons of the course (juggling), my teacher… (post-test)." Examples of the items include "make me feel like I matter to him (involvement), "take into account my individual needs" (autonomy-support), and "help me feel confident" (structure). The items were rated on a 7-point Likert scale (1 = strongly disagree; 7 = strongly agree). The scale has been shown to be valid and internally consistent (Markland & Tobin, 2010).

Randomization

Four classes were randomized to two conditions using a free resource research randomizer program (www.randomizer.org).

Sample size

Statistical power was calculated for the repeated measures analysis of variance using G*Power 3.1.2. We conservatively estimated a moderate effect size (.25) (within-subjects). Using an alpha of .05, an estimated correlation of r = .50, we expected that a sample of 34 participants was required for the 80% power. To account for the data clustering, 34 were adjusted by design effect (Kish, 1965) of 1 + (m-1) x ICC, where m is the sample size of each cluster (25 participants per group), and ICC is an intraclass coefficient. ICCs were determined based on the findings of Yli-Piipari et al. (2018), who found class level ICC of motivational

regulations to be below .05. The final correcting equation was used: 1 + (25–1) x .05 = 2.20. Thus, the total minimum sample was 2.20 x 34 = 75.

Statistical analyses

First, we completed preliminary analyses, e.g., Cronbach alphas for the internal consistency of the measured constructs and 2-way random effect with the absolute agreement ICC (2,3) for the interrater reliability on the instructional strategy observations. Group differences at the pretrial were tested with a one-way analysis of variance. To compare the effects of the experimental conditions on the exploratory outcomes of free-choice and out-of-class practice time, a one-way analysis of variance was conducted. To compare between-group effects on the outcome variables, an analysis of covariance was conducted with trait anxiety, situational interest, gender, and the pretest scores as covariates. Partial eta squared (η^2). All analyses performed using the SPSS (version 22) and Mplus (Version 7.1; Muthén & Muthén, 1998–2013). Alpha set at $p < .05$ for all tests. Standardized mean changes were calculated, with values of .2 (small), .5 (moderate), and .8 (large) used as guidelines for interpreting analyses of covariance effect sizes (Cohen, 1988).

Results

2.8. Preliminary analysis

Missing values and normal distribution of the scores

Preliminary analyses included cleaning of the data, scale reliabilities, and descriptive analyses, e.g., means, standard deviations (SD) were conducted and are presented in Table (4.2, 4.3, and 4.4).

Table 4.2

Characteristics of the Participants

Variables	**Control Group**	**Experimental Group**
Age (SD)	21.0(2.83)	20.17(1.50)
Gender (%)		
Male	23 (39.7%)	18 (34.6%)
Female	35 (60.3%)	34 (65.4%)
Ethnic group (%)		
White Caucasian	40 (69%)	39 (75)
Black African American	5 (8.6%)	4 (7.7%)
Asian	10 (17.2%)	6 (11.5%)
Hispanic	3 (5.2%)	3 (5.8%)
Class rank (%)		
Freshman	9 (15.5%)	4 (7.7%)
Sophomore	12 (20.7%)	8 (15.4%)
Junior	14 (24.1%)	9 (17.3%)
Senior	23 (39.7%)	31 (59.6%)

Our preliminary analyses showed statistically significant differences between self-reported out-of-class daily practice time for each day between the pretest and posttest ($t(94) = 1.47$, $p = .027$), with the students in the need-supportive condition practicing more. Based on the in-class practice observations, on average 37.4% of the students in the need-thwarting condition were practicing during the free-choice activity across five measurement points, whereas in the need-supportive condition the percentage was 22%.

Table 4.3.

Descriptive Statistics of the Variables

Variables	Control Group					Experimental Group				
	M	***SD***	***KU***	***SK***	**α**	***M***	***SD***	***KU***	***SK***	**α**
Primary Outcome Variables										
Skill 1	0	na	na	na	na	0	na	na	na	na
Skill 2	5.90	9.78	1.39	1.65	na	10.81	11.17	8.26	2.43	na
Intrinsic 1	5.37	1.18	-.34	-.22	.83	5.07	.78	-.18	.14	.83
Intrinsic 2	5.44	1.14	1.14	-.80	.76	5.71	1.15	-.89	-.32	.76
Integrated 1	3.48	1.41	-.09	.43	.58	3.51	1.11	.17	.35	.58
Integrated 2	3.69	1.38	-.40	.13	.85	3.75	1.18	.27	.26	.85
Identified 1	4.75	.96	.43	-.23	.75	4.56	.98	-.44	.07	.75
Identified 2	4.75	.91	-.56	.09	.76	4.83	.89	-.22	.24	.76
Introjected 1	3.71	1.61	-1.07	.03	.65	3.62	1.37	-.49	.04	.75
Introjected 2	4.03	1.35	-.69	-.17	.82	3.59	1.31	-.34	-.17	.82
Extrinsic1	2.86	1.33	.01	.61	.61	2.86	1.24	1.27	.68	.71
Extrinsic 2	3.20	1.39	-.21	.50	.93	2.77	1.10	-.16	.19	.93
Amotivation 1	2.00	.81	-.10	.70	.78	2.34	1.01	-.05	.55	.78
Amotivation 2	2.66	1.13	.97	.88	.82	2.22	1.00	-.83	.49	.82
Secondary Outcome Variables										
Enjoyment 1	3.78	.34	2.54	1.12	.96	3.72	.40	2.64	-1.62	.96
Enjoyment 2	3.33	.55	2.22	.88	.97	4.54	.57	-.20	.15	.97
State Anxiety	4.00	.59	1.59	-.41	.95	3.82	.44	2.08	-.62	.95
State Anxiety	4.07	.540	5.68	-1.68	.95	3.75	.65	4.55	-1.75	.95
Covariates										
Trait Anxiety	3.92	.34	-.20	.13	.93	3.97	.37	-.12	.28	.93
Situational Interest	5.30	1.26	1.25	-.61	.91	5.25	1.12	-.95	-.17	.93
Interest EI 1	5.23	1.27	.75	-.84	.83	4.87	1.14	-.70	.08	.83
Interest IE 1	5.09	1.45	.17	-.73	.77	4.94	1.12	-.39	-.04	.77
Interest N 1	5.31	1.03	-.75	-.10	.84	5.02	1.04	-.40	-.02	.84

Interest AD 1	5.47	1.07	1.69	-.81	.57	4.98	1.10	.00	-.26	.57
Interest C 1	5.16	1.07	.01	-.72	.62	5.00	1.03	.78	-.23	.62
Fidelity Measure										
Aut Support 1	5.78	.86	-.63	-.40	.91	6.02	.84	-.47	-.51	.93
Aut Support 2	6.07	1.01	-.50	-.76	.92	5.67	1.07	-.65	-.43	.87
Com Support	5.94	.86	-.21	-.59	.94	6.05	.86	-.46	-.58	.94
Com Support	6.16	.98	.78	-1.17	.95	5.81	1.04	-.65	-.43	.90
Rel Support 1	5.74	.97	-.67	-.41	.96	5.85	.97	-1.01	-.35	.94
Rel Support 2	5.90	1.09	-1.24	-.47	.94	5.56	1.22	-1.02	-.29	.94

Note 1. KU = Kurtosis and SK = Skewness.
Note 2. Interest EI = Interest exploration intention, Interest IE = Interest instant enjoyment, Interest N = Interest novelty, Interest AD = Interest attention demand, Interest C = Interest challenge, Aut Support = Autonomy support, Com Support = Competence support, and Rel Support = Relatedness support

Fidelity measures

Both the objective assessments and students' self-reports showed that the instructor was able to adhere to the pre-planned instructional strategy in both conditions. Observation analyses revealed that NSI (range across 5 lessons 2.05 to 2.88) lessons were different from NTI (range -1.89 to -1.42) lessons in terms of each dimensions of measured need-support (range from $t[108] = 92.23$, $p < .001$ to $t[108] = 40.38$, $p < .001$). In addition, compared to the students in the NTI condition, students in the NSI condition perceived that the instructor supported more their needs of autonomy ($F[2,107] = 12.74$, $p < .001$, $\eta p^2 = .11$), relatedness ($F[2,107] = 2.49$, $p = .027$, $\eta p^2 = .45$) and competence ($F[2,107] = 4.86$, $p = .030$, $\eta p^2 = .43$) from the pre- to posttests. However, there were no statistically significant difference in relatedness-support.

Aim 1

Analysis of covariance test results showed a significant between-group intervention effect on skill performance (F[2,105] = 4.70, p = .032, ηp^2 = .05), intrinsic motivation (F[2,104] = 4.16, p = .044, ηp^2 = .04), introjected regulation (F[2,104] = 5.07, p = .026, ηp^2 = .05), extrinsic regulation (F[2,104] = 5.25, p = .021, ηp^2= .05), and amotivation (F[2,104] = 10.69, p = .001, ηp^2 = .09). In regards to the interaction between covariates and performance, our analyses showed gender to be the only statistically significant covariate (F[2,105] = 15.39, p < .001, ηp^2 = 13.20), with males having better performance compared to females. In terms of motivational regulations, there was a statistically significant interaction between gender and intrinsic motivation (F[2,104] = 4.77, p = .031, ηp^2 = .04; males having higher intrinsic motivation), situational interest and extrinsic regulation (F[2,104] = 6.68, p = .011, ηp^2 = .06; more interested participants had lower external regulation levels), and amotivation and situational interest (F[2,104] = 17.85 p < .001, ηp^2 = .14; low situational interest relating to higher amotivation).

Aim 2

In relation to the second aim, the analysis of covariance test results showed a significant between-group intervention effect on both enjoyment (F[2,104] = 54.33, p < .001, ηp^2 = .34) and state anxiety (F[2,104] = 5.74, p = .018, ηp^2= .05), with NSI group . Having higher enjoyment and lower state anxiety compared to the TTI group. In regard to the covariate interactions, our analyses showed gender to be the only statistically significant covariate on enjoyment. (F[2,104] = 4.77, p = .031, ηp^2 = .04), with males higher enjoyment than females. In state anxiety, there were no statistically significant covariance interactions.

Discussion

The aim of this study is to compare the efficacy of SDT-centered NSI and NTI on participants' motor skill performance, self-determined motivation, enjoyment, and state anxiety. Specifically, we were interested in testing the theory-based hypothesis that compared to NTI, NSI is expected to be more beneficial in terms of participants' selected psychomotor, motivational, and affective outcomes. This study replicated the study protocols of Manninen et al. (2022a) and to enhance our understanding of the potential benefits of NSI.

Our study showed that compared to the NTI classes, participants performed better when exposed to the NSI-centered juggling classes. Our results align with the findings of Manninen et al. (2022a) that have demonstrated NSI participants to have better skill performance than participants in need-neglecting condition (condition in which participants' needs are neglected but not thwarted). These results also support the previous findings that have shown autonomy-supportive teaching strategies to improve motor skill performance of children, children with disabilities (Valentini & Rudisill, 2004a; 2004b), high school students (Barkoukis, et al., 2010; Vansteenkiste et al., 2004), and college students (Behzadnia et al., 2019). Second, the study findings showed that NSI was a superior strategy in motivating participants towards the juggling skill task. Specifically, the results showed that NSI was beneficial in improving participants' intrinsic motivation. This finding corroborated the previous research findings that have shown NSI to positively affects adaptive motivation when psychological needs are supported (Fransen, et al., 2018; Lochbaum & Jean-Noel, 2015; Manninen et al., 2022a;2022b; Moustaka et al., 2012; Vasconcellos et al., 2020). On the other hand, we found that NSI was reducing

participants' introjected regulation, external regulation, and amotivation. These findings are encouraging as introjected regulation, external regulation, and amotivation are theorized to be maladaptive regulations with empirical evidence suggesting that maladaptive regulations lead to less optimal outcomes, e.g., poorer performance, lack of adherence, and lower intrinsic motivation (Aelterman et al., 2012; Bartholomew et al., 2011b; Manninen et al., 2022a; Ryan & Deci 2017; Standage et al., 2003; Teixera et al., 2012). It is noteworthy that our study did not find any statistically significant differences in integrated or identified regulation. Integrated and identified regulations have shown to important motivators relating to more frequent exercise engagement and PA participation (Edmunds et al., 2008; Teixera et al., 2012). It may be that compared to a juggling task, exercise and PA elicit more value-based responses in participants. In other words, as a task, juggling may be less value provoking compared to exercise and PA, since the positive health impacts of exercise and PA are universally recognized.

Finally, the results of the study showed that compared to NTI, NSI was more advantageous in improving participants' enjoyment and reducing state anxiety. This finding is in line with the previous findings that have shown NSI to increase participant enjoyment (Edmunds et al., 2008; Manninen et al., 2022a; Mouratidis et al., 2011). These findings derived from rigorous experimental trials support the previous research that has shown psychological needs to relate positively to positive affect including enjoyment. Manninen et al. (2022a) showed that NSI initiated a positive pathway in which need-support impacted intrinsic motivation (+), integrated regulation (+), and amotivation (-), which impacted enjoyment positively explaining almost 60% in enjoyment during the 12-week intervention. Interestingly and on the contrary to the findings

of this study, the study by Manninen et al. (2022a) did not find any differences in state anxiety when comparing NSI and need-neglecting instruction. It is plausible that the positive changes in state anxiety, evidenced in this study, were most likely due to the differences in the comparison group. Whereas Manninen et al. (2022a) had need-neglecting group as a comparison group, our study employed an NTI group. Thus, NTI, i.e. active and direct violation of participants psychological need, elicit strong enough response in participants, leading to more anxiety provoking experience when engaged in the motor skill tasks.

The findings of this study inform future researchers and practitioners alike. First, the results of this study suggest that NSI is a beneficial instructional strategy to yield better skill performance, motivational outcomes, and less state anxiety. Although these results are promising, future experimental studies are needed in the broad area on PA. E.g., experimental studies examining instruction in sport are much in demand. It may be that athletes have different tolerance in regards to different instructional styles compared to the college PE students. Second, our findings supported the central tenets of the SDT that NSI had more positive impact on participant performance and motivation. PE practitioners are highly encouraged to utilize NSI and minimize the NTI in their instruction for optimal participant outcomes.

Limitations and future direction

This study is not free from limitations. First, we utilized college PE classes for this experiment. Although our sample participated in PE, college-aged students are distinctively different from the K-12 PE students. Second, only one instructor taught all the lesson which have representative issue. Future studies should employ several teachers to examine a teacher variance

when using NSI. Finally, and similar to the previous study (Manninen et al 2022a), we used juggling as the novel skill. The primary reason for this was two-fold. First, juggling is a simple, and it is relatively straight forward to measure student performance. Second, it is possible to recruit a sample where everybody starts with no skill mastery. Future studies should utilize other skills to gain cross-validity.

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Table 4.4.

Bivariate Correlations

Variables	1	2	3	4	5	6	7	8	9	10
1. Sex	1	–	.423**	.057	.181	.208*	.263**	.067	.222*	.035
2. Skill Per. Pre	–	–	–	–	–	–	–	–	–	–
3. Skill Per. Post	.423**	–	1	.185	.280**	.177	.187	.109	.203*	.028
4. Intro. Pre	.057	–	.185	1	.488**	.446**	.298**	.602**	.420**	.140
5. Intro. Post	.181	–	.280**	.488**	1	.286**	.393**	.285**	.694**	.014
6. Integ. Pre	.208*	–	.177	.446**	.286**	1	.716**	.608**	.521**	.451**
7. Integ. Post	.263**	–	.187	.298**	.393**	.716**	1	.427**	.646**	.239*
8. Iden. pre	.067	–	.109	.602**	.285**	.608**	.427**	1	.499**	.375**
9. Iden. Post	.222*	–	.203*	.420**	.694**	.521**	.646**	.499**	1	.224*
10. Intrinsic Pre	.035	–	.028	.140	.014	.451**	.239*	.375**	.224*	1
11. Intrinsic Post	.136	–	.072	.056	.078	.365**	.379**	.304**	.368**	.704**
12. Exter. Pre	.037	–	.178	.166	.046	.577**	.365**	.409**	.210*	.603**
13. Exter. Post	.116	–	.032	−.027	−.123	.393**	.403**	.257**	.247**	.389**
14. Amot. Pre	.108	–	.059	−.367**	−.293**	.042	−.094	−.217*	−.219*	.231*
15. Amot. Post	−.018	–	−.222*	−.235*	−.575**	−.107	−.105	−.189*	−.400**	.008

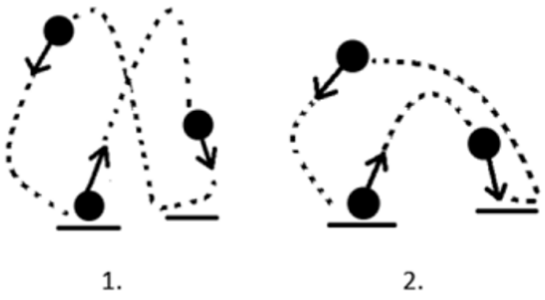
16. Enjoyment. Pre	.055	−	−.014	−.239*	−.260**	−.120	−.031	−.164	−.172	.110
17. Enkoyment. Post	.006	−	.031	−.227*	−.037	−.071	−.025	−.180	−.059	.007
18. Trait anxiety	−.061	−	−.044	.018	−.069	.034	.002	.204*	.028	.225*
19. St. anxiety Pre	.087	−	.108	.350**	.244*	.445**	.437**	.438**	.405**	.224*
20. St. anxiety Post	.068	−	−.040	.143	.016	.185	.218*	.318**	.252**	.110
21. Pes. Pre	−.042	−	.055	.451**	.428**	.249**	.129	.341**	.235*	.130
22. Pes. Post	.111	−	.151	.348**	.546**	.257**	.194*	.275**	.315**	.020

Variables	11	12	13	14	15	16	17	18	19	20	21
1. Sex	.037	.116	.108	−.018	.055	.006	−.061	.087	.068	−.042	.111
2. Skill Per. Pre	−	−	−	−	−	−	−	−	−	−	−
3. Skill Per. Post	.178	.032	.059	−.222*	−.014	.031	−.044	.108	−.040	.055	.151
4. Intro. Pre	.166	−.027	−.367**	−.235*	−.239*	−.227*	.018	.350**	.143	.451**	.348**
5. Intro. Post	.046	−.123	−.293**	−.575**	−.260**	−.037	−.069	.244*	.016	.428**	.546**
6. Integ. Pre	.577**	.393**	.042	−.107	−.120	−.071	.034	.445**	.185	.249**	.257**
7. Integ. Post	.365**	.403**	−.094	−.105	−.031	−.025	.002	.437**	.218*	.129	.194*
8. Iden. pre	.409**	.257**	−.217*	−.189*	−.164	−.180	.204*	.438**	.318**	.341**	.275**
9. Iden. Post	.210*	.247**	−.219*	−.400**	−.172	−.059	.028	.405**	.252**	.235*	.315**

10. Intrinsic Pre	.603**	.389**	.231*	.008	.110	.007	.225*	.224*	.110	.130	.020
11. Intrinsic Post	.444**	.558**	.079	.101	.171	−.154	.127	.334**	.232*	.003	−.027
12. Exter. Pre	1	.584**	.342**	.130	.027	−.017	.104	.351**	.117	−.013	−.002
13. Exter. Post	.584**	1	.161	.340**	.220*	−.086	.018	.338**	.298**	−.184	−.116
14. Amot. Pre	.342**	.161	1	.411**	.228*	.204*	.107	−.135	−.020	−.274**	−.127
15. Amot. Post	.130	.340**	.411**	1	.338**	−.009	.029	−.037	.099	−.432**	−.407**
16. Enjoyment. Pre	.027	.220*	.228*	.338**	1	.330**	−.101	−.043	.089	−.352**	−.199*
17. Enjoyment. Post	−.017	−.086	.204*	−.009	.330**	1	−.131	−.194*	−.135	−.161	.057
18. Trait anxiety	.104	.018	.107	.029	−.101	−.131	1	.121	.061	.000	.028
19. St. anxiety Pre	.351**	.338**	−.135	−.037	−.043	−.194*	.121	1	.354**	.100	.139
20. St. anxiety Post	.117	.298**	−.020	.099	.089	−.135	.061	.354**	1	.039	.112
21. Pes. Pre	−.013	−.184	−.274**	−.432**	−.352**	−.161	.000	.100	.039	1	.652**
22. Pes. Post	−.002	−.116	−.127	−.407**	−.199*	.057	.028	.139	.112	.652**	1

Note. Per = Performance; Intro = Introjected regulation; Integ = Integrated regulation; Iden. = Identified regulation; Exter. = External regulation; Amot. = Amotivation; St. = State; PES = Perceived Environmental Supportiveness;

The juggling test consisted of two three-ball juggling techniques; the Basic Cascade and the Reverse Cascade. In the Basic Cascade, each ball is thrown from one hand to the other so that at least one ball is always in the air. The next ball is always thrown when the ball in the air has reached its apex. A subsequently thrown ball will always rotate under the ball, which is in the air. In the Reverse Cascade, the idea is the same as in the Basic Cascade, but the next ball is thrown over the ball, which in the air.



Juggling test techniques (1. The Basic Cascade;2. The Reverse Cascade)

Figure 3. Juggling test description (with a kind permission of Manninen et al. 2022a).

CHAPTER 5

CONCLUSION

Considering increasing popularity of SDT-based research studying human motivation in physical activity (PA) contexts and a need for experimental studies to test theoretical postulation of SDT and to shed a light on numerous empirical, real-world questions, robust experimental studies are in demand. In response to this need the purpose of my dissertation was, first, to develop and validate a (NSTI) scale and perform psychometric testing of the validity and reliability of the scale to assess instructors' instructional behaviors in PA context. The second purpose of this dissertation was to compare the effects of SDT-centered need-supportive and -thwarting instruction on participants' motivational, behavioral, and affective outcomes.

Valid and reliable scales are the bedrock of any study. E.g., as it relates to experimental studies examining instructional behaviors, it is highly important to ensure that instructional treatment has a strong fidelity. In other words, it is eminent that instructors deliver the intervention as planned. Due to a lack of valid and reliable observation scales to examine need-supportive and -thwarting instruction, the first aim of my dissertation was to develop and validate the NSTI scale.

The results of the study 1 suggested that the NSTI scale had an appropriate factorial validity to measure psychological NSI and NTI in organic, real-time PA sessions. When

observers assess instructors' need-supportive and -thwarting instructional behavior, they could easily rate both behaviors simultaneously by moving slides on the screen from left to right, even if some instructional behaviors are displayed multiple times in one lesson. It is noteworthy that the SDT-suggested three-factor solution was not supported suggesting a weak factorial validity. However, my analysis showed that the one-factor structure was the most plausible because of the nature of instruction, which often affects multiple psychological needs simultaneously. E.g., providing rationale for the students supports not only participant autonomy but their need for relatedness. Based on the findings of this Study 1 and the anecdotal evidence being a teacher, I argue that instruction cannot be separated as theorized by the SDT, but the different instructional cues impact different psychological needs simultaneously.

Responding to the need of experimental studies examining instructional strategies, my second dissertation study compared the efficacy of NSI and NTI on performance as well as motivational and affective outcomes. The findings of my study aligned with the previous results, displaying that the students' participation in the NSI classes positively impacted participants' skill performance, intrinsic motivation), and enjoyment (Edmunds et al., 2008; Fransen, et al., 2018; Lochbaum & Jean-Noel, 2015; Manninen et al., 2022a, 2022b; Mouratidis et al., 2011; Moustaka et al., 2012). It is noteworthy that this study followed the same protocol as the study by Manninen et al. (2022a). Similar to our study, Manninen et al. (2022a) study showed that the NSI group displayed better skill performance, enjoyment, and motivational outcomes compared to the need-neglecting group. The Manninen et al. (2022a) study did not show any evidence that the need-neglect is contributing to higher state anxiety. One of the conclusions of the Manninen

et al. (2022a) study was that their argument that need-neglecting instruction does not violate psychological needs enough to initiate strong negative responses, e.g., state anxiety.

To test the Manninen et al. (2022a) conclusions of the state anxiety, I designed this study to increase negative response to positive by employing the NTI group. Compared to the need-neglecting group of the Manninen et al. (2022a) study, the NTI group violated participants' psychological needs more actively and directly, increasing potential to increase anxiety-provoking experiences when engaged in motor skill tasks. Results indicated that need-thwarting, indeed, triggered a stronger response and contributed to the negative outcomes, e.g., lower enjoyment and higher state anxiety evidenced in the study. The findings of this study highlighted the superiority of the NSI to yield less state anxiety in college students in PA setting.

Scientific Contribution of This Study

Instruction can support or thwart students' psychological needs in teaching and coaching. For example, when a skill practice sessions nurtures learner’s need for autonomy relatedness and competence may not be clearly differentiated due to the dynamic and complex learning environment, which makes it difficult to objectively and directly measure NSI. Also, instructors may face difficulty assessing and developing their need-supportive teaching behavior. Our findings showed that the NSTI scale displayed the desired validity and reliability, measuring instructors' need-supportive and -thwarting behaviors in PA settings. These findings could fill a significant gap in SDT-centered literature focusing on the reliability and validity of measuring NSI in PA.

The study 2 replicated the study protocols of Manninen et al. (2022a). In the skill performance, previous study had a statistically significant between-group effect ($F(1, 48) = 9.23$, $p = .004$, $\eta p2 = .16$). Our results align with the findings on Manninen et al. (2022a), but displayed smaller effect size ($F[2,105] = 4.70$, $p = .032$, $\eta p2 = .05$). These findings supported the central tenets of the SDT that NSI elicits related to learners' positive outcomes, while NTI yielded adverse effects. Regarding the motivational outcome, the current study found no statistically significant differences in integrated or identified regulations that relate to more frequent exercise engagement and PA participation (Edmunds et al., 2008; Teixera et al., 2012). These findings may relate to value-based responses in participants that juggling skill practice may be less valuable for obtaining health benefits than exercise and PA.

Practical Recommendations for Physical Education Teachers and Coaches

The results of this dissertation provided empirical evidence of the benefits of employing the NSI strategies to yield better skill performance, motivation, and affective outcomes. However, in the PA context, some teachers and coaches intentionally use controlling or NTI behaviors to let learners comply with their predetermined ways to achieve specific objectives or goals (Haerens et al., 2015; Bartholomew et al., 2010). On the other hand, some teachers and coaches abruptly display the NTI behaviors when they experience losing control of the class or unexpected situations. In addition, coaches in the competitive sports field often tend to be more controlling toward their athletes to achieve desirable performance and results, because the controlling instructional strategies may be considered an effective way for their goal. However, according to

the theory (Deci & Ryan, 1985), previous research findings (Bartholomew et al., 2010; Vansteenkiste & Ryan, 2013), the findings of this study NTI frustrates learners' three basic psychological needs and increases the chances to maladjustment. School PE teachers, sports coaches, and other PA instructors are highly encouraged to utilize the NSI strategies and minimize the NTI strategies in their instruction for learners' optimal outcomes. The following specific 10 strategies for physical educators have been recently published (Manninen & Yli-Piipari, 2021). PE teachers should:

1. Use informational and noncontrolling language,
2. Use meaningful rationales,
3. Provide choice,
4. Acknowledge and respect different perspectives and feelings
5. Demonstrating interest in each student,
6. Encourage students to ask questions and be proactive,
7. Encourage cooperation,
8. Clarify expectations,
9. Set optimal learning challenges,
10. Give constructive, clear, and relevant feedback (Manninen & Yli-Piipari, 2021).

Limitations and Future Considerations of This Dissertation

The findings from this dissertation have some limitations and recommendations for the future. First, the sample comprised university PE students only. Future studies should test the internal

validity of the NSTI scale in the different PA settings (e.g., K-12 PE context, athletes coaching context, leisure time PA context). Although unlikely, it may be that NSTI does not identify between these two instructional styles in the same manner than in the college PE class. Second, in this study, only one instructor taught all the lessons. Future studies should employ several teachers to examine a teacher variance when using NSI. Third, regarding the interaction between covariates and performance, our finding displayed those males performed better than females in juggling skill performance. Due to a lack of resources, we used tennis balls for the juggling skill performance. Males relatively have a bigger hand than females, which may affect gender differences. Future studies should use actual juggling balls, which are smaller and lighter than tennis balls. Finally, similar to the previous research (Manninen et al. 2022a), we used juggling as a novel skill for convenience. Future studies should utilize other skills to gain cross-validity.

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APPENDICES

The first lesson

Warm-up and enroll (instructor-led 10min):

- Cross-body shoulder stretch
- Overhead triceps and shoulder stretch
- Upper trapezius stretch
- Arm circles
- Wrist extension stretch
- Standing hamstring stretch
- Standing quadriceps stretch
- Small hip circles
- Walking lunges with a torso twist

Juggling content (instructor-led 25min):

- 0-3 min – Intro to the content of the next five lessons
- 3-6 min – 1-ball from one hand to the other
- 6-9 min – 2-balls with the Basic cascade technique without catching the balls
- 9-12 min – 2-balls with the Basic cascade technique with a catch
- 12-15 min – 3-balls with the Basic cascade technique without catching the balls
- 15-18 min – 3-balls with the Basic cascade technique with a catch
- 18-20 min – Break and feedback
- 20-22 min – 3-ball Basic cascade juggling continuously
- 22-24 min – 3-ball juggling technique (elbows, palms, the height of the throw, being stationary)
- 24-25 min – Closure (brief review of the lesson and preview of the next lesson)

Free-choice period (10 min):

- The students practice without the supervision of the instructor. The instructor and observers stayed outside of the practice facility (not visible to the participants)

The second lesson

Warm-up and enroll (instructor-led 10min):

- Cross-body shoulder stretch
- Overhead triceps and shoulder stretch
- Upper trapezius stretch
- Arm circles
- Wrist extension stretch
- Standing hamstring stretch
- Standing quadriceps stretch
- Small hip circles
- Walking lunges with a torso twist

Juggling content (instructor-led 25min):

- 0-3 min – Intro to the content of the day and Reiteration of the progressions from 1 to 2 balls from the last class
- 3-6 min – 3 ball Basic cascade juggling reiteration
- 6-10 min – Highlighting the correct technique
- 10-12 min – Explaining the Reverse cascade technique
- 12-15 min – 2 balls Reverse cascade with a catch
- 15-17 min – 3-balls Reverse cascade without a catch
- 17-19 min – 3 ball Reverse cascade with a catch
- 19-20 min – Break and feedback
- 20-22 min – 3 ball Reverse cascade continuously
- 22-24 min – 3-ball juggling technique (elbows, palms, the height of the throw, being stationary)
- 24-25 min – Closure (brief review of the lesson and preview of the next lesson)

Free-choice period (10 min):

- The students practice without the supervision of the instructor. The instructor and observers stayed outside of the practice facility (not visible to the participants)

The third lesson

Warm-up and enroll (instructor-led 10min):

- Cross-body shoulder stretch
- Overhead triceps and shoulder stretch
- Upper trapezius stretch
- Arm circles
- Wrist extension stretch
- Standing hamstring stretch
- Standing quadriceps stretch
- Small hip circles
- Walking lunges with a torso twist

Juggling content (instructor-led 25min):

- 0-3 min – Intro to the content of the day and demonstration of the Basic and Reverse cascade juggling
- 3-6 min – Basic cascade juggling practice
- 6-8 min – Break and feedback
- 8-10 min –Reverse cascade juggling practice
- 10-11 min – Break and feedback
- 11-13 min – Introduction to the Mill's Mess juggling technique
- 13-18 min – Two throws with the basic cascade technique + the third under and across – no catch
- 18-19 min – Break and feedback
- 19-24 min – Two throws with the basic cascade technique + the third under and across with a catch
- 24-25 min – Closure (brief review of the lesson and preview of the next lesson)

Free-choice period (10 min):

- The students practice without the supervision of the instructor. The instructor and observers stayed outside of the practice facility (not visible to the participants)

The fourth lesson

Warm-up and enroll (instructor-led 10min):

- Cross-body shoulder stretch
- Overhead triceps and shoulder stretch
- Upper trapezius stretch
- Arm circles
- Wrist extension stretch
- Standing hamstring stretch
- Standing quadriceps stretch
- Small hip circles
- Walking lunges with a torso twist

Juggling content (instructor-led 25min):

- 0-3 min – Intro to the content of the day and repeating the three practiced techniques
- 3-5 min – Basic cascade juggling practice
- 5-6 min – Break and feedback
- 6-11 min –Reverse cascade juggling practice
- 11-12 min – Break and feedback
- 12-15 min – Explanation of the Mill's Mess juggling technique
- 15-18 min – Practice with the Mill's Mess juggling technique without a catch
- 18-22 min – Practice with the Mill's Mess juggling technique with a catch
- 22-24 min – Feedback and technique reiteration
- 24-25 min – Closure (brief review of the lesson and preview of the next lesson)

Free-choice period (10 min):

- The students practice without the supervision of the instructor. The instructor and observers stayed outside of the practice facility (not visible to the participants)

The fifth lesson

Warm-up and enroll (instructor-led 10min):

- Cross-body shoulder stretch
- Overhead triceps and shoulder stretch
- Upper trapezius stretch
- Arm circles
- Wrist extension stretch
- Standing hamstring stretch
- Standing quadriceps stretch
- Small hip circles
- Walking lunges with a torso twist

Juggling content (instructor-led 25min):

- 0-2 min – Intro to the content of the day
- 2-5 min – Student choose and practice juggling skills at an optimal skill level (NSI group)/ the Basic cascade juggling practice (NSI group)
- 5-6 min – Break and feedback (NSI group)/ the Basic cascade juggling technique practice (NTI group)
- 6-7 min – Student choose and practice juggling skills at an optimal skill level (NSI group)/ Intro to the Reverse cascade juggling (NTI group)
- 7-11 min – Student choose and practice juggling skills at an optimal skill level (NSI group)/ the Basic cascade juggling practice (NSI group)
- 14-16 min – Introduction to the Mill's Mess juggling technique
- 16-20 min – Two throws with the basic cascade technique + the third under and across – no catch
- 20-22 min – Break and feedback (NSI group)/ Mill's Mess juggling technique juggling technique practice (NTI group)
- 22-24 min – Two throws with the basic cascade technique + the third under and across with a catch
- 24-25 min – Closure (brief review of the lesson and preview of the next lesson)

Free-choice period (10 min):

- The students practice without the supervision of the instructor. The instructor and observers stayed outside of the practice facility (not visible to the participants)

Pre-tests

Q1. Your participant ID (e.g., 105)

Q2. What is your sex?
Male (1)
Female (2)
Other (3)

Q3. What is your age (e.g., 21)?

Q4. What is your classification in college?
Freshman (1)
Sophomore (2)
Junior (3)
Senior (4)
Graduate student (5)

Q5. Choose one or more races that you consider yourself to be:
White (1)
Black or African American (2)
American Indian or Alaska Native (3)
Asian (4)
Native Hawaiian or Pacific Islander (5)
Other (6) _____

Q6. Do you have prior experience or training in circus skills?
No (1)
Somewhat (2)
A lot (3)

DIRECTIONS: After watching the video, please use the scale below, and indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about the juggling module of this PE course. Your responses will be held in confidence and only used for our research purposes.

Q7. Based on the video I saw, I am going to take part in the Basic Physical education course and its **juggling module** because (1= Very untrue & 7= Very true)

	1	2	3	4	5	6	7
1. It's important to me							
2. I don't see why I should							
3. Because it's fun							
4. I feel guilty when I don't							
5. Because it's consistent with my values							
6. Because other people say I should							
7. I value the benefits of the course							
8. I can't see why I should bother							
9. I enjoy the sessions of the course							
10. I feel ashamed when I miss a session							
11. I consider it part of my identity							
12. I take part because my friends/family/partner say I should							
13. I think it's important to make the effort to come to class							
14. I don't see the point in coming to classes of the course							
15. I find it a pleasurable activity							
16. I feel like a failure when I don't come to class							
17. I consider it a fundamental part of who I am							
18. Because others will not be pleased with me if I don't							
19. I get restless if I don't							
20. I think it's a waste of time							
21. I get pleasure and satisfaction from participating							
22. I would feel bad about myself if I was not making the time to							
23. I consider participating consistent with my values							
24. I feel under pressure from my friends/family							

Q8. Based on the video, please rate how do you think you are going to feel about the juggling classes you are going to be having in the next two weeks

	1	2	3	4	5	6	7	
1. I enjoy it								I hate it
2. I feel bored								I feel interested
3. I dislike it								I like it
4. I find it pleasurable								I find it unpleasurable
5. I am very absorbed in this activity								I am not all absorbed in this activity
6. It's not fun at all								It's a lot of fun
7. I find it energizing								I find it tiring
8. It makes me depressed								It makes me happy
9. It's very pleasant								It's very unpleasant
10. I feel good physically while doing it								I feel bad physically while doing it
11. It's very invigorating								It's not at all invigorating
12. I am very frustrated by it								I am not at all frustrated by it
13. It's very gratifying								It's not at all gratifying
14. It's very exhilarating								It's not at all exhilarating
15. It's not at all stimulating								It's very stimulating
16. It gives me a strong sense of accomplishment								It does not give me any sense of accomplishment at all
17. It's very refreshing								It's not at all refreshing
18. It feels as though I would rather be doing something else								It feels as though there was nothing else, I would rather be doing

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then indicate how you feel about the upcoming classes now, that is, after seeing the video. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer, which seems to describe your present feeling best.

Q9. Indicate how you feel at the moment about the upcoming juggling classes (1= Very untrue & 7= Very true)

	1	2	3	4	5	6	7
1. I feel calm							
2. I feel secure							
3. I am tense							
4. I feel strained							
5. I feel at ease							
6. I feel upset							
7. I am presently worrying over possible misfortune							
8. I feel satisfied							
9. I feel frightened							
10. I feel comfortable							
11. I feel self-confident							
12. I feel nervous							
13. I am jittery							
14. I feel indecisive							
15. I am relaxed							
16. I feel content							
17. I am worried							
18. I feel confused							
19. I feel steady							
20. I feel pleasant							

DIRECTIONS: These statements aim to find out how you view the juggling learning environment with the teacher shown in the video. Using the scale below, please indicate to what extent you disagree or agree with each of the following statements. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel.

Q10. Based on the video, I feel my teacher will... (1= Strongly disagree & 7= Strongly agree)

	1	2	3	4	5	6	7
1. Take into account my individual needs							
2. Give me good advice							
3. Make time for me when even though he is busy							
4. Provide a range of activities							
5. Make clear to me what I need to do to get results							
6. Make me feel like I matter to him							
7. Provide me with choices and options							
8. Make clear what to expect from engaging in the activities							
9. Be concerned about my well-being							
10. Encourage me to take my own initiative							
11. Give me exercises that are suited to my level							
12. Look after me well							
13. Consider my personal needs							
14. Help me to feel confident about the activities							
15. Care about me							

Q11. Please rate what you think about the activity presented in the video (juggling) (1= Strongly disagree agree at all & 7= Strongly agree)

	1	2	3	4	5	6	7
1. This activity is exciting							
2. It is a complex activity							
3. The activity is complicated							
4. My attention was high while watching the activity							
5. This activity is interesting							
6. I was very attentive all the time while watching the activity							
7. I like to find out more about how to do it							
8. This is an exceptional activity							
9. I want to analyze it to have a grasp on it							
10. This activity is appealing to me							
11. The activity looks fun to me							
12. This is a new-fashioned activity for me to do							
13. It is an enjoyable activity to me							
14. I want to discover all the tricks in this activity							
15. This activity is fresh							
16. This activity is new to me							
17. I was focused while watching the activity							
18. I was concentrated while watching the activity							
19. It is fun for me to try this activity							
20. This activity is a demanding task							
21. This is an interesting activity for me to do							
22. The activity inspires me to participate							
23. It is hard for me to do this activity							
24. I like to inquire into details of how to do it							

Posttests

Q1. Your participant ID (e.g., 105)

DIRECTIONS: Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about the juggling module of the PE course during the past two weeks. Your responses will be held in confidence and only used for our research purposes.

Q2. Thinking about past two weeks and the five last lessons of the course (juggling), I take part in this PE course because (1= Very untrue & 7= Very true)

	1	2	3	4	5	6	7
1. It's important to me							
2. I don't see why I should							
3. Because it's fun							
4. I feel guilty when I don't							
5. Because it's consistent with my values							
6. Because other people say I should							
7. I value the benefits of the course							
8. I can't see why I should bother							
9. I enjoy the sessions of the course							
10. I feel ashamed when I miss a session							
11. I consider it part of my identity							
12. I take part because my friends/family/partner say I should							
13. I think it's important to make the effort to come to class							
14. I don't see the point in coming to classes of the course							
15. I find it a pleasurable activity							
16. I feel like a failure when I don't come to class							
17. I consider it a fundamental part of who I am							
18. Because others will not be pleased with me if I don't							
19. I get restless if I don't							
20. I think it's a waste of time							
21. I get pleasure and satisfaction from participating							
22. I would feel bad about myself if I was not making the time to							
23. I consider participating consistent with my values							
24. I feel under pressure from my friends/family							

Q3. Please rate what you think about the juggling classes you have been doing the past two weeks

	1	2	3	4	5	6	7	
1. I enjoy it								I hate it
2. I feel bored								I feel interested
3. I dislike it								I like it
4. I find it pleasurable								I find it unpleasurable
5. I am very absorbed in this activity								I am not all absorbed in this activity
6. It's not fun at all								It's a lot of fun
7. I find it energizing								I find it tiring
8. It makes me depressed								It makes me happy
9. It's very pleasant								It's very unpleasant
10. I feel good physically while doing it								I feel bad physically while doing it
11. It's very invigorating								It's not at all invigorating
12. I am very frustrated by it								I am not at all frustrated by it
13. It's very gratifying								It's not at all gratifying
14. It's very exhilarating								It's not at all exhilarating
15. It's not at all stimulating								It's very stimulating
16. It gives me a strong sense of accomplishment								It does not give me any sense of accomplishment at all
17. It's very refreshing								It's not at all refreshing
18. It feels as though I would rather be doing something else								It feels as though there was nothing else, I would rather be doing

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then indicate how you feel about the upcoming classes of the course. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feeling best.

Q4. Indicate how you feel at the moment about the upcoming lessons of the course (1= Very untrue & 7= Very true)

	1	2	3	4	5	6	7
1. I feel calm							
2. I feel secure							
3. I am tense							
4. I feel strained							
5. I feel at ease							
6. I feel upset							
7. I am presently worrying over possible misfortune							
8. I feel satisfied							
9. I feel frightened							
10. I feel comfortable							
11. I feel self-confident							
12. I feel nervous							
13. I am jittery							
14. I feel indecisive							
15. I am relaxed							
16. I feel content							
17. I am worried							
18. I feel confused							
19. I feel steady							
20. I feel pleasant							

DIRECTIONS: These statements aim to find out how you view your learning environment with your teacher during the past two weeks. Using the scale below, please indicate to what extent you disagree or agree with each of the following statements. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel.

Q5. Based on the past two weeks (the five last lessons) of the course (juggling), my teacher has… (1= Strongly disagree & 7= Strongly agree)

	1	2	3	4	5	6	7
1. Take into account my individual needs							
2. Give me good advice							
3. Make time for me when even though he is busy							
4. Provide a range of activities							
5. Make clear to me what I need to do to get results							
6. Make me feel like I matter to him							
7. Provide me with choices and options							
8. Make clear what to expect from engaging in the activities							
9. Be concerned about my well-being							
10. Encourage me to take my own initiative							
11. Give me exercises that are suited to my level							
12. Look after me well							
13. Consider my personal needs							
14. Help me to feel confident about the activities							
15. Care about me							

Q6. Please type in approximately how many minutes of juggling practice you conducted after class each week during the last two weeks (e.g., 30 minutes).

The first week	
The second week	

Free-choice observation sheet

Date: _____

Start	Practicing	
1st		Total =
2nd		Total =
3rd		Total =
4th		Total =
5th		Total =

Start	Not practicing	
1st		Total =
2nd		Total =
3rd		Total =
4th		Total =
5th		Total =

Need-Supportive and -Thwarting Instruction Observation Scale		
Items	**Rating**	**Items**
1. Instructor provides tangible goals of the lesson and lays out reasonable expectations relating to participants' individual development and/or growth.	3 2 1 0 -1 -2 -3	1. Instructor provides inadequate goals and unrealistic or extrinsic (e.g., being better in than others) expectations.
2. Instructor provides chances to choose drills at an optimal skill level.	3 2 1 0 -1 -2 -3	2. Instructor provides same tasks for everyone at the same time and rejects any differentiation or pressures participants to participate her/his way.
3. Instructor offers participants a rationale and expected learning outcomes for tasks and exercises.	3 2 1 0 -1 -2 -3	3. Instructor pushes participants to perform tasks without explaining why they should do what the instructor asks them to do. Instructor ignores participants' efforts to understand the tasks.
4. Instructor provides positive and informational feedback that signifies competence or improves competence.	3 2 1 0 -1 -2 -3	4. Instructor makes all decisions, provides simple tasks requiring lower level of cognitive engagement, and no time to work independently. Instructor provides no opportunities for participant ownership.
5. Instructor provides meaningful choice within the skill drills and flexibility with appropriate techniques.	3 2 1 0 -1 -2 -3	5. Instructor forces participants to follow instructor's decision and offers no choice.
6. Instructor provides new guidelines, tips and advice for participants leading to more engagement and higher-level learning.	3 2 1 0 -1 -2 -3	6. Instructor ignores chances to provide guidance, tips, or advice.
7. Instructor encourages participants to persist (e.g., "come on, you can do it").	3 2 1 0 -1 -2 -3	7. Instructor does not put any effort and energy into the lesson.
8. Instructor is close to the participants, moves around, and interacts with participants.	3 2 1 0 -1 -2 -3	8. Instructor does not move around the space and physically distances (her)himself from the participants.
9. Instructor asks participants questions about their interests, problems, values, or wishes addressing them by their first name.	3 2 1 0 -1 -2 -3	9. Instructor detaches from the participants and ignores their opinions or questions (acting cold).