AN EXAMINATION OF THE EFFICACY OF NEED-SUPPORTIVE INSTRUCTION ON MOTIVATION, SKILL PERFORMANCE, AND AFFECT

by

MIKA MANNINEN

(Under the Direction of Sami Yli-Piipari)

ABSTRACT

This dissertation aimed to quantify the effect of need-supportive instruction on motivational regulations proposed by the Self-Determination Theory (SDT) in physical activity. An additional aim of the dissertation was to examine the efficacy of need-supportive instruction on motivational regulations, skill performance, enjoyment, and state anxiety among college students. Lastly, this dissertation aimed to test whether the effect of need-supportive instruction followed the theoretical model of SDT.

The systematic review and meta-analysis of 20 studies showed that need-supportive instruction can increase intrinsic motivation and identified regulation, and decrease amotivation in physical activity. The effects were heterogeneous, with a medium-to-large effect on identified regulation (g = .72; *CI* 95% [.08, 1.37]) and intrinsic motivation (g = .51; *CI* 95% [.19, .83]) and a small-to-medium on amotivation (g = -.35; *CI* 95% [-.66, .05]). The findings support the usefulness of psychological need-supportive instruction in physical activity, but at the same time indicate a demand for high-quality experimental studies examining the effects of need-supportive instruction.

The cluster-randomized trial showed that need-supportive instruction improved intrinsic motivation ($F(1, 49) = 5.52$, $p = .023$, $\eta^2 = .10$), skill performance ($F(1, 48) = 9.23$, $p = .004$, $\eta^2 = .16$), and enjoyment ($F(1, 49) = 4.89$, $p = .032$, $\eta^2 = .09$). No effect in state anxiety nor in the other motivational regulations were discovered. The path analysis indicated a positive motivational pathway, with the intervention impacting intrinsic motivation ($\beta = .55$), integrated regulation ($\beta = .30$) and amotivation ($\beta = -.27$), which impacted positively skill performance ($R^2 = .42$) and enjoyment ($R^2 = .58$). The results suggest that need-supportive instruction is beneficial for many important physical activity-related outcomes. Need-supportive instruction seems to affect participants' outcomes through both ends of the motivational spectrum.

INDEX WORDS: self-determination theory, instruction, enjoyment, state anxiety, physical activity, meta-analysis

AN EXAMINATION OF THE EFFICACY OF NEED-SUPPORTIVE INSTRUCTION ON MOTIVATION, SKILL PERFORMANCE, AND AFFECT

by

MIKA MANNINEN

BS, The University of Jyväskylä, Finland, 2012

MS, The University of Jyväskylä, Finland 2014

A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2019

AN EXAMINATION OF THE EFFICACY OF NEED-SUPPORTIVE INSTRUCTION ON MOTIVATION, SKILL PERFORMANCE, AND AFFECT

by

MIKA MANNINEN

Major Professor:	Sami Yli-Piipari
Committee:	Patrick J. O'Connor
	Philip D. Tomporowski

Electronic Version Approved:

Suzanne Barbour
Dean of the Graduate School
The University of Georgia
May 2019

DEDICATION

For my Mother and Father. Thank you for everything.

ACKNOWLEDGEMENTS

I would like to express my great appreciation to my advisor Dr. Sami Yli-Piipari for guiding me through the journey towards a doctorate. Everything did not always go as we had planned, but with your support and help, I was able to make it to the end and even enjoy the ride. Thank you also to Dr. Patrick O'Connor and Dr. Philip Tomporowski for being part of the team and helping me to understand the scientific process better. Also, I wish to acknowledge the assistance and honest mentality towards research by Dr. Rod Dishman.

I also want to extend my gratitude to the graduate students of my department. Special thanks to my office mates Sophie Waller for the daily support and Eui-Soo Kim for the company and noodles during the late hours of my second year. I would also like to thank Eric Magrum and Thomas Novak for the insightful yet lighthearted conversations and sporty attitude. The help with the data collection by Yangyang Deng and Yongju Hwang is also much appreciated.

Finally, I wish to thank my parents and the love of my life Riikka. Between all the problem solving, uncertainty, and slight dreading, I was always glad that I had at least something figured out.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

Most people spend a considerable amount of their life in educational settings. The majority of people's educational experiences from childhood to adolescence and young adulthood take place in formal contexts ranging from kindergarten to college. However, permitting the idea of the proclaimed concept of life-long learning, participation in education should not halt at a specific time or be constrained only to formal education, but should continue in one way or another throughout one's whole life in various formal and informal settings (Commission of the European Communities, 2000).

The experiences that people acquire in the course of their educational path can have immediate positive and negative effects, such as learning and stress, as well as more far-reaching consequences, such as health and occupational choices on individuals' lives. Besides individuals, education influences society, for example, in terms of economic and social progress (OECD, 1997). Since educational institutions have a profound and long-lasting influence on people's lives and societies' function, the structures and environments in which education takes place should be considered carefully.

It has been proposed that the characteristics of good-quality education are reflected in individuals' interest in learning, their sense of accomplishment, and volitional engagement with educational pursuits (Deci, Vallerand, Pelletier, & Ryan, 1991). Besides the individual, the single most significant educational-related element influencing the above mentioned and other educational outcomes is arguably the teacher (or the instructor) (OECD, 2018). Further, out of

the various ways teachers can influence educational outcomes, the characteristics and qualities of instruction are especially important (Cohen, McCabe, Michelli, & Pickeral, 2009; Wentzel, 2002).

Effective instruction and teaching have been widely researched topics (e.g., Liu & Meng, 2009; Reynolds & Teddlie, 2000; Walls, Nardi, von Minden, & Hoffman, 2009). One summarization of this research suggests that teachers' effective instructional behaviors comprise of a) management of time b) classroom organization (planning, explaining the purpose of the lesson, and structure) c) effective teaching practices (e.g., questioning and having a warm relationship with students, and d) adaptation of the lesson to the needs of the students (Reynolds & Teddlie, 2000). Another extensive account of effective teaching by Stronge (2007) separates effective teaching characteristics into six categories: a) the teacher as a person (e.g. clear communication, active work with students, and a sense of humor) b) classroom management and organization (e.g. provision of positive feedback, displays of respect and positivity, and discipline by respect and dignity) c) organization and preparation (e.g., lesson plans are done for every day, and they are done carefully) d) instruction (e.g., use of student questions to guide lesson and use of variety of activities and strategies to engage students) e) monitoring of student progress and potential (e.g., provision of oral and written feedback and use of variety of assessments f) professionalism (e.g., maintenance of accurate records and focus on students).

An example within formal education with a strong emphasis on instruction and a goal of positive class experiences transferring to later life is physical education (PE; NASPE, 2004). Generally, school PE has shown to have a positive impact on physical, affective, social, and cognitive domains of the lives of people who participate in it (Bailey, 2009).

There is a broad consensus that the ultimate goal of PE is students' adoption of a physically active lifestyle for a lifetime (Dyson, 2014). To achieve this goal, a significant amount of transfer of skills, knowledge, attitudes, and motivation needs to take place from class settings to the outside life (Lave, 1997). PE programs, however, have been criticized for not achieving these effects (Kirk, 2005). Instead, research has shown school PE leaving students sometimes with traumatic experiences of shame and a lack of interest in physical activity and exercise (Cardinal, Yan, & Cardinal, 2013). The negative experiences linked to PE can be long-lasting and influence people's perceptions of physical activity counterproductively even in adulthood (Beltrán-Carrillo, Devís-Devís, Peiró-Velert, & Brown, 2012).

In PE, the instructional style of the teacher does not only pertain to a general student-teacher relationship level, but it is recognized as a central piece of several teaching models, such as the Modified Games Approach (Bunker & Thorpe, 1982) and Sport Education Model (Siedentop, 1994). Specifically, teaching behaviors that lead to more engagement and academic learning time, such as good management have traditionally considered being trademarks of effective teaching and instruction in PE (McKenzie & Lounsbery, 2013; Rink, 2013). Additionally, the content knowledge of PE teachers is seen as a crucial factor in determining teacher effectiveness (Ward, 2013). On the other hand, it is argued that teacher effectiveness should always be reviewed against the learning goals, which should transcend the PE lessons and be related more to public health (MzKenzie & Lounsbery, 2013). Finally, a more holistic view of PE has been proposed, in which quality PE should include a robust affective learning domain, and it is paramount that PE teachers promote positive attitudes and motivation toward physical activity and do not focus solely on physical activity (Dyson, 2014).

From the perspective of positive outcomes of PE, it is shown that PE teachers can facilitate student engagement through quality interactions (Curran & Standage, 2017). Also, characteristics of instruction can affect several factors related to positive PE experiences, such as feeling successful and competent in class and having high-quality relationships with peers (Portman, 2003). The interpersonal relationships between the teachers and the students seem to be crucially important for the students (Skinner & Belmont, 1993), but interestingly teachers' quality communication has also shown to increase teachers' motivation (Cheon et al., 2014).

The instructional style of a teacher can also play a prominent part in forming disengagement in PE (Beltrán-Carrillo et al., 2012). The teacher-student relationship that leaves students feeling ignored, avoided or even mocked (Tischler & McCaughtry, 2011) are especially disadvantageous for the promotion of physical activity but also larger purposes of education. Negative PE experiences have been described as alienating, frustrating, and resulting in reduced self-esteem and feelings of worthlessness (Cardinal et al., 2013). Additional negative consequences that have reported from participating in PE include avoidance behavior from physical activity and even strong physical symptoms, such as nausea (Tischler & McCaughtry, 2011). Especially the students who perceive themselves as low skilled seem to be more likely to be disengaged with PE (Portman, 2003).

Sports participation, although not usually a part of formal education is regarded as an essential educational venue, especially for children and adolescents (European Commission, 2007, White paper section 1). Highlighting the link between sport participation and education, it has been shown that sports participation increases educational attainment among adolescents (Pfeifer & Cornelissen, 2010) and is correlated with higher educational aspirations (Rees & Sabia, 2010). With regards to coaching, coaches' behaviors have been shown to predict athletes'

motivation and initiative taking (Coatsworth & Conroy, 2009; Conroy & Coatsworth, 2007). Also, the interpersonal style of a coach has shown to be related to athletes' improved performance (Mageau & Vallerand, 2003), but it has also been found to relate to adverse athlete outcomes, such as antisocial behavior (Delrue et al., 2017).

With regards to non-formal education in physical activity, instruction has also shown to be an essential factor in exercise. For example, the behavior of the exercise instructor in exercise settings (e.g., group fitness classes) is suggested being one of the most critical factors influencing participants' exercise adherence and motivation (Franklin, 1986). This statement is also supported by sizeable empirical evidence (e.g., Carron, Hausenblas, & Mack, 1996). Particularly the communication style of the instructor has shown to be an important factor affecting participants' motivation and engagement to sustain exercise behavior (Edmunds, Ntoumanis, & Duda, 2008).

In the physical activity context, including PE, sports, and exercise, the social cognitive approach has dominated the research in efforts to examine the best theory-based instructional behaviors and characteristics of the physical activity settings that will lead to the best possible participant outcomes (Hastie, Rudisill, & Wadsworth, 2013). One of the most prominent social cognitive theories that has dominated physical activity research is Self-Determination Theory – macro theory of human motivation (SDT; Deci & Ryan, 1985, 2000).

One of the central tenets of SDT is the interplay of the social environment, psychological needs, and quality of participant motivation (Deci & Ryan, 1985, 2000). Applying SDT within education, particular interest has been directed towards the use of autonomy- and need-supportive behavior of teachers, instructors, and coaches (Reeve & Jang, 2006; Su & Reeve, 2011). Autonomy-supportive teaching/instruction, which is the most used conceptualization of

SDT-based interventions, highlights instructional strategies that seek to satisfy the human need for autonomy (Reeve & Jang, 2006). Although not always differentiated from autonomy-supportive instruction (see Reeve, Cheon, & Ntoumanis, 2018), need-supportive instruction, on the other hand, conceptualize instructional strategies more comprehensively from the perspective of all three psychological needs suggested by the SDT (i.e., needs for autonomy, competence, and relatedness; Tessier et al., 2010).

Previous SDT-centered systematic reviews on the efficacy of the autonomy and need-supportive instructional interventions have focused solely on general education (Stroet et al., 2015), health (Gillison et al., 2019), or PE (Lochbaum & Jean-Noel, 2015). Although all these previous reviews have shown need-supportive instruction to be beneficial, several gaps in the literature warrant additional study. First, the effects of need-supportive instruction on motivation have not been previously quantitatively summarized. Further, it is unclear under which contexts (e.g., exercise or PE) need-supportive instruction is the most beneficial for motivation in physical activity. Second, there is a scarcity of research experimentally examining the effects of need-supportive instruction on important physical activity-related outcomes of motor skill performance and negative affect.

A literature review of the theories and concepts of interest are presented in Chapter 2. Moreover, prior related research is reviewed comprehensively. The chapter devotes special attention to SDT and its educational applications – autonomy- and need-supportive instruction.

Chapter 3 of this dissertation is a systematic review and meta-analysis of need-supportive instruction and its effect on the motivational regulations in physical activity. *A priori* moderators deduced using logic, theoretical postulations, and previous research are used to explain the expected variability in the effect sizes.

Chapter 4 is a manuscript summarizing an experiment testing the efficacy of need-supportive instruction on skill performance, motivational regulations as well as the adverse affect of anxiety and positive affect of enjoyment. The manuscript also examines whether the effects of need-supportive instruction follow the theoretical model of SDT.

The results of these studies are expected to contribute useful knowledge to PE teachers, exercise instructors, and sport coaches alike. The results are aimed to improve teachers', coaches' and exercise instructors' knowledge and teaching effectiveness from the perspective of theory-driven instructional styles. Also, these findings can be used to improve PE teacher and coach education. Finally, this study contributes to the scientific knowledge base and will help PE, physical activity, and motivation scholars to improve the effectiveness of interventions in physical activity and education.

References

1. Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., Sandford, R., & Education, B. P. (2009). The educational benefits claimed for physical education and school sport: An academic review. *Research Papers in Education*, *24*(1), 1-27.
2. Beltrán-Carrillo, V. J., Devís-Devís, J., Peiró-Velert, C., & Brown, D. H. (2012). When physical activity participation promotes inactivity: Negative experiences of Spanish adolescents in physical education and sport. *Youth & Society*, *44*(1), 3-27.
3. Bunker, D., & Thorpe, R. (1982). A model for the teaching of games in secondary schools. *Bulletin of Physical Education*, *18*(1), 5-8.
4. Cardinal, B. J., Yan, Z., & Cardinal, M. K. (2013). Negative experiences in physical education and sport: How much do they affect physical activity participation later in life? *Journal of Physical Education, Recreation & Dance*, *84*(3), 49-53.
5. Carron, A. V., Hausenblas, H. A., & Mack, D. (1996). Social influence and exercise: A meta-analysis. *Journal of Sport and Exercise Psychology*, *18*(1), 1-16.
6. Cheon, S. H., Reeve, J., & Ntoumanis, N. (2018). A needs-supportive intervention to help PE teachers enhance students' prosocial behavior and diminish antisocial behavior. *Psychology of Sport and Exercise*, *35*(3), 74-88.
7. Cheon, S. H., Reeve, J., Yu, T. H., & Jang, H. R. (2014). The teacher benefits from giving autonomy support during physical education instruction. *Journal of Sport and Exercise Psychology*, *36*(4), 331-346.
8. Coatsworth, J. D., & Conroy, D. E. (2009). The effects of autonomy-supportive coaching, need satisfaction, and self-perceptions on initiative and identity in youth swimmers. *Developmental Psychology*, *45*(2), 320-328.
9. Cohen, J., McCabe, L., Michelli, N. M., & Pickeral, T. (2009). School climate: Research, policy, practice, and teacher education. *Teachers College Record*, *111*(1), 180-213.
10. Commission of the European Communities. (2000). *A Memorandum on lifelong learning*, Brussels, Belgium: CEE.
11. Conroy, D.E. and Coatsworth, J.D., Assessing Autonomy-Supportive Coaching Strategies in Youth Sport, *Psychology of Sport and Exercise*, 2007, 8(5), 671-684.
12. Curran, T., & Standage, M. (2017). Psychological needs and the quality of student engagement in physical education: Teachers as key facilitators. *Journal of Teaching in Physical Education*, *36*(3), 262-276.
13. Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum Press.
14. Deci, E. L., & Ryan, R. M. (2000). The" what" and" why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*(4), 227-268.
15. Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and education: The self-determination perspective. *Educational Psychologist*, *26*(3-4), 325-346.
16. Delrue, J., Vansteenkiste, M., Mouratidis, A., Gevaert, K., Broek, G. V., & Haerens, L. (2017). A game-to-game investigation of the relation between need-supportive and need-thwarting coaching and moral behavior in soccer. *Psychology of Sport and Exercise*, *31*, 1-10.
17. Dyson, B. (2014). Quality physical education: A commentary on effective physical education teaching. *Research Quarterly for Exercise and Sport*, *85*(2), 144-152.

18. Edmunds, J., Ntoumanis, N., & Duda, J. L. (2008). Testing a self-determination theory-based teaching style intervention in the exercise domain. *European Journal of Social Psychology, 38*(2), 375-388.
19. European Commission. (2007). *White paper on sport* (COM/2007, 391 final). Brussels, Belgium: Author.
20. Franklin, B. A. (1986). Clinical components of a successful adult fitness program. *American Journal of Health Promotion, 1*(1), 6-13.
21. Gillison, F. B., Rouse, P., Standage, M., Sebire, S. J., & Ryan, R. M. (2019). A meta-analysis of techniques to promote motivation for health behaviour change from a self-determination theory perspective. *Health Psychology Review*, *13*(1), 110-130.
22. Hastie, P. A., Rudisill, M. E., & Wadsworth, D. D. (2013). Providing students with voice and choice: lessons from intervention research on autonomy-supportive climates in physical education. *Sport, Education and Society, 18*(1), 38-56.
23. Kirk, D. (2005). Physical education, youth sport and lifelong participation: The importance of early learning experiences. *European Physical Education Review*, *11*(3), 239-255.
24. Lave, J. (1997). The culture of acquisition and the practice of understanding. In D. Kirshner & J.A. Whitson (Eds.), *Situated cognition: Social, semiotic, and psychological perspectives* (pp. 63-82). Mahwah, NJ: Erlbaum.
25. Liu, S., & Meng, L. (2009). Perceptions of teachers, students and parents of the characteristics of good teachers: A cross-cultural comparison of China and the United States. *Educational Assessment, Evaluation and Accountability, 21*(4), 313-328.
26. Lochbaum, M., & Jean-Noel, J. (2015). Perceived Autonomy-Support Instruction and Student Outcomes in Physical Education and Leisure-Time: A Meta-Analytic Review of Correlates. *Revista Internacional de Ciencias del Deporte, 12*(43), 29-47.
27. Mageau, G. A., & Vallerand, R. J. (2003). The coach–athlete relationship: A motivational model. *Journal of Sports Science*, *21*(11), 883-904.
28. McKenzie, T. L., & Lounsbery, M. A. (2013). Physical education teacher effectiveness in a public health context. *Research Quarterly for Exercise and Sport, 84*(4), 419-430.
29. National Association for Sport and Physical Education [NASPE], (2004). *Moving into the future: The National Standards for Physical Education* (2nd ed.). Reston, VA: AAHPERD.
30. Organisation for Economic Cooperation and Development (OECD). (1997). *What works in innovation in education: Combating social exclusion through adult learning*, Paris, France: OECD.
31. Organisation for Economic Cooperation and Development (OECD). (2018). *Teaching for the future: Effective classroom practices to transform education*. Paris, France: OECD.
32. Pfeifer, C., & Cornelissen, T. (2010). The impact of participation in sports on educational attainment—New evidence from Germany. *Economics of Education Review*, *29*(1), 94-103.
33. Portman, P. A. (2003). Are physical education classes encouraging students to be physically active? Experiences of ninth graders in their last semester of required physical education. *The Physical Educator*, *60*(3), 150-162.
34. Rees, D. I., & Sabia, J. J. (2010). Sports participation and academic performance: Evidence from the National Longitudinal Study of Adolescent Health. *Economics of Education Review*, *29*(5), 751-759

35. Reeve, J., & Jang, H. (2006). What teachers say and do to support students' autonomy during a learning activity. *Journal of Educational Psychology*, *98*(1), 209.
36. Reynolds, D., & Teddlie, C. (2000). The processes of school effectiveness. In C. Teddlie & D. Reynolds (Eds.), *The International handbook of school effectiveness research* (pp. 135–159). London, UK: Falmer.
37. Rink, J. E. (2013). Measuring teacher effectiveness in physical education. *Research Quarterly for Exercise and Sport*, *84*(4), 407-418.
38. Siedentop, D. (1994). *Sport education: Quality PE through positive sport experiences*. Champaign, IL: Human Kinetics.
39. Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology*, *85*, 571–581.
40. Stroet, K., Opdenakker, M. C., & Minnaert, A. (2013). Effects of need supportive teaching on early adolescents' motivation and engagement: A review of the literature. *Educational Research Review*, *9*, 65-87.
41. Stronge, J. H. (2007). *Qualities of effective teachers* (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development (ASCD).
42. Su, Y. L., & Reeve, J. (2011). A meta-analysis of the effectiveness of intervention programs designed to support autonomy. *Educational Psychology Review*, *23*(1), 159-188.
43. Tessier, D., Sarrazin, P., & Ntoumanis, N. (2010). The effect of an intervention to improve newly qualified teachers' interpersonal style, students' motivation and psychological need satisfaction in sport-based physical education. *Contemporary Educational Psychology*, *35*(4), 242-253.
44. Tischler, A., & McCaughtry, N. (2011). PE is not for me: when boys' masculinities are threatened. *Research Quarterly for Exercise and Sport*, *82*(1), 37-48.
45. Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 29, pp. 271–360). San Diego: Academic.
46. Vallerand, R. J. (2000). Deci and Ryan's self-determination theory: A view from the hierarchical model of intrinsic and extrinsic motivation. *Psychological Inquiry*, *11*(4), 312-318.
47. Walls, R. T., Nardi, A. H., von Minden, A. M., & Hoffman, N. (2002). The characteristics of effective and ineffective teachers. *Teacher Education Quarterly*, *29*(1), 39-48.
48. Ward, P. (2013). The role of content knowledge in conceptions of teaching effectiveness in physical education. *Research Quarterly for Exercise and Sport*, *84*(4), 431-440.
49. Wentzel, K. R. (2002). Are effective teachers like good parents? Teaching styles and student adjustment in early adolescence. *Child development*, *73*(1), 287-301.

CHAPTER 2

LITERATURE REVIEW

This dissertation has two aims. The first aim is to define, using a meta-analytic approach, the quantitative effect of need-supportive instruction in physical activity on motivational regulations as theorized by SDT (Deci & Ryan, 1985a, 2000). The second aim is to test the effect of need-supportive instruction on motivation, skill performance, and affect in physical activity. The purpose of this chapter is to review the definitions, research, and theories pertinent to the aims of the dissertation.

1. Overview of SDT

1.1 Theoretical Premise of SDT

The general premise of SDT is that humans are active and growth-oriented organisms who seek to integrate their psychic elements into a broader, unified sense of self and themselves into larger social structures (Deci & Ryan, 1985a, 2000). Humans are expected to be willing to pursue interesting activities, enhance their capacities, and relate with others, but these tendencies are assumed to require support from the environment. In other words, this organismic view of human motivation suggests that humans seek to actualize their potential, but that this process is facilitated or hindered by the social environment (Deci & Ryan, 2000; Ryan & Deci, 2002).

According to SDT, humans have three basic human needs that are key to achieving optimal personality development, well-being, and integrity—competence, autonomy, and relatedness. (Deci & Ryan, 1985a, 2000). Notably, this notion is dialectical, as the social contexts that support the satisfaction of these needs lead to optimal functioning, and

environments, which thwart these needs, are antagonistic to healthy functioning. For example, an environment that is overly controlling, overwhelming, and socially alienating will lead to self-protective processes and general ill-being (Deci & Ryan, 2000). Additionally, according to the SDT framework, the three basic needs are considered universal and innate rather than learned (Ryan & Deci, 2002). Furthermore, these needs bear similarities with other prominent need-theories of Maslow's Hierarchy of Needs (Maslow, 1943) and ERG-theory (Alderfer, 1969). Contrary to Maslow's theory, SDT does not organize the needs hierarchically, but in a parallel fashion, while SDT is similar to Alderfer's ERG-theory in that it proposes that basic human needs should be clustered into three categories of existence, relatedness, and growth (Alderfer, 1969; Maslow, 1943). Ultimately, SDT prioritizes the quality and different types of motivation over the quantity of motivation (Deci & Ryan, 2008), stating that both a goal's contents and the different regulation processes through which a goal is attained influence human behavior and well-being as mediated by through the three basic psychological needs (Deci & Ryan, 2000).

1.2 Psychological Needs

SDT identifies autonomy as the central psychological requisite for optimal functioning (Deci & Ryan, 2000). Autonomy refers to the perceived sense of being the origin of one's behavior (deCharms, 1968). It involves acting out from own interests and integrated values with a full sense of volition and endorsement, and it is contrasted by heteronomy, or regulating behavior without self-endorsement (Ryan & Deci, 2006). Further, autonomous behavior can be seen as an expression of the self even if the behavior is influenced by outside sources (Ryan, 1993), although one has to agree with the influences, value them, and feel an initiative to allow behaviors to be autonomous. Thus, autonomy differs from the concept of independence (not relying on external sources and influences), as one can be autonomously dependent on others or

conversely forced to be independent (Ryan, 1993; Ryan & Deci, 2002). Autonomy is also not equivalent to having many choices, which may lead to non-optimal functioning via ego-depletion (Iyengar & Lepper, 2000; Schwartz, 2000), but refers explicitly to people's experience of volition and being free of extrernal pressuers (Ryan & Deci, 2006). Notably, autonomy is considered the most unique of the three needs, since behavior can still be controlled even when the needs of relatedness and competence are satisfied.

Competence, or the need to feel competent, is identified as the second most powerful influence on motivation in SDT (Deci & Ryan, 2000). Competence is a belief that one can successfully and effectively exercise and express one's abilities (White, 1959), and also refers to the perception of achieving one's goals and mastery of one's environment (Deci & Ryan, 2000). Optimal challenges and the pursuit of maintaining and enhancing one's skills and abilities are central to the need for competence (Csikzenmihalyi, 1990; Deci & Ryan, 2000). Competence has been conceptualized from various perspectives, including self-efficacy (Bandura, 1997), expectancy-related beliefs (Eccles et al., 1983), cognitive representations of one's general self-worth, and the level of one's ability in different domains, such as school, social settings, and sports (Harter, 1982, 1998). Adding to these conceptualizations, SDT suggests that competence is vital for human development, growth, and well-being (Deci & Ryan, 2000).

Finally, the need for relatedness refers to the desire to connect with others in a meaningful way (Deci & Ryan, 1985a, 2000). The importance of relatedness has often been emphasized, and has been discussed in numerous studies, such as several experimental studies focusing on infant monkeys (Harlow, 1958) and in the attachment theory stemming from the Freudian tradition emphasizing humans' early experiences with one's mother or other primary carer (Bowlby, 1979). The significance of relatedness for motivation is believed to vary from

activity to activity, and it is not necessarily a requirement for ideal motivation. Nonetheless, the perceptions of attachment, security, intimacy, and belongingness are theorized to be a crucial part of optimal human functioning (Baumeister & Leary, 1995), which, when satisfied, advances human behavior (Deci & Ryan, 2000). Similarly to the ERG-theory (Alderfer, 1969), SDT views relatedness as a means to feel connected to others, having a sense of belongingness, and being cared for (Deci & Ryan, 2000).

1.3 Minitheories of SDT

The work leading to the formulation of SDT (Deci & Ryan, 1985a, 2000) began in the 1970s with experimental studies on intrinsic motivation (see Deci 1971, 1972). This process was guided through development by four mini-theories, with two more mini-theories added later. The six mini-theories that currently constitute SDT seek to explain various phenomena of human life. All of the mini-theories integrate the aforementioned organismic and dialectical assumptions with the involvement of the three basic psychological needs. (Ryan & Deci, 2002).

1.3.1 Cognitive Evaluation Theory

Cognitive evaluation theory evaluates the dynamic relationship between intrinsic motivation and social contexts (Deci, Cascio, & Krusell, 1975; Deci & Ryan , 1980). According to SDT, intrinsic motivation refers to the motivations of 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 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, intrinsic motivation is enhanced. 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).

1.3.2 Organismic Integration Theory

Organismic Integration Theory focuses on different forms of extrinsic motivation and changes in different extrinsic regulations (Ryan & Connell, 1989). Changes in motivation depend here on internalization—a process in which external values and requirements are transformed into personal values (Ryan, 1993). SDT posits that people naturally 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 that a behavior or the value underlying it 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 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 concern 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).

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 are expected 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 (Yamuchi & Tanaka, 1998; 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).

1.3.3 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).

1.3.4 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 (US), 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.

1.3.5 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. Instruction and SDT

2.1 Early Developments of Need-Supportive Instruction

The contemporary conceptualization of need-supportive instruction dates back to studies focusing on the effects of teachers' autonomy and control teaching orientations on their students' intrinsic motivation (Deci, Schwartz, Sheinman, & Ryan, 1981; Deci, Spiegel, Ryan, Koestner, Kauffman, 1982). These teaching orientations were theorized to lead to classrooms that are predominantly either controlling (Deci et al., 1981), which exert pressure toward specific outcomes, or informational, which provide feedback that signifies competence or assists students in becoming more competent while supporting their autonomy (Deci et al., 1981; Ryan, 1982). Teachers were made the focus of these contexts because teachers' expectations, rewards, and competence feedback were thought to be able to be given either in an informative or a controlling way (Ryan, 1982). For example, an early study by Koestner, Ryan, Bernieri, & Holt (1984) showed that language free of pressure and implying choice enhanced autonomous motivation even with motivational techniques that could easily be seen as controlling, such as deadlines. Although teacher communication has a significant influence on student outcomes, it

was recognized from early on that what ultimately matters is how the recipient – the student - interprets the communication (Ryan, 1982).

One of the central aims of early studies was to identify teachers' practical strategies to motivate students optimally and to determine the central characteristic of controlling and autonomy-supportive teachers (Deci et al., 1981, 1982). Early evidence indicated that controlling teachers use more controlling language, allow students to work less on their own, use "should" statements more frequently, give more directives and criticism, and give less choice compared to autonomy-supportive teachers. Interestingly, it was also found that controlling teachers praised their students more than autonomy-supportive teachers (Deci et al., 1982). In contrast, autonomy-supportive teachers listened to their students more and showed more empathy (Deci et al., 1982). Moreover, Koestner et al. (1984) showed that when students were asked to perform an uninteresting activity and the teacher acknowledged their negative feelings, the autonomous motivation of the students toward the task increased. Additionally, giving choice in terms of allocated time and choosing between different tasks resulted in more student autonomous motivation.

To summarize the first findings on autonomy-supportive teaching, internalization was most effective when students understood the personal utility of the behavior, when they were provided choices and minimal pressure, and when their perceptions and feelings were acknowledged (Deci et al., 1994). Further, the knowledge of outcomes and the expectancies to be successful in the educational pursuit is not enough—the student also had to feel free to adopt the value of the activity on one's own (Deci, Vallerand, Pelletier, & Ryan, 1991).

2.1.1 Autonomy-Support as a Cornerstone of Need-Supportive Instruction

As explained, early research in the area of SDT and teaching focused mostly on autonomy-support and autonomy-satisfaction and paid less attention to the needs of competence and relatedness (Deci et al., 1981, 1982, 1994; Reeve & Jang, 2006; Ryan & Grolnick, 1986). Teachers' motivating styles were thought to range only from controlling to autonomous, as discussed in the aforementioned organismic integration theory (Ryan, 1993). Consequently, this emphasis on autonomy led to scholars systematically investigating the characteristics of teaching that solely support the autonomy need and not the other needs (Reeve et al., 1999; Reeve & Jang, 2006). Although autonomy-supportive instruction was not initially thought to be a prearranged teaching method with specific teaching strategies and techniques, these research results helped to formulate a teaching style that could be characterized by a list of autonomy-supportive behaviors (Reeve & Jang, 2006). This conceptualization of a SDT-based teaching style is still used widely in research (e.g., Cheon, Reeve, & Song, 2016).

In accordance with SDT, the autonomy-supportive teaching style posits that students have inner motivational resources that can be supported or restricted by the teacher (Reeve & Jang, 2006). Autonomy-supportive teachers seek to nurture students' inner motivational resources by coordinating instructional practices with students' interests and preferences. Autonomy-supportive teachers also try to foster students' sense of enjoyment, challenge, competencies, and choice-making (Reeve, Bolt, & Cai, 1999; Reeve & Jang, 2006).

Although the first studies on autonomy-supportive teaching examined the interpersonal dynamics of a classroom (e.g., Deci et al., 1981), more systematic explorations have since been performed. In one such study, Reeve et al. (1999) explored autonomy-supportive behaviors in US schools. Autonomy-supportive and controlling teachers (N = 122) were identified with a Problems in School Questionnaire, and then the teachers were observed during a one-on-one

instructional segment in a laboratory context. The results showed that compared to more controlling teachers, autonomy-supportive teachers listened more, had less control over the instructional materials, resisted helping the students too much, gave fewer directives, asked for students' opinions more, supported students' initiative, provided rationale to the task at hand, responded to students' questions more, and sought to see things from students' perspective (Reeve et al., 1999).

The study by Reeve and Jang (2006) on 144 preservice teachers in the US examined whether the behaviors stated above (Reeve et al., 1999) and in other studies (e.g., Deci et al., 1982) correlated with students' autonomy-satisfaction in a one-on-one teaching situation among undergraduate students. The results showed that eight specific teacher behaviors correlated with students autonomy-satisfaction: time listening, time allowing the student to work in his or her own way, time allowing students to talk, praise as informational feedback, offering encouragement, offering hints, being responsive to students generated questions and making perspective-acknowledging statements (Reeve & Jang, 2006). However, a multiple regression analysis showed that only offering encouragement, providing time for the student to work in his or her own way, and time allowed students to talk explained students' perceived autonomy uniquely.

Ultimately, based on the several autonomy-supportive interventions in schools and universities (Cheon & Reeve, 2013; Cheon & Reeve, 2015: Cheon, Reeve, & Moon, 2012; Reeve & Cheon, 2016; Reeve & Jang, 2006), Reeve (2016) identified six specific autonomy-supportive instructional behaviors and strategies: taking the students' perspective, energizing students' inner motivational resources, provision of explanatory rationales, acknowledgment, and acceptance of negative affect, use of informational and non-pressuring language, and patience.

However, it seems that all autonomy-supportive behaviors are not equally efficient. For example, it was found among Israeli school students (N = 862) that children and adolescents can distinguish between the different autonomy-supportive behaviors of their teachers (Assor, Kaplan, & Roth, 2002). In addition, the study showed that the most important factors for students' sense of engagement in their teacher behavior was providing relevance and a lack of suppression of criticism.

Despite the wide acceptance of Reeve's (2016) conceptualization of autonomy-supportive teaching, some researchers (Stefanou, Perencevich, DiCintio, & Turner, 2004) have argued that autonomy-support is too complicated and broad a concept in teaching contexts, and that it should be split into the categories of organizational autonomy support (e.g., choices concerning the layout of the lesson), procedural autonomy support (e.g., allowing students to choose and handle materials), and cognitive autonomy support (e.g., students are encouraged to find multiple solutions to problems, receive informational feedback, and be supported when they encounter mistakes). In a study by Agbuga, Xiang, McBride, & Su (2016), Turkish middle school students (N = 246) felt more autonomous when they had influence over cognitive, organizational (e.g., developing class rules) and procedural instructional (e.g., selecting used equipment) aspects of their PE lessons. Notably, procedural and organizational choices predicted autonomy need satisfaction, and the feeling of being autonomous mediated the relationship between having choices and being engaged during class.

2.1.2 Autonomy-Supportive Instruction vs. Need-Supportive Instruction

Lately, research focusing on autonomy-support has begun incorporating the three psychological needs to form a concept of psychological need-supportive instruction (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 an intervention design in PE. In the study, autonomy-supportive behaviors targeted the need for autonomy, structure supported competence, and teachers' interpersonal involvement targeted the need for relatedness (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, they found that different students in the same class environment can perceive need-support in very different ways (Haerens et al., 2013). It is thus possible that students perceive teacher behavior differently and/or that teachers behave differently with different students.

To support competence, the most common strategy has been to provide structure (e.g., Jang, Reeve, & Deci, 2010). In education, the structure is the clearness of teacher-provided information that guides students toward learning goals and expectations (Skinner & Belmont, 1993). The opposite of structure is chaos and a lack of clarity as to what the students are expected to do. Although autonomy and structure can easily be seen as opposite things, it is thought that lack of structure leads to environments that are permissive and indulgent and not to more autonomy (Jang et al., 2010). The study by Haerens et al. (2013) in Belgian PE context showed that a PE class structure formed two dimensions: structure during the activity and structure before the activity. Structure before the activity includes behaviors such as giving clear verbal instructions, demonstrating activities, and providing lesson overviews. Structure behaviors during the activity included helping and monitoring the students as well as giving them advice, guidelines, and feedback. Besides structure, SDT assumes that optimally challenging tasks,

positive feedback that promotes a sense of mastery, and understandable and controllable learning objects promote the satisfaction of competence (Niemiec & Ryan, 2009).

In the study by Vansteenkiste et al. (2012), autonomy-support and structure in high school provided by the teacher formed two very different dimensions that still correlated positively with one another. The students who experienced most autonomy-support and clear expectations reported most autonomous motivation, least problem behavior, and least test anxiety, which suggest that autonomy and structure complement each other. The effectiveness of structure alone on student perceived competence has also been shown in classroom contexts (Tucker et al., 2002). Interestingly, the study by Hospel & Galand (2016) examining Belgian adolescents (N = 744) found that structure (e.g., clarifying expectations and test assessment criteria) in language classes was more strongly linked to students' engagement than autonomy-support characterized by giving choice.

In the classroom, the need for relatedness emanates from students' feelings of connection and belonging (Niemiec & Ryan, 2009). Thus, students should feel that their teacher is warm toward them and genuinely cares for and respects them. To accomplish this, it would be beneficial for teachers to be interpersonally involved, making a conscious effort to achieve quality relationships with students, for example by learning something about the students' background (Taylor & Ntoumanis, 2007). Research has shown that African American low-income students who perceive that their teacher is interested and involved in their lives are more engaged in school work (Tucker et al. 2002). Specifically pertaining to the PE context in Australia, research relying on student interviews (N = 48) has shown that PE teachers possess certain behavioral tendencies that promote relatedness between the teachers and the students (Sparks, Dimmock, Whipp, Lonsdale, & Jackson, 2015). These behaviors can be split into three

groups: (1) teacher communication (e.g., individual conversations, teacher enthusiasm, and friendly general communication (2) in-class social support (e.g., task-related support, promoting cooperation and teamwork), and (3) teacher attentiveness (awareness, caring-behaviors). Moreover, in a study by Haerens et al. (2013) investigating Belgian PE teachers' need-supportive interactions, relatedness-support manifested itself in empathetic behavior, asking questions and paying attention to the students' opinions. Teachers illustrating relatedness-support were also physically closer to their students and were more enthusiastic and eager about the lessons (Haerens et al., 2013).

2.1.3 Autonomy- and Need-Supportive Instruction in Physical Activity Context

Although there has been an increasing interest in examining need-supportive instruction, most of the intervention research in education and physical activity has applied autonomy-support as their main component of the intervention. One of the first studies in this tradition found that a communication style combining rationales, a minimal amount of pressure, provision of choice, and acknowledgment of negative feelings affect the perceptions of autonomy-support leading to high school students' (N =79) greater intention to be physically active (Chatzisarantis, Hagger, & Smith, 2007). In a subsequent study looking at the effectiveness of autonomy-supportive teaching behaviors on student outcomes, 235 English students in co-educational schools were taught for five weeks either in an autonomy-supportive way or in a teaching style not emphasizing autonomy-support (Chatzisarantis & Hagger, 2009). The students taught in an autonomy-supportive way perceived their teachers to be more autonomy-supportive, had higher autonomous motivation in PE, and were more physically active in their leisure time than the students in the control group. In an intervention study of Tessier et al. (2010), researchers trained French high school teachers for four hours to support need satisfaction in their students over the

course of three two-hour lessons. The training improved students' relatedness need satisfaction, decreased their controlling motivation, and increased their engagement. Lastly, in a cluster randomized study conducted by Yli-Piipari, Layne, Hinson, and Irwin (2018) in an urban middle school in the US, eight PE teachers taught their 408 students either in an autonomy-supportive way (manipulated in professional development) or in a traditional way for seven weeks. The results showed that those students taught in an autonomy-supportive way had higher levels of autonomous PE motivation, physical activity intentions, and self-reported physical activity compared to the students taught traditionally.

In addition to the aforementioned studies, the most prominent SDT-based PE interventions have been conducted in South Korea (Cheon et al., 2012; Cheon & Reeve, 2013; Cheon & Reeve, 2015; Cheon et al., 2016; Cheon, Reeve, & Ntoumanis, 2018). These studies have used an intervention protocol known as the autonomy-supportive intervention program to change PE teachers' motivational strategies. Over the course of three workshops, some teachers are trained to adopt an autonomy-supportive communication style, after which the teachers and their students are followed over a semester or a school year. In addition, the efficacy of trained teachers' instruction is compared to teachers who have taught their classes without intervention (traditionally). These studies find that students who have been taught by the autonomy-supportive intervention program trained teachers showed modest-sized increases in need satisfaction (e.g., Cheon et al., 2012; Cheon et al., 2018), autonomous motivation, future intention toward physical activity, and improvement in perceived skill development compared to the students taught by the teachers in the control condition (Cheon et al., 2012). These positive changes in students have been shown to last up to one year after the training (Cheon & Reeve, 2013). The program also decreases secondary school students' amotivation and perception of

need thwarting (active undermining of the three basic needs) in PE classes and increases their engagement with PE (Cheon & Reeve, 2015; Cheon et al., 2016).

Autonomy-supportive experiments have also been conducted in Europe. In a study by Leptokaridou, Vlachopoulos, and Papaiannou (2016), two classes of 54 Greek elementary school students were taught by one teacher in an autonomy-supportive or in an autonomy-lacking way for a trimester. The results showed that the students in the control condition, i.e., autonomy-lacking teaching, showed considerably less autonomous motivation and intrinsic motivation, less enjoyment, and less need satisfaction at the end of the intervention than the students in the experimental group. Per the results, the difference was mainly due to the deterioration of the motivational constructs in the control group and not due to increases in the constructs among the students in the experimental group. Moreover, in a quasi-experimental study by Mouratidis, Vansteenkiste, Sideridis, & Lens, (2011), it was found that 138 Greek elementary school pupils showed greater enjoyment when their teacher supported their needs for autonomy and relatedness in their PE classes. Further, the students that were more autonomously motivated toward PE benefited more of the need-supportive teaching in terms of experienced enjoyment.

In Asia, a study by Meng, and Keng (2016) had eight PE teachers from Singapore teach 648 secondary school students either in an as usual, autonomy-supportive, or both autonomy-supportive and structure-emphasizing way for ten weeks. The teacher training was similar to the autonomy-supportive intervention program (Cheon & Reeve, 2015). The results showed that supporting autonomy and structure of the classes led to better motivational outcomes than supporting only student autonomy or teaching the students in a usual way. In an Australian study by Perlman (2013), 79 secondary school PE students were randomly assigned to either a highly autonomy-supportive group or a highly controlling group within a 4-week basketball module

taught by the same teacher. The results indicated that the autonomy-supportive teaching style improved students' enjoyment, autonomous motivation, and competence need compared to the controlling teaching condition.

Interestingly, in an Australian cluster randomized study by Lonsdale et al. (2013), only teaching conditions in PE settings that involved free-choice, increased student's physical activity levels, but the same effect was not observed for conditions that either provided relevance (significance and positive consequences of physical activity) or choice—motivational strategies derived from autonomy-supportive teaching. The manipulations of the aforementioned independent dimensions of the autonomous-teaching style also did not increase autonomous motivation of the students, suggesting that for the need-supportive actions to be effective, all aspects of the instructional style should be implemented. Lastly, in a unique study looking only relatedness support by Sparks, Lonsdale, Dimmock and Jackson (2017), 382 Australian high school students and their 18 PE teachers were assigned to either a "teaching-as-usual" control group or to a relatedness-supportive intervention group. Per the results, the students in the intervention group showed more relatedness satisfaction and enjoyment but not autonomous motivation compared to the control group.

In addition to PE in schools, SDT-based interventions have also been conducted in fitness class environments. In a British study by Edmunds, Ntoumanis, & Duda (2008), two fitness classes were taught for 10-weeks in a realistically controlling way or in a way that positively manipulated autonomy satisfaction, structure (competence), and interpersonal involvement (relatedness). It was found that the participants in the experimental group experienced improvements in relatedness and competence need satisfaction compared to the control group, but not autonomy satisfaction. Additionally, although the teaching styles did not affect the

participants' autonomous motivation, participants in the experimental group attended classes more often and enjoyed the class more than participants in the control group. Similar results came from a study by Moustaka, Vlachopoulos, Kabitsis, & Theodorakis (2012), who compared motivational outcomes between 35 female middle fitness-class participants in Greece who were taught either in an autonomy-supportive or autonomy-depriving way for eight weeks. Participants in the autonomy-supportive group demonstrated higher levels of perceived autonomy support, autonomous motivation, and autonomy and competence need satisfaction at the end of the intervention and attended the classes more frequently.

Few studies have examined need-supportive instruction among college students. In a study by Kirby, Byra, Readdy and Wallhead (2015), 149 college students from the US were taught badminton in either practice or inclusion style derived from the spectrum styles teaching (Mosston & Ashworth, 2002). The inclusion style theoretically allows more decision making to the students compared to more commanding practice style and, thus, is similar to autonomy-supportive teaching. The results showed that both styles positively affected students' need-satisfaction and identified regulation compared to baseline levels. However there were not any differences between the students' perception of the different teaching styles.

Not relating to physical activity, in a study by Sheldon and Filak (2008) the researchers conducted a 2x2x2 factorial design with American college students' in a word game context. Participants were set to nine different conditions, which varied in provided need-support from no need-support to support for all needs, along with a neutral group. The results indicated that competence support and relatedness support positively influenced performance in the game, intrinsic motivation towards the game, and positive and negative mood during the game. However, the results between the neutral group and the groups that were positively manipulated

in their need-support did not differ, suggesting that thwarting needs is especially harmful whereas supporting them does not necessarily lead to added benefits.

Lastly, in a study by Vansteenkiste et al. (2004), 200 Belgian college preschool teacher students participated in lessons about recycling in autonomy-supportive or controlling contexts. The students who learned under autonomy-support performed better on the test and engaged in more free-choice activities. The same results were also extended to 377 marketing students learning about business communicating styles. In the third part of the study, 214 Belgian high school students were taught Tai-Bo over two lessons. The results showed that students in the autonomy-supportive contexts showed greater autonomous motivation, performance judged by an outside rater, and participated more in a free-choice activity compared to students in the controlling context.

Not all studies examining autonomy-support have produced hypothesized results Moreover, in education, research has concluded that conducting autonomy-support interventions in natural settings is difficult due to practical reasons relating to a real-world setting (Gillison, Standage, & Skevington, 2013). Moreover, the provision of choice in educational settings has led to mixed results (Katz & Assor, 2007). More specifically, in a study by Furtak and Kunter (2012), perceived autonomy-support led to greater autonomous motivation in a science classroom. However, students did not perceive their supposedly autonomy-supportive teachers as autonomy-supportive, and controlling teachers were perceived as more autonomy-supportive. In addition, the students in the controlling condition had better achievement scores compared to the supposedly autonomy-supportive teachers. One explanation of the result offered by the researchers was that the cognitive autonomy-support (freedom to choose) may have been too cognitively taxing for the students. Another potential explanation was that the intervention was

too short to refute the socialization process of traditional controlling teaching (Furtak & Kunter, 2012). An interesting finding was also that as teachers offered more cognitive-autonomy support, teachers became frustrated and students misbehaved more. There is also evidence suggesting that perceived autonomy-support in schools is linked to autonomy need satisfaction at the beginning of the semester, but this effect might fade as the semester goes on. Autonomy satisfaction has also shown to be both a consequence and a result of engagement (Jang, Kim, & Reeve, 2012).

2.2 Controlling and Need-Depriving Instruction

2.2.1 Controlling instruction

The definition of controlling instruction can be operationalized based on the location of the instructional strategies on the autonomy-control continuum (Ryan, 1993). Thus, controlling (or autonomy-thwarting) instruction is the opposite of autonomy-supportive instruction, in which controlling teachers follow their agenda and are not interested in their students' preferences (Reeve, 2006). Controlling instruction typically involves the use of extrinsic incentives and goals and commanding students with pressuring language (Ryan & Niemiec, 2009). Controlling instruction can also involve forcing students to specific outcomes through internal pressures, shame, and ego-involvement (Reeve; 2009; Ryan, 1982).

In one of the first experimental studies on controlling instruction, teachers were guided to be controlling by telling them that it is teachers' role to make sure the children perform up to standards (Deci et al., 1982; Flink, Boggiano, & Barrett, 1990). After this manipulation, teachers were rated to give more hints, offer more directives, and limit students' autonomy. In another study aiming to explore specific behaviors of controlling teaching by Reeve and Jang (2006), six specific instructional behaviors of preservice teachers correlated negatively with their students' perceived autonomy in a one-on-one teaching segment. These behaviors were monopolizing

learning materials, exhibiting solutions to problems, uttering solutions, giving directives and commands, making "should" and "got to" statements, and asking controlling questions. However, only asking controlling questions and making "should" and "got to" statements explained the variance of students' perceived autonomy uniquely.

An interesting finding derived across different studies has been that when teachers are primed to be more controlling, students perceive them as more enthusiastic, interested, and competent (Deci et al., 1982; Flink, Boggiano, & Barrett, 1990). Further, there appears to be some inconsistency related to the prevalence of controlling teaching. For example, in the widely cited article by Reeve, Jang, Carrell, Jeon, and Barch, (2004), the authors state that in general teachers have a positive attitude towards controlling strategies, such as rewards, citing studies by Barrett and Boggiano (1988) and Boggiano, Barrett, Weiher, McClelland, and Lusk (1987). These studies did not, however, have teachers as their participants but college students and their parents. Notably, there is evidence that 1st year elementary school teachers tend to use punishments and rewards as their primary motivational strategy (Newby, 1991), but in a Belgian study of PE teachers' controlling behaviors PE, researchers showed that controlling instructional behaviors are relatively rare in real-life teaching situations (Bartholomew et al., 2018).

2.2.2 Need depriving instruction

Need-depriving instruction refers to strategies that do not support the three psychological needs of autonomy, competence, and relatedness (Vansteenkiste & Ryan, 2013). These instructional behaviors are suggested to lead to a variety of non-optimal consequences, such as decreased opportunities for student initiatives, perceptions of not being effective in one's environment, and not being connected with other students (Vansteenkiste & Ryan, 2013; Ryan & Deci, 2000b). Need-deprivation is a separate term from need-frustration and need-thwarting,

which refer to social contexts that actively inhibit and deteriorate, not just dissatisfy the fulfillment of autonomy, competence, and relatedness (Haerens, Vansteenkiste, Aelterman, & Van den Berghe, 2016). These contexts may lead to even pathological consequences, such as depression (Soenens et al., 2008; Vansteekiste & Ryan, 2013). Specifically, need-frustrating environments can result in feelings of pressure and internal conflict and inadequacy, alienation, and isolation (Haerens et al., 2016). Teacher behaviors leading to these consequences include pressures, threats, the creation of chaotic environments, use of destructive criticism (Reeve & Jang, 2006), and being unfriendly and rejecting (Skinner & Belmont, 1993).

Need-frustration research has been earned more interest compared to just need-deprivation. Nevertheless, a separate factor structure has been found with all three different concepts (Costa, Ntoumanis, & Bartholomew, 2015). Need-frustration has been found to be associated with less well-being (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani., 2011b), psychological markers of acute stress among athletes (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011a), and increased ill-being among middle-aged exercisers (Gunnell, Crocker, Wilson, Mack, & Zumbo, 2013). Relating to autonomy-frustration, it has been found that controlling contexts lead to a greater cortisol release among students than neutral or autonomy-supportive contexts (Reeve & Tseng, 2011). Controlling teaching has also found to be associated with controlled motivation and motivation mediated by need-frustration among 499 Belgian secondary PE students (Haerens, Aelterman, Vansteenkiste, Soenens, & Van Petegem, 2015).

3. Student outcomes

3.1 Enjoyment

There has been considerable research in identifying factors leading to enjoyment in sports and exercise (Craike, Hibbins, & Cuskelly, 2010; Scanlan & Lewthwaite, 1986; Wankel & Kreisel, 1985; Wiersma, 2001). Indeed, enjoyment has been a crucial part of explaining prolonged behavior, involvement, and commitment in youth sport (e.g., Weiss, Kimmel, & Smith, 2001), school PE (Dishman et al., 2005), and leisure time physical activity (Kimecik & Harris, 1996; Wallhead & Buckworth, 2004). The term itself has proven difficult to define, and there are still considerable disagreements as to how it should be measured and what constitutes enjoyment (Kimiecik & Harris, 1996; Wankel, 1997).

One suggested way to conceptualize enjoyment is based on Csikszentmihalyi's (1990) flow theory (Kimiecik & Harris, 1996). According to flow theory, enjoyment refers to an optimal psychological state or autotelic activity that is intrinsically motivating (Nakamura & Csikszentmihalyi, 2014). The concept is similar to intrinsic motivation (see Deci, 1971), but research is guided by a phenomenological approach, not by experimental studies, and is based on interviews of people who experience flow (Csikzentmihalyi, 1975). Due to the interrelatedness of intrinsic motivations and enjoyment, measures of intrinsic motivation are often used as measures of enjoyment in meta-analyses examining enjoyment (e.g., Burns, Fu, & Podlog, 2017). According to flow theory, enjoyment or flow stems from growth orientation and experiencing a balance between skills and meaningful challenges (Nakamura & Csikzentmihalyi, 2014), whereas imbalance between skills and challenges leads to either boredom or anxiety. Besides the perception of balance between challenges and skills of the actor, clear goals and immediate feedback characterize flow experiences. The resulting subjective state includes an intense concentration in the present moment, integration of action and awareness, loss of

awareness of oneself, a sense of control, distortion of the experience of time, and experiences of the activity being rewarding in its own right (Nakamura & Csikzentmihalyi, 2014).

Some researchers have criticized the correspondence of enjoyment and flow as people enjoy other aspects of activities besides the perception of balance between skills and challenges (Wankel, 1997). For example, in youth sports participation, it is found that the sources of enjoyment are effort, mastery experiences, positive team interactions and support, coach support, and satisfaction with performance (Scanlan, Carpenter, Lobel, Simons, 1993). In this study, enjoyment was defined as a positive affect and being similar with terms like fun and pleasure (Scanlan et al., 1993). Relating to the SDT, research on sports context suggests that enjoyment can result from extrinsic (e.g., social approval) and intrinsic sources (sensory experiences), and be derived from achievement (meeting goals) and non-achievement (peer relatedness, and affiliation (Scanlan & Simons, 1992). In this dissertation, enjoyment is measured using Kendzierski's and DeCarolo's (1991) physical activity enjoyment scale (PACES), which is designed to study enjoyment as a one-dimensional affective state and fits more broadly to physical activity contexts than other enjoyment scales, which relate more to sports.

3.1.1 Need-Support, Self-Determined Motivation, and Enjoyment

The relationship between enjoyment and psychological needs/different motivational regulations suggested by the SDT have been examined thoroughly in the physical activity context. In a Finnish study by Yli-Piipari, Watt, Jaakkola, Liukkonen, and Nurmi (2009), 429 Finnish sixth-grade students who had high intrinsic motivation, identified regulation, and introjected regulation in physical education reported high enjoyment. On the other hand, students with low levels of motivation across the board reported only moderate levels of enjoyment. Ntoumanis (2002) has also demonstrated the link between high motivation and high enjoyment

in PE. Further, in exercise settings, it has been found that among 135 American college students' enjoyment and general positive affect in fitness class was related to their autonomous motivation. (Puente & Anshel, 2010). In addition, in a study by Cox, Smith, and Williams (2008), 344 elementary school students from the US responded to questions relating to their enjoyment, psychological need satisfaction, and motivation in PE and leisure time physical activity. The results showed that autonomous motivation partially mediated the relationship between need satisfaction and enjoyment, which consequently mediated the relationship between autonomous motivation and leisure time physical activity. The need satisfaction for competence, autonomy, and relatedness was also directly related to enjoyment. Moreover, in a study by Cox, Duncheon, and McDavid (2009), junior high students in the US answered questions regarding their relatedness need satisfaction, self-determined motivation, and enjoyment in PE. The results showed that autonomous motivation partially mediated the relationship between perceived relatedness and enjoyment in PE. Further, a US study by Barr-Anderson et al. (2008) examined 1,511 middle-school students PE experiences using self-report questionnaires. The findings showed self-efficacy for leisure time physical activity to be the strongest predictor of PE enjoyment but also perceived teacher support predicted enjoyment in PE class.

3.1.2 Need-Supportive Instruction and Enjoyment

In the quasi-experimental study by Mouratidis et al. (2011), the researchers examined the class-to-class variation of Greek elementary school students' interest-enjoyment as a consequence of a need-supportive teaching style, which was operationalized using the common distinction of differentiated and directive teaching styles in PE presented by the Mosston Spectrum of Teaching Styles (Mosston & Assworth, 2002). The results showed that students enjoyed the classes that incorporated need-supportive practices more than the classes taught in a

no need-supportive way. Moreover, students with higher autonomous motivation benefited more from need-supportive practices compared to their less autonomously motivated classmates. Students' perceived need-support mediated the effects of need-supportive teaching and enjoyment fully. In a study conducted among US college students participating in a 13-week organic chemistry course, researchers examined the students' levels of perceived need-satisfaction, perceived autonomy-support from the teacher, and enjoyment (Black & Deci, 2000). The students who entered the course with higher autonomous motivation demonstrated higher enjoyment at the end of the course. Moreover, perceiving the instructor to be more autonomy-supportive was linked to more enjoyment on the course.

3.2 Need-support, Self-Determined Motivation, and Anxiety

3.2.1 Anxiety

Anxiety is a state characterized by worry, apprehension, tension and the activation of the autonomic nervous system (Spielberger, 1989). People tend to experience anxiety when they perceive a situation or a stimulus to be possibly dangerous, harmful, or otherwise detrimental to them (Spielberger, 1972b). 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).

3.2.2 Motivation and anxiety

In general, SDT proposes that higher self-determined motivation is related to beneficial affective responses, such as experiencing less anxiety (Deci & Ryan, 2000). Ample evidence supports this theoretical claim, although most of it is cross-sectional. Vansteenkiste, Sierens, Soenens, Luyckx, and Lens (2009) conducted cluster analyses on Belgian high school and college students' motivational profiles and their relations to different outcomes. In both groups,

four motivational groups appeared: good quality motivation group, high quantity motivation group, poor quality motivation group, and low quantity motivation group. The high-quality motivation group (highly autonomously motivated students) demonstrated less test anxiety compared to the other groups excluding the low quantity motivation group. High autonomous motivation has also been linked to low levels of anxiety among US students participating in an organismic chemistry course (Black & Deci, 2000). In addition, a cross-sectional study by Vansteenkiste, Zhou, Lens, and Soenens (2005) found that controlled motivation to study English among 153 Chinese college-age students was linked to higher levels of performance anxiety. Further cross-sectional evidence by Cox et al. (2009) enforces the link between anxiety and autonomous motivation, showing that higher levels of autonomous motivation were linked to less worrying in a sample of 411 American junior high school students. Autonomous motivation to exercise has also been linked to less exercise anxiety (e.g., "I feel nervous when other are watching me when I am exercising") among 424 English adults (Sebire, Standage, & Vansteenkiste, 2009). Autonomous forms of motivation were linked to less and controlled motivation to more social physique anxiety (concern about others evaluating one's appearance negatively) among high school students in the USA (Cox, Ullrich-French, Madonia, & Witty, 2011; Cox, Ullrich-French, & Sabiston, 2013). A study conducted by Yli-Piipari et al. (2009) examining self-determined motivation and state anxiety among 429 Finnish 6th-grade students by a cluster analysis showed somewhat different results compared to the studies above. The students that were clustered into the high motivation profile (high levels of intrinsic and extrinsic regulations) showed greater state anxiety compared to the students in the low motivation profile (low levels of intrinsic and extrinsic regulations).

3.2.3 Need-Satisfaction and State Anxiety

Besides motivation, anxiety has been linked directly to need-satisfaction, although the research evidence in exercise settings is not broad. Evidence from other fields includes a study on therapeutic settings where more perceived autonomy-satisfaction was linked to more significant reductions in anxiety symptoms (Dwyer, Hornsey, Smith, Oei, & Dingle, 2011). Moreover, in an organization environment need-satisfaction has been shown to be negatively associated with measures of anxiety among 698 American bankers (Baard, Deci, & Ryan, 2004). This relationship has also been established in organization settings in Bulgaria (Deci et al., 2001). In physical activity, it was shown among 61 English dancers that basic psychological need-satisfaction one month before a performance was related to lower anxiety levels before and after the performance (Quested et al., 2011). In addition, a study by Cox et al. (2009) showed that relatedness satisfaction, mainly emanating from perceived teacher support in PE classes in the US was negatively linked to the feeling of worry among junior high school students. Moreover, in a study by Sebire et al. (2009), psychological need-satisfaction while exercising was negatively linked to exercise anxiety among English governmental employees.

3.2.4 Need-Supportive Instruction and Anxiety

The evidence on the links between need-supportive instruction and anxiety is scarce at best. In the most descriptive study on the matter by Black and Deci (2000), 137 US college students participating in a 13-week organismic chemistry course responded questions regarding perceived autonomy-support of their teacher and state anxiety. The students who perceived their teacher to be more autonomy-supportive during the course showed more significant reductions in their state anxiety compared to the students who did not perceive their teacher as being autonomy-supportive. Other relevant research on the matter focuses on perceived teacher support resembling the relatedness need, and studies using motivational climate approaches, which have

some commonalities with need-supportive elements but use another theoretical framework (Nicholls, 1989). In relation to teachers' perceived relatedness support, perceived teacher involvement and support was weakly associated with 1,037 primary school students' but not secondary school students' test anxiety in Hong Kong (Yin, Lee, & Zhang, 2009). Moreover, perceived teacher support was negatively linked to math anxiety among 238 seventh-grade students in the Netherlands (Ahmed, Xiang, McBride, & Su, 2010). In terms of the motivational climate studies, the results are somewhat contradictory. In the study by Barkoukis, Koidou, and Trorbatzoudis (2010), 317 Greek high school students were taught the triple jump and shot put techniques over ten lessons either in a traditional commanding style or in teaching style (task-involvement) emphasizing for example meaningful choices, informational feedback, and students' needs much like in need-supportive teaching. The two groups did not show differences in their anxiety after the intervention. Contradicting this result, in the study by Papaioannou and Kolli (1999), 239 Greek high school students completed either task or ego-involving tasks. The results showed that the students experienced less somatic anxiety after the task-involving tasks compared to the ego-involving tasks. Providing partial support for this result, it was shown that among 181 English dance students experiencing a motivational climate emphasizing performance and competition over self-improvement and learning was linked to higher cognitive trait anxiety (Carr & Wyon, 2003).

3.3 Motor performance and need-supportive teaching

Motor performance can be defined as "an observable outcome or behavior on one particular trial or instance of activity" (Schmidt, Lee, Winstein, Wulf, & Zelanik, 2018, p. 438). On the other hand, motor skills – a similar term - are defined as "a set of internal processes associated with practice or experience leading to relatively permanent gains in the capability for

skilled performance" (Schmidt et al., 2018, p. 438). Finally, motor skills learning has been defined as the attainment of novel spatiotemporal patterns of muscle-activation (Sanes & Donoghue, 2000).

The distinction of motor performance, motor skills, and motor learning have to be made as the results of a performance test cannot directly convey learning as transitory influences that are not permanent might affect performance temporarily (e.g., motivation and arousal). Thus, research focusing on learning, transfer, and retention designs are used to reveal the degree of actual learning (Schmidt, 2018). In other words, the experimental study of this dissertation focuses on motor skill performance, which in general improves with practice and repetition (Ericsson, Krampe, & Tesch-Römer, 1993; Karni et al., 1998; Hodges, Hayes, Horn, & Williams, 2005), but not on motor learning as an outcome.

3.3.1 Instructional styles and motor performance

Most of the research examining the link between different strategies of teaching and skill performance has focused either on the motivational climate approach (Ames, 1992), highlighting either task or performance characteristics of the lesson, or the spectrum approach into teaching PE, that separates teaching styles according to how much the teacher in relation to the students make decisions about learning during the lesson (Mosston & Assworth, 2002).

In a study by Theeboom, De Knop, and Weiss (1995), 119 children participated in a summer camp where they learned Wushu under a traditional or a mastery-oriented teaching program for three weeks. The motor performance operationalized as fluency of a forward leg kick was half a standard deviation larger for the children learning under mastery-oriented teaching. In addition, in a study by Martin, Rudisill, and Hastie (2009), low-autonomy teaching was compared to mastery-oriented teaching in teaching gross-motor skills among American

kindergarteners over thirty lessons during 6-weeks. The results showed that children taught in a mastery-oriented way improved their locomotor and object control skills from pre-test to post-test, whereas children taught in a low-autonomy way did not. The results of a similar comparison between mastery-teaching and traditional teaching of triple-jump and shot-put among 335 Greek high school students during ten lessons indicated that the mastery approach led to better technique in shot-put, but not in triple jump technique, and absolute performance of either skill (Barkoukis et al., 2010).

Regarding the spectrum style approach, the results are not congruent. Comparing the attainment of volleyball skills of setting, passing, serving and spiking using either a practice or command style among 63 university students over 19 days showed that low-skilled students improved more using the command style on setting whereas practice style was more efficient improving spiking, and that differences did not occur in other skills (Harrison, Fellingham, Buck, & Pellett, 1995). In addition, the commanding and practice styles have been found to be more effective in shooting skills acquisition compared to reciprocal teaching among 135 university students over three lessons (Boyce, 1992). There is also evidence that practice style and inclusion style of teaching (containing more choice opportunities for the students) yield similar improvements in soccer juggling among 120 university students (Beckett, 1991). There are also findings reporting guided discovery teaching to result in more learning of manipulative skills compared to the command style among 59 Greek first graders (Derri & Pachta, 2007).

3.3.2 Need-supportive instruction and motor performance

The evidence linking need-supportive teaching practices and motor performance are lacking. Only three studies are addressing the two factors at some level. First, in the study by Cheon et al. (2012) 19 secondary school PE teachers from South-Korea were assigned either to

teach in an autonomy-supportive way or to continue teaching in their traditional manner for one semester. The students taught by autonomy-supportive teachers perceived their skills to develop over the semester whereas the students taught traditionally perceived their skills to remain unchanged. Second, Behzadnia, Mohammadzadeh, and Ahmadi (2018) showed that college students' badminton skills could be improved by autonomy-supportive teaching compared to conventional teaching strategies over 14 weeks. Third, in the study by Vansteenkiste et al. (2004) with 224 Belgian high school-aged adolescent practiced Tai-Bo during two PE classes under autonomy-supportive or controlling context and extrinsic goals or intrinsic goals. An experienced instructor rated the performance of the students only at the end of the second lesson on a scale varying from 1 to 10. The students learning in an autonomy-supportive context demonstrated better performance compared to the students learning in a controlled context. The results were augmented by the goal condition favoring the intrinsic goals (e.g., remaining healthy) over extrinsic ones (e.g., looking appealing to others).

3.3.3 OPTIMAL theory and motor learning

The OPTIMAL (Optimizing Performance Through Intrinsic Motivation and Attention for Learning) theory (Wulf & Lewthwaite, 2016; Lewthwaite & Wulf, 2017) suggests that motor learning happens most effectively through external attentional focus, enhanced expectancies for performance, and perceived autonomy. Two of the components of the OPTIMAL theory – enhanced expectancies and autonomy support are linked to SDT and its proposed basic needs, enhanced expectancies relating to the need of competence and perceived autonomy to the need of autonomy. These two components are based on the emphasis of need-supportive teaching and have been interpreted to affect motor learning in various ways even though the research behind these conclusions have not measured them (Sanli, Patterson, Bray, & Lee, 2013).

Competence or specifically self-efficacy has been found to relate to improved performance in many domains, like work (Stajkovic & Luthans, 1998), education (Holden, Moncher, Schinke, & Barker, 1990), and sports (Moritz, Feltz, Fahrbach, & Mack, 2000). Related to motor performance, self-efficacy has also been found to determine effort and enhance performance in an isometric hand-grip task among 72 university students in US (Hutchinson, Sherman, Martinovic, & Tenenbaum, 2008), and to predict diving performance using path analysis among 80 novice female university students (Feltz, Chow, & Heplet, 2008). Relating to competence, it has been found that learners prefer to get feedback after good than bad trials if they have the chance to do so (Chiviacowsky & Wulf, 2002). Using a high-performance criterion versus a lower criterion has also been found to reduce motor learning among 51 university students on a novel anticipatory timing task (Chiviacowsky, Wulf, & Lewthwaite, 2012).

Self-controlled practice conditions in learning motor skills have been found to be more effective compared to practice conditions that are forced upon the learner (Wulf, 2007; Sanli et al., 2013). For example, self-controlled practice conditions are achieved by giving the learner control over when feedback is delivered (Huet, Camachon, Fernandez, Jacobs, & Montagne, 2009) or how the demonstration of the task is presented (Wrisberg & Pein, 2002). The supposed mechanism behind the effect of self-controlled practice is that learner controlled conditions lead the learners to be more involved, to take responsibility for the learning, be more confident, and match their practice level with their own capabilities (Janelle, Barba, Frehlich, Tennant, & Cauraugh, 1997; Wulf, 2007; Wulf & Lewthwaite, 2016). Specific examples of the positive outcomes of autonomy provision for the learners for motor learning include the study by Chiviacowksky (2014), in which 28 college students were measured in their timing accuracy on a coincident timing task either in a group where they could decide the timing of their feedback or

in a group where the feedback was yoked on them. The results showed that when students decided the timing of the feedback, they did better on the retention test compared to the yoked group (Chiacowsky, 2014). The same students also demonstrated greater self-efficacy for the task. A similar design in terms of the demonstration was induced to 24 children from Brazil learning five ballet positions (Lemos, Wulf, Lewthwaite, & Chiviacowsky, 2017). The girls who could decide the timing of the demonstrations of the positions demonstrated more self-efficacy and better performance in the post-test and in the retention test compared to the yoked group. Moreover, in a study by Hooyman, Wulf, & Lewthwaite (2014) 48 undergraduate students were randomly assigned to learn the cricket bowling movement in three conditions: autonomy-supportive instructional language, neutral instructional language, and controlling instructional language. The students in the autonomy-supportive instruction condition showed greater throwing accuracy compared to the controlling instruction group on a retention test and also experienced more choice and self-efficacy compared to the controlled students.

3.4 Need-Support and Free-Choice Behavior

Within the studies concerning autonomous motivation, especially intrinsic motivation, the measures of free-choice behavior, engagement, and effort have been under much interest. There are for example several meta-analyses done about the effectivity of controlling and informational events on intrinsic motivation conceptualized as persistence and participation under free-choice condition (Deci, 1971; Deci, Koestner, & Ryan, 1999; Deci, Koestner & Ryan, 2001). These studies found that extrinsic rewards that are contingent on some outcome (e.g., performance) or are tangible undermine people’s intrinsic motivation due to their controlling nature (Deci et al., 1999). On the other hand, according to these studies, positive feedback tends

to increase intrinsic motivation, especially among children and college students measured by time spent on an activity during a free-choice period (Deci et al., 1999; Deci at al., 2001).

Autonomy-support of teachers has found to be linked to intrinsic motivation measured by free-choice behavior (Deci & Ryan, 1987 for review). This has been demonstrated in both academic and physical activity contexts (Vansteenkiste et al., 2004). Autonomy-support has also been found to increase classroom engagement compared to "as usual" teaching among South Korean (Cheon et al., 2012) and American (Reeve et al., 2004) middle and high-school students The same effect has been shown with need-supportive instruction in PE context among French students (Tessier et al., 2010). Out of single need-supportive behaviors, providing rationale even for an uninteresting task has been shown to increase engagement of college students measured by objective ratings (Jang, 2008). Moreover, providing opportunities for choice in PE lessons has been found to increase the PA levels in subsequent free-choice periods among high-school students from Hong Kong (Lonsdale, Sabiston, Raedeke, Ha, & Sum, 2009). Lastly, effort has been shown to decline in PE contexts with non-autonomy-supportive teachers compared to autonomy-supportive teachers among Greek elementary students (Leptokaridou et al., 2016).

4. Conclusion

The research summarized at the end of the literature review suggests that need-supportive instruction has been examined quite extensively, but only in terms of specific outcomes. Moreover, studies of need-supportive are done in very different contexts and with various conceptualizations of need-support. The theory and evidence suggest that need-supportive instruction has a positive effect on motivational regulations in physical activity. This effect, however, has not been previously quantified. In addition, how the effect of need-supportive instruction varies across different conceptualizations and contexts is unknown.

The next chapter presents a meta-analysis and systematic review of experimental studies examining the effect of need-supportive instruction on motivational regulations in physical activity. The fourth chapter is a cluster-randomized trial testing the effect of need-supportive instruction on motivation as well as less examined outcomes of skill performance, enjoyment, and anxiety. The fifth and last chapter is the conclusion of the dissertation.

References

1. Aelterman, N., Vansteenkiste, M., Van den Berghe, L., De Meyer, J., & Haerens, L. (2014). Fostering a need-supportive teaching style: Intervention effects on physical education teachers' beliefs and teaching behaviors. *Journal of Sport and Exercise Psychology*, *36*, 595-609.
2. Agbuga, B., Xiang, P., McBride, R. E., & Su, X. (2016). Student perceptions of instructional choices in middle school physical education. *Journal of Teaching in Physical Education*, *35*(2), 138-148.
3. Ahmed, W., Minnaert, A., van der Werf, G., & Kuyper, H. (2010). Perceived social support and early adolescents' achievement: The mediational roles of motivational beliefs and emotions. *Journal of Youth and Adolescence*, *39*(1), 36.
4. Alderfer, C. P. (1969). An empirical test of a new theory of human needs. *Organizational Behavior and Human Performance*, *4*(2), 142-175.
5. American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. Washington, DC: American Psychiatric Pub.
6. Ames, C. (1992). Achievement goals, motivational climate, and motivational processes. In G.C. Roberts (Ed.), *Motivation in sport and exercise* (pp. 161-176). Champaign, IL: Human Kinetics.
7. Assor, A., Kaplan, H., & Roth, G. (2002). The choice is good, but relevance is excellent: Autonomy-enhancing and suppressing teacher behaviors predicting students' engagement in schoolwork. *British Journal of Educational Psychology*, *72*(2), 261-278.
8. Baard, P. P., Deci, E. L., & Ryan, R. M. (2004). Intrinsic need satisfaction: A motivational basis of performance and well-being in two work settings. *Journal of Applied Social Psychology*, *34*(10), 2045-2068.
9. Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.
10. Barkoukis, V., Koidou, E., & Tsorbatzoudis, H. (2010). Effects of a motivational climate intervention on state anxiety, self-efficacy, and skill development in physical education. *European Journal of Sport Science*, *10*(3), 167-177.
11. Barr-Anderson, D. J., Neumark-Sztainer, D., Lytle, L., Schmitz, K. H., Ward, D. S., Conway, T. L., & Pate, R. R. (2008). But I like PE: Factors associated with enjoyment of physical education class in middle school girls. *Research Quarterly for Exercise and Sport*, *79*(1), 18-27.
12. Barrett, M., & Boggiano, A. K. (1988). Fostering extrinsic orientations: Use of reward strategies to motivate children. *Journal of Social and Clinical Psychology*, 6(3-4), 293–309.
13. Bartholomew, K. J., Ntoumanis, N., Mouratidis, A., Katartzi, E., Thøgersen-Ntoumani, C., & Vlachopoulos, S. (2018). Beware of your teaching style: A school-year long investigation of controlling teaching and student motivational experiences. *Learning and Instruction*, *53*, 50-63.
14. Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C. (2011a). Self-determination theory and diminished functioning: The role of interpersonal control and psychological need thwarting. *Personality and Social Psychology Bulletin*, *37*(11), 1459–1473.

15. Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., & Thogersen-Ntoumani, C. (2011b). Psychological need thwarting in the sport context: Assessing the darker sides of athletic experience. *Journal of Sport and Exercise Psychology, 33*(1), 75–102.
16. Baumeister, R. F., & Leary, M. R. (1995). The need to belong: desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*(3), 497-527.
17. Beckett, K. D. (1991). The effects of two teaching styles on college students' achievement of selected physical education outcomes. *Journal of Teaching in Physical Education, 10*(2), 153-169.
18. Behzadnia, B., Mohammadzadeh, H., & Ahmadi, M. (2017). Autonomy-supportive behaviors promote autonomous motivation, knowledge structures, motor skills learning and performance in physical education. *Current Psychology*, 1-14.
19. Black, A. E., & Deci, E. L. (2000). The effects of instructors' autonomy support and students' autonomous motivation on learning organic chemistry: A self-determination theory perspective. *Science Education, 84*(6), 740-756.
20. Boggiano, A. K., Barrett, M., Weiher, A. W., McClelland, G. H., & Lusk, C. M. (1987). Use of the maximal-operant principle to motivate children's intrinsic interest. *Journal of Personality and Social Psychology*, 53(5), 866–879.
21. Bowlby, J. (1979). *The making and breaking of affectional bonds*. London, UK: Tavistock.
22. Boyce, B. A. (1992). The effects of three styles of teaching on university students' motor performance. *Journal of Teaching in Physical Education, 11*(4), 389-401.
23. Burns, R. D., Fu, Y., & Podlog, L. W. (2017). School-based physical activity interventions and physical activity enjoyment: A meta-analysis. *Preventive Medicine, 103*(3), 84-90.
24. Carr, S., & Wyon, M. (2003). The impact of motivational climate on dance students' achievement goals, trait anxiety, and perfectionism. *Journal of Dance Medicine & Science, 7*(4), 105-114.
25. Chatzisarantis, N. L., & Hagger, M. S. (2009). Effects of an intervention based on self-determination theory on self-reported leisure-time physical activity participation. *Psychology and Health, 24*(1), 29-48.
26. Chatzisarantis, N. L., Hagger, M. S., & Smith, B. (2007). Influences of perceived autonomy support on physical activity within the theory of planned behavior. *European Journal of Social Psychology, 37*(5), 934-954.
27. Cheon, S. H., & Reeve, J. (2013). Do the benefits from autonomy-supportive PE teacher training programs endure?: A one-year follow-up investigation. *Psychology of Sport and Exercise, 14*(4), 508-518.
28. Cheon, S. H., & Reeve, J. (2015). A classroom-based intervention to help teachers decrease students' amotivation. *Contemporary Educational Psychology, 40*, 99-111.
29. Cheon, S. H., Reeve, J., Moon, I. S. (2012). Experimentally based, longitudinally designed, teacher-focused intervention to help physical education teachers be more autonomy supportive toward their students. *Journal of Sport & Exercice Psychology, 34*(3), 365-396.
30. Cheon, S. H., Reeve, J., & Ntoumanis, N. (2018). A needs-supportive intervention to help PE teachers enhance students' prosocial behavior and diminish antisocial behavior. *Psychology of Sport and Exercise, 35*, 74-88.

31. Cheon, S. H., Reeve, J., & Song, Y. G. (2016). A teacher-focused intervention to decrease PE students' amotivation by increasing need satisfaction and decreasing need frustration. *Journal of Sport and Exercise Psychology*, *38*(3), 217-235.
32. Chirkov, V., Ryan, R. M., Kim, Y., & Kaplan, U. (2003). Differentiating autonomy from individualism and independence: A self-determination theory perspective on internalization of cultural orientations and wellbeing. *Journal of Personality and Social Psychology, 84*, 97–109.
33. Chirkov, V. I., Ryan, R. M., & Willness, C. (2005). Cultural context and psychological needs in Canada and Brazil: Testing a self-determination approach to the internalization of cultural practices, identity, and well-being. *Journal of Cross-Cultural Psychology, 36*(4), 423-443.
34. Chiviacowsky, S. (2014). Self-controlled practice: Autonomy protects perceptions of competence and enhances motor learning. *Psychology of Sport and Exercise*, *15*(5), 505-510.
35. Chiviacowsky, S., & Wulf, G. (2002). Self-controlled feedback: Does it enhance learning because performers get feedback when they need it? *Research Quarterly for Exercise and Sport*, *73*(4), 408-415.
36. Chiviacowsky, S., Wulf, G., & Lewthwaite, R. (2012). Self-controlled learning: The importance of protecting perceptions of competence. *Frontiers in Psychology*, *3*, 458.
37. Costa, S., Ntoumanis, N., & Bartholomew, K. J. (2015). Predicting the brighter and darker sides of interpersonal relationships: Does psychological need thwarting matter? *Motivation and Emotion*, *39*(1), 11-24.
38. Cox, A., Duncheon, N., & McDavid, L. (2009). Peers and teachers as sources of relatedness perceptions, motivation, and affective responses in physical education. *Research Quarterly for Exercise and Sport*, *80*(4), 765-773.
39. Cox, A. E., Smith, A. L., & Williams, L. (2008). Change in physical education motivation and physical activity behavior during middle school. *Journal of Adolescent Health*, *43*(5), 506-513.
40. Cox, A. E., Ullrich-French, S., Madonia, J., & Witty, K. (2011). Social physique anxiety in physical education: Social contextual factors and links to motivation and behavior. *Psychology of Sport and Exercise*, *12*(5), 555-562.
41. Cox, A. E., Ullrich-French, S., & Sabiston, C. M. (2013). Using motivation regulations in a person-centered approach to examine the link between social physique anxiety in physical education and physical activity-related outcomes in adolescents. *Psychology of Sport and Exercise*, *14*(4), 461-467.
42. Craike, M. J., Hibbins, R., & Cuskelly, G. (2010). The influence of various aspects of enjoyment on participation in leisure time physical activity. *World Leisure Journal*, *52*(1), 20-33.
43. Csikszentmihalyi, M. (1975). Play and intrinsic rewards. *Journal of Humanistic Psychology 15*(3), 41-63.
44. Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience.* New York, NY: Harper & Row.
45. deCharms, R. (1968). *Personal causation*: *The internal affective determinants of behavior*. New York, NY: Academic Press.
46. Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology, 18(*1), 105-115.

47. Deci, E. L. (1972). The effects of contingent and noncontingent rewards and controls on intrinsic motivation. *Organizational Behavior and Human Performance*, *8*(2), 217-229.
48. Deci, E. L., Cascio, W. F., & Krusell, J. (1975). Cognitive evaluation theory and some comments on the Calder and Staw critique. *Journal of Personality and Social Psychology*, *31*(1), 81-85.
49. Deci, E.L., Eghari, H., Patrick, B.C., & Leone, D.R. (1994). Facilitating internalization: The Self-Determination theory perspective. *Journal of Personality, 62*(1).
50. Deci, E. L., Koestner, R., & Ryan R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin, 125*(6), *627-668.*
51. Deci, E. L., Koestner, R., Ryan, R. M. (2001). Extrinsic rewards and intrinsic motivation in education: reconsidered once again. *Review of Educational Research, 71*(1), 1-27.
52. Deci, E. L., & Ryan, R. M. (1980). The empirical exploration of intrinsic motivational processes. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 13, pp. 39–80). New York, NY: Academic.
53. Deci, E. L., & Ryan, R. M. (1985a). *Intrinsic motivation and self-determination in human behavior.* New York, NY: Plenum.
54. Deci, E. L., & Ryan, R. M. (1985b). The General causality orientations scale: Self-determination in personality. *Journal of Research in Personality, 19*(2), 109-134.
55. Deci, E. L., & Ryan, R. M. (1987). The support of autonomy and the control of behavior. *Journal of Personality and Social Psychology, 53*(6), 1024-1037.
56. Deci, E. L., & Ryan, R. M. (2000). The 'what' and 'why' of goal pursuits: human needs and the self-determination of behavior. *Psychological Inquiry, 11,* 227-268.
57. Deci, E. L., & Ryan, R. M. (2008). Self-Determination Theory: A macrotheory of human motivation, development, and health. *Canadian Psychology 49*(3), 182–185.
58. Deci, E. L., & Ryan, R. M. (2014). Autonomy and need satisfaction in close relationships: Relationships motivation theory. In N. Weinstein (Ed.), *Human motivation and interpersonal relationships: Theory, research, and application* (pp. 53–76). New York: Springer.
59. Deci, E. L., Schwartz, A. J., Sheinman, L., & Ryan, R. M. (1981). An instrument to assess adults' orientations toward control versus autonomy with children: Reflections on intrinsic motivation and perceived competence. *Journal of Educational Psychology, 73*(5), 642-650.
60. Deci, E. L., Spiegel, N. H., Ryan, R. M., Koestner, R., & Kauffman, M. (1982). Effects of performance standards on teaching styles: Behavior of controlling teachers. *Journal of Educational Psychology*, *74*(6), 852-859.
61. Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and education: The self-determination perspective. *Educational Psychologist, 26*(3-4), 325-346.
62. Derri, V., & Pachta, M. (2007). Motor skills and concepts acquisition and retention: a comparison between two styles of teaching. *RICYDE. Revista Internacional de Ciencias del Deporte*, *3*(9), 37-47.
63. Dishman, R. K., Motl, R. W., Saunders, R., Felton, G., Ward, D. S., Dowda, M., et al. (2005). Enjoyment mediates effects of a school-based physical-activity intervention. *Medicine & Science in Sports & Exercise*, *37*(3), 478–487.

64. Dwyer, L. A., Hornsey, M. J., Smith, L. G., Oei, T. P., & Dingle, G. A. (2011). Participant autonomy in cognitive behavioral group therapy: An integration of self-determination and cognitive behavioral theories. *Journal of Social and Clinical Psychology*, *30*(1), 24.

65. Eccles, J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J., & Midgley, C. (1983). Expectancies, values and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motives* (pp. 75-146). San Francisco, CA: W.H. Freeman.

66. Edmunds, J., Ntoumanis, N., & Duda, J. L. (2006). A test of self-determination theory in the exercise domain. *Journal of Applied Social Psychology*, *36*(9), 2240-2265.

67. Epstein, S. (1972). The nature of anxiety with emphasis upon its relationship to expectancy. In C. D. Spielberger (Ed.), *Anxiety: Current trends in theory and research* (Vol. 2, pp. 291–338). New York, NY: Academic Press.

68. Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review*, *100*(3), 363.

69. Feltz, D. L., Chow, G. M., & Hepler, T. J. (2008). Path analysis of self-efficacy and diving performance revisited. *Journal of Sport and Exercise Psychology*, *30*(3), 401-411.

70. Flink, C., Boggiano, A. K., & Barrett, M. (1990). Controlling teaching strategies: Undermining children's self-determination and performance. *Journal of Personality and Social Psychology*, *59*(5), 916-924.

71. Furtak, E. M., & Kunter, M. (2012). Effects of autonomy-supportive teaching on student learning and motivation. *The Journal of Experimental Education*, *80*(3), 284-316.

72. Gillison, F. B., Standage, M., & Skevington, S. M. (2013). The effects of manipulating goal content and autonomy support climate on outcomes of a PE fitness class. *Psychology of Sport and Exercise*, *14*(3), 342-352.

73. Gunnell, K. E., Crocker, P. R., Wilson, P. M., Mack, D. E., & Zumbo, B. D. (2013). Psychological need satisfaction and thwarting: A test of basic psychological needs theory in physical activity contexts. *Psychology of Sport and Exercise*, *14*(5), 599-607.

74. Haerens, L., Aelterman, N., Van den Berghe, L., De Meyer, J., Soenens, B., & Vansteenkiste, M. (2013). Observing physical education teachers' need-supportive interactions in classroom settings. *Journal of Sport and Exercise Psychology*, *35*(1), 3-17.

75. Haerens, L., Aelterman, N., Vansteenkiste, M., Soenens, B., & Van Petegem, S. (2015). Do perceived autonomy-supportive and controlling teaching relate to physical education students' motivational experiences through unique pathways? Distinguishing between the bright and dark side of motivation. *Psychology of Sport and Exercise 16*, 26-36.

76. Haerens, L., Vansteenkiste, M., Aelterman, N., & Van den Berghe, L. (2016). Towards a systematic study of the dark side of student motivation: Antecedents and consequences of teachers' controlling behaviors. In W. C. Liu, J. Chee Keng Wang, & R. M. Ryan (Eds.), *Building autonomous learners: Perspectives from research and practice using self-determination theory* (pp. 59-81). Singapore, Singapore: Springer.

77. Harlow, H. F. (1958). The nature of love. *American Psychologist*, *13*(12), 673–685.

78. Harrison, J. M., Fellingham, G. W., Buck, M. M., & Pellett, T. L. (1995). Effects of practice and command styles on rate of change in volleyball performance and self-efficacy of high-, medium-, and low-skilled learners. *Journal of Teaching in Physical Education*, *14*(3), 328-339.

79. Harter, S. (1982). The perceived competence scale for children. *Child development*, *53*(1), 87-97.

80. Harter, S. (1998). The development of self-representations. In W. Damon & N. Eisenberg (Ed.), *Handbook of child psychology: Social, emotional, and personality development* (pp. 553-617). Hoboken, NJ, US: John Wiley & Sons Inc.
81. Hodges, N. J., Hayes, S., Horn, R. R., & Williams, A. M. (2005). Changes in coordination, control and outcome as a result of extended practice on a novel motor skill. *Ergonomics*, *48*(11-14), 1672-1685.
82. Holden, G., Moncher, M. S., Schinke, S. P., & Barker, K. M. (1990). Self-efficacy of children and adolescents: A meta-analysis. *Psychological Reports*, *66*(3), 1044-1046.
83. Hooyman, A., Wulf, G., & Lewthwaite, R. (2014). Impacts of autonomy-supportive versus controlling instructional language on motor learning. *Human Movement Science*, *36*, 190-198.
84. Hospel, V., & Galand, B. (2016). Are both classroom autonomy support and structure equally important for students' engagement? A multilevel analysis. *Learning and Instruction*, *41*, 1-10.
85. Huet, M., Camachon, C., Fernandez, L., Jacobs, D. M., & Montagne, G. (2009). Self-controlled concurrent feedback and the education of attention towards perceptual invariants. *Human Movement Science*, *28*(4), 450-467.
86. Hutchinson, J. C., Sherman, T., Martinovic, N., & Tenenbaum, G. (2008). The effect of manipulated self-efficacy on perceived and sustained effort. *Journal of Applied Sport Psychology*, *20*(4), 457-472.
87. Iyengar, S. S., & Lepper, M. R. (2000). When choice is demotivating: Can one desire too much of a good thing? *Journal of Personality and Social Psychology*, *79*(6), 995-1006.
88. Janelle, C. M., Barba, D. A., Frehlich, S. G., Tennant, L. K., & Cauraugh, J. H. (1997). Maximizing performance feedback effectiveness through videotape replay and a self-controlled learning environment. *Research Quarterly for Exercise and Sport*, *68*(4), 269-279.
89. Jang, H., Kim, E. J., & Reeve, J. (2012). Longitudinal test of self-determination theory's motivation mediation model in a naturally occurring classroom context. *Journal of Educational Psychology*, *104*(4), 1175.
90. Jang, H., Reeve, J., & Deci, E. L. (2010). Engaging students in learning activities: It is not autonomy support or structure but autonomy support and structure. *Journal of Educational Psychology*, *102*(3), 588-600.
91. Karni, A., Meyer, G., Rey-Hipolito, C., Jezzard, P., Adams, M. M., Turner, R., & Ungerleider, L. G. (1998). The acquisition of skilled motor performance: fast and slow experience-driven changes in primary motor cortex. *Proceedings of the National Academy of Sciences*, *95*(3), 861-868.
92. Kasser, T., & Ryan, R. M. (1996). Further examining the American dream: Differential correlates of intrinsic and extrinsic goals. *Personality and Social Psychology Bulletin*, *22*(3), 280-287.
93. Katz, I., & Assor, A. (2007). When choice motivates and when it does not. *Educational Psychology Review*, *19*(4), 429-442.
94. Kendzierski, D., & DeCarlo, K. J. (1991). Physical activity enjoyment scale: Two validation studies. *Journal of Sport and Exercise Psychology*, *13*(1), 50-64.
95. Kimiecik, J. C., & Harris, A. T. (1996). What is enjoyment? A conceptual/definitional analysis with implications for sport and exercise psychology. *Journal of Sport and Exercise Psychology*, *18*(3), 247-263.

96. Kirby, S., Byra, M., Readdy, T., & Wallhead, T. (2015). Effects of spectrum teaching styles on college students' psychological needs satisfaction and self-determined motivation. *European Physical Education Review, 21*(4), 521-540.
97. Koestner, R., Ryan, R. M., Bernieri, F., & Holt, K. (1984). Setting limits in children's behavior: The differential effects of controlling versus informational styles on intrinsic motivation and creativity. *Journal of Personality, 52*(3), 233-248.
98. Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York, NY: Springer.
99. Lemos, A., Wulf, G., Lewthwaite, R., & Chiviacowsky, S. (2017). Autonomy support enhances performance expectancies, positive affect, and motor learning. *Psychology of Sport and Exercise, 31*, 28-34.
100. Leptokaridou, E. T., Vlachopoulos, S. P., & Papaioannou, A. G. (2016). Experimental longitudinal test of the influence of autonomy-supportive teaching on motivation for participation in elementary school physical education. *Educational Psychology, 36*(7), 1138-1159.
101. Liebert, R. M., & Morris, L. W. (1967). Cognitive and emotional components of test anxiety: A distinction and some initial data. *Psychological Reports, 20*(3), 975-978.
102. Lonsdale, C., Rosenkranz, R. R., Sanders, T., Peralta, L. R., Bennie, A., Jackson, B., …& Lubans, D. R. (2013). A cluster randomized controlled trial of strategies to increase adolescents' physical activity and motivation in physical education: Results of the Motivating Active Learning in Physical Education (MALP) trial. *Preventive Medicine, 57*(5), 696-702.
103. Lonsdale, C., Sabiston, C. M., Raedeke, T. D., Ha, A. S., & Sum, R. K. (2009). Self-determined motivation and students' physical activity during structured physical education lessons and free choice periods. *Preventive Medicine, 48*(1), 69-73.
104. Martin, E. H., Rudisill, M. E., & Hastie, P. A. (2009). Motivational climate and fundamental motor skill performance in a naturalistic physical education setting. *Physical Education and Sport Pedagogy, 14*(3), 227-240.
105. Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*(4), 370–396.
106. McKenzie, T. L., & Lounsbery, M. A. (2013). Physical education teacher effectiveness in a public health context. *Research Quarterly for Exercise and Sport, 84*(4), 419-430.
107. Meng, H. Y., & Keng, J. W. C. (2016). The effectiveness of an Autonomy-Supportive Teaching Structure in Physical Education. *RICYDE. Revista Internacional de Ciencias del Deporte, 12*(43), 5-28.
108. Moritz, S. E., Feltz, D. L., Fahrbach, K. R., & Mack, D. E. (2000). The relation of self-efficacy measures to sport performance: A meta-analytic review. *Research Quarterly for Exercise and Sport, 71*(3), 280-294.
109. Morris, L. W., Davis, M. A., & Hutchings, C. H. (1981). Cognitive and emotional components of anxiety: Literature review and a revised worry–emotionality scale. *Journal of Educational Psychology, 73*(4), 541.
110. Mosston, M., & Ashworth, S. (2002). *Teaching physical education* (5th ed.). New York, NY: Macmillan.
111. Mouratidis, A. A., Vansteenkiste, M., Sideridis, G., & Lens, W. (2011). Vitality and interest–enjoyment as a function of class-to-class variation in need-supportive teaching and pupils' autonomous motivation. *Journal of Educational Psychology, 103*(2), 353-366.

112. Moustaka, F. C., Vlachopoulos, S. P., Kabitsis, C., & Theodorakis, Y. (2012). Effects of an autonomy-supportive exercise instructing style on exercise motivation, psychological well-being, and exercise attendance in middle-age women. *Journal of Physical Activity and Health*, *9*(1), 138-150.
113. Nakamura, J., & Csikszentmihalyi, M. (2014). The concept of flow. In C. R. Snyder & S. J. Lopez (Eds.), *Handbook of positive psychology* (pp. 89–105). Oxford, England: Oxford University Press.
114. Newby, T. J. (1991). Classroom motivation: Strategies of first-year teachers. *Journal of Educational Psychology*, *83*(2), 195-200.
115. Nicholls, J.G. (1989). *The competitive ethos and democratic education.* Cambridge, MA: Harvard University Press.
116. Niemiec, C. P., Lynch, M. F., Vansteenkiste, M., Bernstein, J., Deci, E. L., & Ryan, R. M. (2006). The antecedents and consequences of autonomous self-regulation for college: A self-determination theory perspective on socialization. *Journal of Adolescence*, *29*(5), 761-775.
117. Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom: Applying self-determination theory to educational practice. *School Field*, *7*(2), 133-144.
118. Papaioannou, A., & Kouli, O. (1999). The effect of task structure, perceived motivational climate and goal orientations on students' task involvement and anxiety. *Journal of Applied Sport Psychology*, *11*(1), 51-71.
119. Perlman, D. (2013). Manipulation of the self-determined learning environment on student motivation and affect within secondary physical education. *Physical Educator, 70*(4), 413–428.
120. Puente, R., & Anshel, M. H. (2010). Exercisers' perceptions of their fitness instructor's interacting style, perceived competence, and autonomy as a function of self-determined regulation to exercise, enjoyment, affect, and exercise frequency. *Scandinavian Journal of Psychology*, *51*(1), 38-45.
121. Quested, E., Bosch, J. A., Burns, V. E., Cumming, J., Ntoumanis, N., & Duda, J. L. (2011). Basic psychological need satisfaction, stress-related appraisals, and dancers' cortisol and anxiety responses. *Journal of Sport and Exercise Psychology*, *33*(6), 828-846.
122. Reeve, J. (2016). Autonomy-supportive teaching: What it is, how to do it. In *Building autonomous learners* (pp. 129-152). Springer, Singapore.
123. Reeve, J., Bolt, E., & Cai, Y. (1999). Autonomy-supportive teachers: How they teach and motivate students. *Journal of Educational Psychology*, *91*(3), 537-548.
124. Reeve, J., & Cheon, S. H. (2016). Teachers become more autonomy supportive after they believe it is easy to do. *Psychology of Sport and Exercise*, *22*(3), 178-189.
125. Reeve, J., & Jang, H., (2006). What teachers say and do to support students' autonomy during a learning activity. *Journal of Educational Psychology 98(1),* 209-218.
126. Reeve, J., Jang, H., Carrell, D., Jeon, S., & Barch, J. (2004). Enhancing students' engagement by increasing teachers' autonomy support. *Motivation and Emotion*, *28*(2), 147-169.
127. Reeve, J., & Tseng, C. M. (2011). Cortisol reactivity to a teacher's motivating style: The biology of being controlled versus supporting autonomy. *Motivation and Emotion*, *35*(1), 63-74.

128. Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology, 43*(3), 450-461.
129. Ryan, R. M. (1993). Agency and organization: Intrinsic motivation, autonomy and the self in psychological development. In J. Jacobs (Ed.), *Nebraska symposium on motivation: Developmental perspectives on motivation* (Vol. 40, pp. 1–56). Lincoln: University of Nebraska Press.
130. Ryan, R. M., Bernstein, J. H., & Brown, K. W. (2010). Weekends, work, and well-being: Psychological need satisfactions and day of the week effects on mood, vitality, and physical symptoms. *Journal of Social and Clinical Psychology*, *29*(1), 95-122.
131. Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*(5), 749–761.
132. Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78.
133. Ryan, R. M., & Deci, E. L. (2000). The darker and brighter sides of human existence: Basic psychological needs as a unifying concept. *Psychological Inquiry, 11*(4), 319-338.
134. Ryan, R. M., & Deci, E. L. (2002). Overview of self-determination theory: An organismic dialectical perspective. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 3–33). Rochester, NY: University of Rochester.
135. Ryan, R. M., & Deci, E. L. (2006). Self-regulation and the problem of human autonomy: does psychology need choice, self-determination, and will? *Journal of Personality*, *74*(6), 1557-1586.
136. Ryan, R. M., & Grolnick, W. S. (1986). Origins and pawns in the classroom: Self-report and projective assessments of individual differences in children's perceptions. *Journal of Personality and Social Psychology, 50*(3), 550–558.
137. Sanes, J. N., & Donoghue, J. P. (2000). Plasticity and primary motor cortex. *Annual Review of Neuroscience*, *23*(1), 393-415.
138. Sanli, E. A., Patterson, J. T., Bray, S. R., & Lee, T. D. (2013). Understanding self-controlled motor learning protocols through the self-determination theory. *Frontiers in Psychology*, *3*, 611.
139. Scanlan, T. K., Carpenter, P. J., Lobel, M., & Simons, J. P. (1993). Sources of enjoyment for youth sport athletes. *Pediatric Exercise Science*, *5*(3), 275-285.
140. Scanlan, T. K., & Lewthwaite, R. (1986). Social psychological aspects of competition for male youth sport participants: IV. Predictors of enjoyment. *Journal of Sport Psychology, 8*(1), 25-35.
141. Scanlan, T.K., & Simons, J.P. (1992). The construct of sport enjoyment. In G.C. Roberts (Ed.), *Motivation in sport and exercise* (pp. 199-215). Champaign, IL: Human Kinetics.
142. Schmidt, R. A., Lee, T., Winstein, C., Wulf, G., & Zelaznik, H. (2018). *Motor Control and Learning* (6th edition). Champaign, IL: Human Kinetics.
143. Schwartz, B. (2000). Self-determination: The tyranny of freedom. *American Psychologist*, *55*(1), 79-88.
144. Sebire, S. J., Standage, M., & Vansteenkiste, M. (2009). Examining intrinsic versus extrinsic exercise goals: Cognitive, affective, and behavioral outcomes. *Journal of Sport and Exercise Psychology*, *31*(2), 189-210.

145. Sheldon, K. M., & Filak, V. (2008). Manipulating autonomy, competence, and relatedness support in a game-learning context: New evidence that all three needs matter. *British Journal of Social Psychology*, *47*(2), 267-283.
146. Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology*, *85*(4), 571–581.
147. Smith, R. E., Smoll, F. L., Cumming, S. P., & Grossbard, J. R. (2006). Measurement of multidimensional sport performance anxiety in children and adults: The Sport Anxiety Scale-2. *Journal of Sport and Exercise Psychology*, *28*(4), 479-501.
148. Soenens, B., Luyckx, K., Vansteenkiste, M., Luyten, P., Duriez, B., & Goossens, L. (2008). Maladaptive perfectionism as an intervening variable between psychological control and adolescent depressive symptoms: A three-wave longitudinal study. *Journal of Family Psychology*, *22*(3), 465-474.
149. Sparks, C., Dimmock, J., Whipp, P., Lonsdale, C., & Jackson, B. (2015). "Getting connected": High school physical education teacher behaviors that facilitate students' relatedness support perceptions. *Sport, Exercise, and Performance Psychology*, *4*(3), 219.-224.
150. Sparks, C., Lonsdale, C., Dimmock, J., & Jackson, B. (2017). An intervention to improve teachers' interpersonally involving instructional practices in high school physical education: implications for student relatedness support and in-class experiences. *Journal of Sport and Exercise Psychology*, *39*(2), 120-133.
151. Spielberger, C. 1972a. Anxiety as an emotional state. In C. Spielberger (Ed.) *Anxiety: Current trends in theory and research* (pp. 23-49). New York, NY: Academic Press.
152. Spielberger, C. 1972b. Conceptual and methodological issues in anxiety research. In C. Spielberger (Ed.) *Anxiety: Current trends in theory and research* (pp. 481-493) New York, NY: Academic Press.
153. Spielberger, C. D. (1989). Stress and anxiety in sports. In D. Hackfort & C. Spielberger (eds) *Anxiety in Sports: An International Perspective* (pp. 3-17). New York, NY: Hemisphere.
154. Stajkovic, A. D., & Luthans, F. (1998). Self-efficacy and work-related performance: A meta-analysis. *Psychological Bulletin*, *124*(2), 240-261.
155. Stefanou, C. R., Perencevich, K. C., DiCintio, M., & Turner, J. C. (2004). Supporting autonomy in the classroom: Ways teachers encourage student decision making and ownership. *Educational Psychologist*, *39*(2), 97-110.
156. Taylor, I. M., & Ntoumanis, N. (2007). Teacher motivational strategies and student self-determination in physical education. *Journal of Educational Psychology*, *99*(4), 747-760.
157. Tessier, D., Sarrazin, P., & Ntoumanis, N. (2010). The effect of an intervention to improve newly qualified teachers' interpersonal style, students' motivation and psychological need satisfaction in sport-based physical education. *Contemporary Educational Psychology*, *35*(4), 242-253.
158. Theeboom, M., De Knop, P., & Weiss, M. R. (1995). Motivational climate, psychological responses, and motor skill development in children's sport: A field-based intervention study. *Journal of Sport and Exercise Psychology*, *17*(3), 294-311.
159. Tucker, C. M., Zayco, R. A., Herman, K. C., Reinke, W. M., Trujillo, M., Carraway, K., & Ivery, P. D. (2002). Teacher and child variables as predictors of academic engagement

among low-income African American children. *Psychology in the Schools*, *39*(4), 477-488.

160. Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration*, *23*(3), 263-280.
161. Vansteenkiste, M., Sierens, E., Goossens, L., Soenens, B., Dochy, F., Mouratidis, A., & Beyers, W. (2012). Identifying configurations of perceived teacher autonomy support and structure: Associations with self-regulated learning, motivation and problem behavior. *Learning and Instruction*, *22*(6), 431-439.
162. Vansteenkiste, M., Sierens, E., Soenens, B., Luyckx, K., & Lens, W. (2009). Motivational profiles from a self-determination perspective: The quality of motivation matters. *Journal of Educational Psychology*, *101*(3), 671-688.
163. Vansteenkiste, M., Simons, J., Lens, W., Sheldon, K. M., & Deci, E. L. (2004). Motivating learning, performance, and persistence: The synergistic effects of intrinsic goal contents and autonomy-supportive contexts. *Journal of Personality and Social Psychology*, *87*(2), 246-260.
164. Vansteenkiste, M., Zhou, M., Lens, W., & Soenens, B. (2005). Experiences of autonomy and control among Chinese learners: Vitalizing or immobilizing?.*Journal of Educational Psychology*, *97*(3), 468.
165. Wallhead, T. L., & Buckworth, J. (2004). The Role of Physical Education in the Promotion of Youth Physical Activity. *Quest*, *56*(3), 285-301.
166. Wankel, L. M., & Kreisel, P. S. (1985). Factors underlying enjoyment of youth sports: Sport and age group comparisons. *Journal of Sport Psychology*, *7*(1), 51-64.
167. Weiss, M. R., Kimmel, L. A., & Smith, A. L. (2001). Determinants of sport commitment among junior tennis players: Enjoyment as a mediating variable. *Pediatric Exercise Science*, *13*(2), 131-144.
168. White, R. W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review*, *66*(5), 297-333.
169. Wiersma, L. D. (2001). Conceptualization and development of the sources of enjoyment in youth sport questionnaire. *Measurement in Physical Education and Exercise Science*, *5*(3), 153-177.
170. Wrisberg, C. A., & Pein, R. L. (2002). Note on learners' control of the frequency of model presentation during skill acquisition. *Perceptual and Motor Skills*, *94*(3), 792-794.
171. Wulf, G. (2007). Self-controlled practice enhances motor learning: implications for physiotherapy. *Physiotherapy*, *93*(2), 96-101.
172. Wulf, G., & Lewthwaite, R. (2016). Optimizing performance through intrinsic motivation and attention for learning: The OPTIMAL theory of motor learning. *Psychonomic Bulletin & Review*, *23*(5), 1382-1414.
173. Yamauchi, H., & Tanaka, K. (1998). Relations of autonomy, self-referenced beliefs, and self-regulated learning among Japanese children. *Psychological Reports*, *82*(3), 803-816.
174. Yin, H., Lee, J. C., & Zhang, Z. (2009). Examining Hong Kong students' motivational beliefs, strategy use and their relations with two relational factors in classrooms. *Educational Psychology*, *29*(6), 685-700.
175. Yli-Piipari, S., Layne, T., Hinson, J., & Irwin, C. (2018). Motivational Pathways to Leisure-Time Physical Activity Participation in Urban Physical Education: A Cluster-Randomized Trial. *Journal of Teaching in Physical Education*, *37*(2), 123-132.

176. Yli-Piipari, S., Watt, A., Jaakkola, T., Liukkonen, J., & Nurmi, J. E. (2009). Relationships between physical education students' motivational profiles, enjoyment, state anxiety, and self-reported physical activity. *Journal of Sports Science & Medicine*, *8*(3), 327-336.
177. Öhman, A. (2008). Fear and anxiety: Overlaps and dissociations. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed,, pp. 444-453). New York, NY: Guilford Press.

CHAPTER 3

NEED-SUPPORTIVE INSTRUCTION AND MOTIVATIONAL REGULATIONS IN PHYSICAL ACTIVITY: A SYSTEMATIC REVIEW AND META-ANALYSIS[1]

[1]Manninen, M., Dishman, R., Hwang, Y., Deng, Y., & Yli-Piipari, S. To be submitted to *Journal of Educational Psychology*.

Abstract

The aim of this study was to provide a quantitative synthesis of the effect of psychological need-supportive instruction on the motivational regulations of physical activity as theorized by the self-determination theory. We conducted a systematic review and meta-analysis on the experimental studies published between January 2000 and December 2018. The initial search yielded 2,501 articles, with 20 articles meeting the inclusion criteria. The articles were analyzed using a random effects model and Hedges' *g* effect size. The study showed that need-supportive instruction had a heterogeneous, medium-to-large effect on identified regulation (g = .72; *CI* 95% [0.08, 1.37]) and intrinsic motivation (g = .51; *CI* 95% [.19, .83]) and a heterogeneous, small-to-medium effect on amotivation (g = -.35; *CI* 95% [-.66, .05]). Need-supportive instruction did not have an effect on external regulation (g = -.46; *CI* 95% [-.93, .01]) or introjected regulation (g = -.00; *CI* 95% [-.47, .46]). These results show that psychological need-supportive instruction is beneficial in physical activity settings, supporting three out of five motivational regulations. Further, this meta-analysis showed that need-support enhancing studies yield very heterogeneous results. High-quality experimental trials testing the efficacy of need-supportive instruction in physical activity are needed. Specifically, interventions using precise conceptualizations of need-supportive behaviors and strategies are in demand.

Keywords: motivation, teaching, coaching

Motivation is an important factor impacting the direction, strength, persistence, and termination of human behavior (Pintrich, 2003). In physical activity, motivation has been found to predict performance (Cerasoli, Nicklin & Ford, 2014; Charbonneau, Barling & Kelloway, 2001), physical activity behavior (Ryan et al., 1997; Teixeira et al., 2012; Standage, Gillison, Ntoumanis & Treasure, 2012), and positive and negative affective outcomes (Cox, Smith & Williams, 2008; Standage, Duda & Ntoumanis, 2005). Despite overwhelming evidence on the importance of the quantity and quality of motivation on human functioning, little is known how much theory-based instructional interventions can improve the quality of motivation in physical activity.

Self-Determination Theory

The construct of motivation can be viewed from several perspectives (see Pintrich, 2003 for review). This study utilized the self-determination theory (SDT) (Deci & Ryan, 1985, 2000) to determine the effect of instructional practices on participant motivation in physical activity. SDT is one of the most prevalent contemporary social-cognitive motivational theories used to understand physical activity, sport, and exercise. SDT theorizes how different social contexts may support or thwart human functioning based on the degree the social environment satisfies basic psychological needs. Specifically, SDT argues that humans have three basic psychological needs, the need for autonomy (engaging in a behavior with a full sense of volition), the need for competence (feeling efficacy in one's environment), and the need for relatedness (connecting to other people in a meaningful way) (Deci & Ryan 1985, 2000). It is argued that if the social environment is need-supportive, it increases human's inner motivational sources, whereas need-depriving or even need-thwarting environment decreases human internal motivational sources even to the exetent of producing amotivation (Deci & Ryan 1985, 2000).

SDT argues that need-support or –deprivation impact motivational regulations. Motivational regulations refers to intrinsic motivation (participating in behaviors due to the inherent satisfaction and interest of the behavior and without any external reasons), amotivation (the lack of motivation and intention), and four distinctive types of extrinsic motivation (Deci & Ryan, 2000). The four extrinsic regulations, i.e., external, introjected, identified, and integrated regulation, are argued to exist on the amotivation-intrinsic motivation continuum, and their placement in the continuum is based on the amount of self-determination they reflect (Ryan & Connel, 1989). External (e.g., behavior performed to comply with externally administered reward/punishment contingencies) and introjected (e.g., behavior that is driven by the desire to seek acceptance from others) regulations are hypothesized to be controlling and thus maladaptive (Deci & Ryan, 2000). On the other hand, identified and integrated regulations are extrinsic motives but autonomous and adaptive in nature. Individuals with identified regulation participate in the activity because of the goal, i.e., health, is personally important and valued. Integrated regulation, on the other hand, is the most autonomous of extrinsic motivation and occurs when the behavior is fully assimilated with self so that it is included in person's self-evaluations and beliefs on personal needs (Deci & Ryan, 2000).

Central to the SDT is a concept of internalization. Internalization highlights the process in which different forms of the behavioral regulations become more self-determined and how this process can be supported by the satisfaction of the needs of autonomy, competence, and relatedness (Ryan & Connel, 1989). In general, the theory posits that this tendency is natural for humans albeit it requires the support of the environment, and it is based on the process of assimilating external values into personal values (Deci & Ryan, 2000; Ryan, 1993). In physical activity, the social environment can be manipulated by instruction to help exercisers, physical

education (PE) students, or athletes to internalize their behaviors and consequently improve their functioning. Vallerand's hierarchical model of intrinsic and extrinsic motivation (Vallerand, 1997, 2000) extends the central tenets of the SDT by arguing that the basic psychological needs and the different behavioral regulations mediate the influence of various socio-contextual factors on different affective, cognitive, and behavioral outcomes (Vallerand & Losier, 1999).

Prior Research Evidence on Motivational Regulations in PE, Exercise, and Sport

In PE, previous correlational evidence has shown students' autonomous motivation (intrinsic motivation and identified regulation) to be positively linked to persistence and effort (Standage, Duda, & Ntoumanis, 2006), objectively measured (Chatzisarantis & Hagger, 2009; Haerens et al. 2015; Taylor, Ntoumanis, Standage, & Spray, 2010) and self-reported (Yli-Piipari, Watt, Jaakkola, Liukkonen, & Nurmi, 2009) leisure physical activity, objectively measured physical activity during PE (Aelterman et al. 2012; Lonsdale et al., 2009), and autonomous exercise motivation (Standage et al., 2012). On the contrary, controlled motivation (introjected regulation and external regulation) and amotivation have been found to have no relationship with positive outcomes or to be related to negative outcomes, such as lack of engagement in PE (Aelterman et al., 2012; Standage, Duda, & Ntoumanis, 2003).

Similarly, in exercise, research has shown identified regulation and intrinsic motivation to be linked to positive exercise outcomes, such as increased physical activity and weight loss (Silva et al., 2011). Moreover, although some mixed correlational findings have been reported (see McDonough & Crocker, 2007; Werman-Josefsson ,Lindwall, & Ivarsson, 2015), intrinsic motivation, integrated regulation and identified regulation have usually been linked to increased physical activity (Daley & Duda, 2006; Dishman, McIver, Dowda, & Pate, 2018; Duncan, Hall, Wilson, & Jenny, 2010; Wilson, Rodgers, Fraser, & Murray, 2004). In addition, a systematic

review has reported positive associations between exercise behaviors and intrinsic and identified regulation whereas the link of introjected regulation to exercise behavior has been found to be mixed (Teixera, Carraca, Markland, Silva, & Ryan, 2012). Intrinsic motivation and identified regulation have found to be related to better physical self-esteem among female exercisers (Wilson & Rodgers, 2002), greater physical self-worth, and future intentions to exercise (Thøgersen-Ntoumani & Ntoumanis, 2006), whereas amotivation and external regulation have found to have an opposite relationship to these constructs. Finally, intrinsic motivation, identified regulation, and introjected regulation have shown to have a positive reciprocal relationship with the development of exercise identity (Ntoumanis et al., 2018).

In sport, autonomous forms of motivation have shown to be associated with positive outcomes, such as effort (Pope & Wilson, 2012), persistence (Sarrazin et al., 2002), greater enjoyment (Rottensteiner et al., 2015), and reduced drop-out intentions (Gillet, Berjot, Vallerand, & Amoura, 2012). In addition, amotivation has been associated with attrition from sports, whereas introjected regulation has been linked inconsistently to persistence over time (Pelletier, Fortier, Vallerand, & Briere, 2001).

Prior Systematic Reviews

Although several systematic reviews and meta-analyses have been conducted on need-supportive strategies in education and health, to our knowledge, only one meta-analysis has been conducted specifically targeting the physical activity domain. A meta-analysis by Lochbaum and Jean-Noel (2015; $N_{studies}$ = 39; $N_{participants}$ = 23,554), aggregated correlational research on autonomy-supportive teaching in PE and detected large positive correlations between perceived autonomy support and both intrinsic motivation (r = .54) and identified regulation (r = .50) and small correlations between perceived autonomy support and introjected regulation (r = .20),

external regulation (r = -.15), and amotivation (r = -.19). In general education, systematic reviews have supported the central assumptions of the SDT and have corroborated the benefits of need-supportive instruction on student motivation (Lazowski & Hulleman, 2016; Stroet et al., 2013). Specifically, a qualitative synthesis by Stroet et al. (2013; $N_{studies}$ = 71; $N_{participants}$ = NA) on the effects of need-supportive teaching on adolescents' motivation showed a positive relationship between perceptions of need-supportive teaching and students' motivation measured by students' self-reports. Lazowski and Hulleman (2016; $N_{studies}$ = 74 [11 SDT-based]; $N_{participants}$ = 38,377 in total), in turn, showed SDT-based motivational interventions to improve various student outcomes (self-report measures, performance, and behavioral indicators) by a medium effect size (Cohen's d = .70). In the health care context (excluding studies within PE and sport), correlational meta-analytic findings by Ng et al. (2012; $N_{studies}$ = 188; $N_{participants}$ = NA) demonstrated a positive link between autonomy-supportive health care climate and intrinsic motivation (r = .42) and identified regulation (r = .36). In contrast, the associations between autonomy-supportive health care climate and introjected regulation (r = .09) and external regulation (r = -.02) were minuscule and in amotivation negative (r = -.27). Lastly, in a recent meta-analysis by Gillison et al. (2018; $N_{studies}$ = 74 [58 effects for autonomous motivation]; $N_{participants}$ = NA) examining SDT-based health intervention studies, it was found that SDT-interventions affected autonomous motivation toward health behavior change on average by .41 standard deviations (Hedge's g). An additional finding was that out of all the examined need supportive strategies (e.g., interpersonal involvement, acknowledging participant's perspective, and provision of structure) only the provision of rationale was detected to increase the amount of autonomous motivation more compared to the other strategies (Gillison et al., 2018).

Our review of the current literature exposed several gaps in knowledge that warrant further meta-analytic review. First, the meta-analysis by Lochbaum and Jean-Noel (2016) examined only correlational studies in PE without examining possible moderators even with high heterogeneity of the effect sizes. Second, although the recent meta-analysis by Gillison et al. (2018) included physical activity studies, the focus of their review was more broadly on health studies and solely in autonomous forms of behavioral regulations. Thus, it is important to understand the effect of need-supportive interventions on the full spectrum of motivation in physical activity settings, which differs from the general education and health contexts.

PE teachers, coaches, and instructors have a central role in their participants' lives that is different from the role of classroom teachers and especially health professionals. In addition, we seek to explain effect size differences between studies by a priori moderators and focus our meta-analytical procedure on experimental studies only. Experimentally-oriented research allows for the establishment of causality, whereas correlational and qualitative approaches are limited in establishing causality. Thus, the purpose of this meta-analysis was to find the existing need-supportive instruction centered experimental studies and to quantify the size of the effect of need-supportive instruction on participant motivation in the physical activity setting and examine potential moderators of the effects.

Method

Literature Search

The meta-analysis was conducted according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) guidelines (Moher, Liberati, Tetzlaff, & Altman, 2009). The articles used in the meta-analysis were searched using a publishing interval between the years 2000 and 2018. The research articles were searched from PsychINFO,

PsychARTICLES, ERIC, and SportDISCUS databases as well as Google Scholar. The authors of the study gathered the articles from these databases using different combinations of the keywords *need, autonomy, supportive, intervention, teach*, physical, education, sport, exercise, motivation, self-determination, and motivation.* All the found articles were scanned by the title, and the articles that appeared to fit the inclusion criteria were investigated by reading the abstract. All duplicate publications were removed. In the final phase of the search, the authors reviewed the reference lists of the retrieved articles and the tables of the found review articles to detect publications not found using the initial database search.

Study Selection

The inclusion criteria were 1) peer-reviewed research publications from academic journals, 2) intervention studies using control and intervention groups with pre- and post-measures, 3) physical education, sport, or exercise setting, 4) interventions using only SDT-based autonomy- or need-supportive instruction, 5) at least one motivational regulation (amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic regulation) as outcome measures of the intervention, and 6) published between the years 1999 and 2019. Exclusion criteria were 1) non-peer review articles, 2) studies lacking an experimental design, and 3) a composite score of the outcome measures without specific information on the individual regulations.

The initial search identified 2,501 studies. Twenty studies met the inclusion criteria and were included in the quantitative analysis. The authors of the publications that met the inclusion criteria but did not report all necessary information were contacted directly via email (maximum three email contacts). The total number of studies with incomplete information was seven. Four authors responded back with the requested information. In the case of two studies with

incomplete reporting of standard deviations or errors and no response from authors, we estimated the standard deviations from the most similar other study (Cheon, Reeve, & Moon, 2012). The complete flowchart representing the study selection process is provided in Figure 1.

Since only two studies that were included in the meta-analysis assessed integrated regulation (Edmunds, Ntoumanis, & Duda, 2008; González-Cutre, Sierra, Beltrán-Carrillo, Peláez-Pérez, & Cervelló, 2018), we decided to exclude this outcome from the analysis. Thus, we included the five dimensions of motivation: amotivation, external regulation, introjected regulation, identified regulation and intrinsic motivation in the meta-analysis.

Effect Size Calculation

The effect sizes were calculated by subtracting the mean change in the control condition from the mean change in the intervention condition and dividing the difference by the pooled standard deviation of the baseline scores (Hedges & Olkin, 1985). All the studies included had group means for pre- and post-scores and their standard deviations or mean standard errors that were transformed to standard deviations. Hedges *g* was used as the effect size (Hedges & Olkin, 1985). The studies that had multiple measurement points, the time point closest to 10 weeks (the average time for the studies with only two measurement points) was used as the post-measurement point. In the studies reporting only a total number of participants, an even split of participants was assumed to the different conditions ($k = 2$). An increase in the behavioral regulations resulted in a positive effect size. Cohen's (1988) widely used criteria of small (.2), medium (.5) and large (.8) were used to assess the size of the effects.

The reliability of all the derived individual effect sizes ($k = 59$) was assessed with a two-way mixed intraclass correlation (ICC) for absolute agreement. The preliminary ICC of two raters for all the effect sizes was high (ICC, [2, 62] = .93, CI 95% [.88, .96]). Before the

analyses, a rater agreement was achieved by locating and resolving dissimilarities, which were due to data extraction and coding.

Selection and Coding for Moderators

An *a priori* moderator selection based on reason, empirical findings, and theoretical postulations was conducted to explain the expected variation in the effect sizes (Rosenthal & DiMatteo, 2001). A total number of six moderators were categorized as setting (PE or exercise and sport), age (under 18 or over 18), intervention scope (support for one need or support for two or more needs), intervention type (professional training or planned intervention), control condition (as usual or need deprivation), and intervention length (one session or minimum two weeks) (see Table 1).

Statistical Analysis

A random-effects model (Hedges & Olkin, 1985; Hunter & Schmidt, 2000), with weighting by the inverse of the variance of each effect, and restricted information maximum likelihood (REML) estimation of heterogeneity was carried out using R and the Metafor package (Victhbauer, 2010). Parameters of Q and I^2 were used to test the heterogeneity of the effects (Higgins, Simon, Deeks & Altman, 2003). Precision of effect sizes (g) were indicated by 95% confidence intervals (CI). A significant Q statistic indicates heterogeneity between the effects and I^2 the non-sampling error variance of heterogeneity between studies. Heterogeneity of the effect sizes was indicated if Q total reached a significance level of $p < .05$ and the sampling error contributed to the observed variance less than 75% (Hedges & Olkins, 1985). The I^2 values, which represents the heterogeneity of the studies, were categorized as low (25%), moderate (50%), and high (75%).

A priori determined moderators were used in a linear regression analysis as univariate independent variables to explain the possible heterogeneous effects of the outcomes. Multiple regression of the moderators and their interactions were not tested because of inadequate numbers of effects for each outcome (Deeks, Higgins, & Altman, 2011).

Egger's test (Egger, Smith, Schneider, & Minder, 1997) was used to detect potential publication bias. Funnel plots were visually interpreted to further examine publication bias and to evaluate the need for sensitivity analyses. The number of unpublished null-effects that could reduce the significance of the observed effects to < 0.05 was estimated as the random effects fail-safe $N+$ for the motivational regulations. The value of fail-safe $N+$ signifies the minimal number of additional null effects from multiple studies of average sample size required to reach a non-significant value of the mean effect size (Rosenberg, 2005).

Results

Fifty-nine effects from 20 studies were derived for five outcomes: intrinsic motivation (k = 15), identified regulation (k = 10), introjected regulation (k = 9), external regulation (k = 10), and amotivation (k =15). The total amount of participants was 6,954 (60% females, with one study not reporting gender distribution). In the 15 studies, in which the age of the participants was reported in detail, the mean age was 18.3(9.8) years. The other five studies provided information only on the grade level of the participants (e.g., college). The setting for 13 studies was PE, for three studies sports, and for four studies, it was an exercise class. All of these studies applied a cluster randomization design with existing groups. Eleven of the studies implemented an "*as usual*" control condition, whereas nine manipulated the control condition in a need-depriving way (e.g., systematically limiting choice). The implementation of the interventions was conducted by teachers (k = 12), researchers (k = 3), instructors (k = 4) and a coach (k = 1).

The interventions used various need-supportive behaviors and strategies, which were either taught or made known to the intervention conductors (k = 10) or carried out according to a specific and systematic plan (k = 10). Seven of the studies reported supporting one need, six two needs (autonomy and competence), and seven all the three psychological needs. The most frequently used behavioral regulation scales were perceived locus of causality in PE (Goudas, Biddle, & Fox, 1994; PLOC in PE) (k = 9) and behavioral regulations in exercise questionnaire - 2 (Markland & Tobin, 2004; BREQ-2) (k = 3). Four of the interventions lasted only for one session whereas the average duration for the longer interventions was 9.6(3.2) weeks. Eleven of the studies were conducted in Europe, six in Asia, one in the U.S., and one in Australia. The full details of the independent studies are listed in Table 1.

Effects of Need-supportive Instruction

The statistically significant increases for intrinsic motivation (Q = 110.0, df = 14, p < .001, I^2 = 92.3%) and identified regulation (Q = 85.6, df = 9, p < .001, I^2 = 97.6%) and decreases for amotivation (Q = 82.1, df = 14, p < .001, I^2 = 97.0%) were heterogeneous. In the same fashion, the non-significant decreases for introjected regulation (Q = 43.2, df = 8, p < .001, I^2 = 92.1%) and external regulation (Q = 63.5, df = 9, p < .001, I^2 = 95.4%) were heterogeneous. Based on the significant Q statistics and high values of I^2, there was a strong reason to believe that the variability in need-supportive interventions on the behavioral regulations did not occur based only on sample error of the independent studies. Thus, the between-study variances in relation to possible moderators were pursued to identify using univariate regression analyses. The regression analysis was conducted using six *a priori* determined moderators, namely setting, intervention scope, type of intervention, type of control group, intervention length, and age of participants. The individual effect sizes and their CIs for the independent studies and separate

forest plots are presented in Table 2 and in Figures 2. The moderating effects are displayed in Table 3.

The mean change of intrinsic motivation followed by a need-supportive intervention was .51 (CI 95% [-.19, .83]). According to the univariate analyses, no single moderator explained the variance between the effect sizes in a statistically significant way.

Identified regulation improved after a need-supportive intervention on average by .72 (CI 95% [.08, 1.37]) standard deviations. Again, no single *a priori* moderator explained the variance between the effect sizes in a statistically significant way.

There was no mean change in introjected regulation (g = -.00, CI 95% [-.47, .46]). The univariate moderator analyses did not explain the variance between the effect sizes in a statistically significant way. As with introjected regulation, there was not a mean change of external regulation followed by a need-supportive intervention (g = -.46, CI 95% [-.93, .01]). According to the univariate moderator analyses, the type of control explained the observed variance (Q = 47.1, df = 8, $p < .001$, I^2 = 92.3%) between the effect sizes in a statistically significant way, with the studies using a need-depriving control group showing a greater reduction in external regulation compared to the studies using an *as usual* control group ($p <$ .05).

The mean change of amotivation followed by a need-supportive intervention was -.35 (95% CI [-.66, -.05]). The univariate analyses indicated that the type of intervention (Q = 70.4, df =13, $p < .001$, I^2 = 96.3%) and the type of control (Q = 64.5, df =13, $p < .001$, I^2 = 93.9%) explained the variance between the studies in a statistically significant way with studies utilizing planned interventions versus training protocols ($p < .05$) and need-depriving control groups versus as usual control groups ($p < .001$) showing greater reductions in amotivation.

Egger's Test and Fail Safe N

Egger's test (Egger et al., 1997) was primarily used to detect potential publication bias. The Egger's test for the regression intercept was found to be significant for four motivation facets consequently suggesting publication bias for intrinsic motivation, $p < 0.001$, for identified motivation, $p < 0.001$, for external regulation, $p < 0.05$, for amotivation, $p < 0.001$, but not for introjected regulation, $p = 0.38$. Similarly, the visual interpretation of the funnel plots implies publication bias for the same outcomes (especially for identified regulation and amotivation) due to the asymmetry of the plots (Egger et al., 1997).

The fail-safe *N*+ values for the outcomes were for intrinsic motivation 65, for identified regulation 42, for introjected regulation 0, for extrinsic regulation 87, and for amotivation 138. The fail-safe *N* is estimated to be robust when its value exceeds 5*N* +10 (*N* is the number of effect sizes in the meta-analysis) (Rosenthal, 1991). With nine to 15 effects examined depending on the motivational regulation, the fail-safe *N* value should be higher than 5*(9-15) + 10 = 55-85. Comparison of the derived fail-safe *N*-values to the cut-off values of 55-85 suggests that there is an issue with a potential publication bias for intrinsic motivation, identified regulation, and introjected regulation. However, a small number of heterogeneous studies analyzed with statistical and graphical tests of publication bias may result in high false-positive rates (Sterne, Cavaghan, & Egger, 2000).

Sensitivity Analyses

For all outcomes, considerable amounts of the effects lie outside the 95% confidence interval of the funnel plot. Due to the high number of outlying studies and no justifiable logic for excluding only some of the outlying studies for all the outcomes, a decision was made to keep all the studies in the final analyses (Figure provided in a supplemental file).

Discussion

According to the SDT, environmental factors, such as teachers' or coaches' instructional style, affect motivation through the satisfaction of three basic needs of competence, autonomy, and relatedness (Deci & Ryan, 2000). As the instructional strategies and behaviors that nurture need-satisfaction are not clearly established (see Gillison et al., 2018), or they vary from study to study and may be culturally and individually determined (Iyengar & Lepper, 1999; Taylor & Lonsdale, 2010), the findings of this study do not directly clarify the applicability of SDT in physical activity. The results, however, do shed light on how current instructional interventions and their operationalization of SDT-based need-supportive strategies influence participants motivational regulations in physical activity.

The results suggest that need-supportive instruction has a moderate-to-large but heterogeneous effect on improving participants' intrinsic motivation and identified regulation (autonomous forms of motivation). Although smaller in size, the results also suggest that need-support reduces participant amotivation. This all is encouraging and in line with the theorization of the SDT and the previous studies, such as the meta-analysis by Lochbaum & Jean-Noel (2016) and the systematic review by Stroet el al. (2013). In addition, this meta-analysis showed need-supportive instruction to have no mean effect on extrinsic and introjected regulations. While not supporting the central stipulations of the SDT, these findings are similar to the findings of a previous meta-analysis on correlations between perceived autonomy-supportive teaching and motivational regulations (Lochbaum & Jean-Noel, 2016). It is largely unknown why need-supportive interventions influence adaptive motivation but not external or introjected regulations. It may be that participants perceive physical activity context inherently controlling and that surpasses the effect of need-supportive instruction. For example, K-12 education is mandatory

for students and teacher, administration, and their parents can impose its value upon the students. Thus, the school environment might be easily perceived as an environment with external control regardless of the instruction style of the teacher.

These findings were overshadowed by the considerable heterogeneity in the effect sizes in all outcomes. This was, in part, anticipated based on the previous meta-analyses on different SDT based interventions (Gillison et al., 2018; Su & Reeve, 2011). However, the magnitude of the heterogeneity was surprising and suggests that the interventions might yield different effects under different contexts. Moreover, a closer examination on the need-supportive instruction strategies used in the analyzed studies might partly explain the heterogeneity. Need-supportive instruction has been conceptualized in numerous different ways. For example, four of the analyzed studies (Abula et al., 2018; Cheon et al., 2012; Cheon & Reeve, 2015; Cheon, Reeve, & Song, 2016) utilized an autonomy-supportive intervention program that conceptualized need-supportive (or autonomy-supportive) strategies into six specific categories: taking the students' perspective, vitalizing students' inner motivational resources, provision of explanatory rationales, acknowledgement and acceptance of negative affect, use of informational and non-pressuring language and patience (Reeve, 2016). On the other hand, the study by Sanchez-Oliva et al. (2017) focused their need-supportive intervention program specifically to target all the basic needs of SDT and thus, at least according to procedure descriptions, provided considerable support to the need for relatedness by behaviors such as being helpful and friendly which are not part of the autonomy-supportive intervention program protocol. Moreover, adding to the variation of the intervention procedures, the study by Edmunds, Ntoumanis, and Duda (2008) conceptualized need-supportive strategies based on autonomy-support, provision of structure, and interpersonal involvement.

Out of the six moderators, only two explained the variance in the effect sizes for two of the five examined motivational regulations. Further, the reductions in heterogeneity with these moderators were small leaving much of the heterogeneity in the effect sizes to be unexplained. Nevertheless, the moderating effects for the type of control group (*as usual* or need depriving) on external regulation and amotivation, as well as moderation for the type of intervention (planned or trained procedure) on amotivation were detected. These moderating effects corroborate the central postulations of SDT and partly explain the circumstances the need-supportive instruction decreases external regulation. Specifically, it seems that the decreasing effect of need-supportive instruction on amotivation and external regulation arises only when compared to conditions that are manipulated to lack need-support. This finding supports the previous correlational evidence suggesting that need depriving and thwarting environments should be avoided in sport (Bartholomew, Ntoumanis, Ryan, Bosch, Thøgersen-Ntoumani, 2011) and PE (Haerens et al., 2015). From a practical standpoint, it appears, however, that instructors' "*as usual*' instructional style does not separate itself negatively from need-supportive instruction in terms of its efficacy in reducing extrinsic regulation and amotivation.

For amotivation, need-supportive interventions that used strategies, which were carried out by researchers or instructors who are familiar with the instructional strategy rather than professionally trained instructors (or teachers/coaches), were more effective in reducing participant amotivation. It might be that standard professional training intervention schemes, even though deemed generally effective (Su & Reeve, 2011), are not effective enough to train regular teachers/coaches or exercise instructors from the standpoint of reducing participants' amotivation. Alternatively, it may be that regular instructors' personal characteristics or other

structural factors of physical activity are impacting participants' amotivation so strongly that it cannot be changed with professional training.

Although the small number of studies and the small power to detect moderating effects were anticipated, the non-significance of most of the moderators was unexpected. Previous research has shown that SDT-based interventions are more effective with an adult than adolescent populations (Gillison et al., 2018) – a finding, which could not be replicated in this study. The high heterogeneity of the effect sizes added to the notion that need-supportive interventions have been conducted and operationalized in very different ways (Gillison et al., 2018; Stroet et al., 2013), and that the interplay between the different need-supportive schemes and different contextual factors is not understood well. Adding to the notion of the high heterogeneity of the effects, we did not conduct a sensitivity analysis as the visual interpretation of the funnel plots indicated far too many studies to be outliers. A combined examination of the funnel plots and the characteristics of the separated studies, however, showed that three small studies deploying a long and planned intervention with support for at least for two needs and a need-depriving control condition yielded consistently higher effect sizes across all the outcomes (excluding introjected regulation). Even with this finding, these studies were not excluded from the analyses as, depending on the outcome, other studies, with similar criterion, should have been excluded. This would have led to the situation of too few studies with effects to be analyzed.

Limitations

The results of this meta-analysis should be interpreted carefully. The small number of effects (at most, 15, for intrinsic motivation and amotivation) and the large heterogeneity of effects limit the interpretation and generalizability of the findings, as well as the statistical power to detect moderators of the heterogeneous results. The results of the analyses are also bound to

the methodological features of the included studies, which typically lacked randomized allocation to conditions and rigorous control of confounding factors.

Other moderators might have been selected *a priori*. However, because of the small number of effects and the risk of type 1-error, we did not pursue additional univariate moderator analyses. In addition, all moderators were selected carefully and the reasons why for example the duration of the intervention, the scope of the intervention or the setting of the intervention did not emerge as significant moderators is left to speculation. A potential reason, for example, in the case of the intervention scope is that we were unsuccessful in coding the studies in terms of their use of need-supportive strategies. On the other hand, coding the studies according to the used need-supportive strategies was difficult with the reported information - a problem reported also elsewhere (Gillison et al., 2018).

The Egger's test, funnel plots, and the fail-safe *N*+ metric suggested that there is a possibility for publication bias with the retrieved studies. However, caution regarding the publication bias results should be taken as the number of analyzed studies were small and the heterogeneity among effects high (Sterne et al., 2000). In our search, we set out to find out only experimental studies published in peer-reviewed journals. Yet, we did not come across any other publications (dissertations, theses, presentations) that would have provided us any further data, had our inclusion criteria been different. The logical implications are that the null and opposite as expected findings might have not been published and, thus, are not retrievable by standard literature search procedures or that the high heterogeneity of the results influence also the publication bias analyses.

Future Studies

About the heterogeneity of the studies, there is a need for well-designed studies using more detailed descriptions of the experimental procedures and contextual factors of the study characteristics. Clearer conceptualizations of the study characteristics would allow more careful and reliable examination of the moderating effects and would be valuable in determining in which contexts and in which way conducted need-supportive instruction is the most effective.

In educational settings, individual randomization is usually not attainable and as demonstrated by this review; cluster randomization is regarded to be the most practical design to apply. However, in exercise settings, designs that are more ambitious could be deployed more easily. Moreover, different age groups, school-levels, and physical activity settings should be examined more thoroughly in the future. It would also be interesting to see how culture influences the effect of need supportive instruction on motivation. SDT argues that there are no cultural differences in the satisfaction of the basic psychological needs (Deci & Ryan, 2000). However, it is possible that people from different cultures respond differently to the same need-supportive behaviors because they might carry a different cultural meaning (Iyengar & Lepper, 1999; Markus & Kitayama, 2003). In addition, the *as usual* style (the most used control condition in this review) is probably very different cross-culturally, and as it affects the size of the effect of the need-supportive interventions on external regulation and amotivation, it might be reasonable to anticipate variable effects across different cultures.

Based on the included studies, it is evident that sport is an avenue that has not been examined very much at all from the perspective of need-supportive instruction. In fact, for this review, only three studies were conducted in sport settings, and they all used short one session intervention designs. We suggest that sport interventions intervening with coaching behaviors could be highly important as the strong correlational link between need-thwarting coaching

strategies and detrimental outcomes have been established (Bartholomew et al. 2011; Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011). Furthermore, including sport settings and, for example, coaching training programs would offer a completely new venue for longer need-supportive interventions.

In this analysis, we decided to look at only one post measurement time point on each study, although some of the studies had several measuring points of motivational regulations even including follow-up measurements. With more studies, and adopting multilevel analyses taking into consideration possible nesting effects within studies, the moderating effect of the duration of the intervention on the motivational regulations could be estimated with a better precision as well.

For this meta-analysis, we included only studies that had outcome measures for separate motivational regulations postulated by SDT. This approach left us to reduce the number included studies excluding studies, which reported motivational outcomes as weighted composite scores such as the relative autonomy index, self-determination index, and autonomous motivation. We suggest that future research should always report the information also on the separate motivational regulations as they are theoretically different from one another and have been theorized to have different implications for behavioral, affective, and cognitive outcomes (Vallerand, 1997). Compressing information can sometimes be justified, but for example, RAI-index combines all the different motivational constructs into the same variable limiting the interpretation of the effects of interventions considerably (Howard, Gagne, Morin, & Forest, 2018). Furthermore, as only two included studies reported scores on integrated regulation, we decided to leave this outcome out of the analyses. Future research should also measure this

regulation as it is postulated in SDT to be one of the six distinct motivational regulations with its implications for human behavior.

Lastly, we propose that future research efforts should use standardized need-supportive strategies and behaviors. The meta-analysis by Gillison et al. (2018) is a good start to this direction and clearly shows the abundance of behaviors and strategies that could be defined as need-supportive. This is potentially a problem since interventions utilizing several strategies and behaviors are not able to pinpoint the importance of single strategies or their interaction with a certain another strategy. This leaves the effectiveness of need-supportive instruction somewhat vague, open for too much interpretation and the importance of certain strategies over others impossible to determine. Promising, however, is that 13 of the 20 analyzed studies were published in 2015 or after. This indicates a clear positive trend in studying the efficacy of need-supportive interventions in physical activity. More studies with a careful concentration on the methodology should improve the quality of research.

Conclusion

This meta-analysis suggests that need-supportive instruction has a positive but heterogeneous effect participant motivation in physical activity. The effect of need-supportive instruction is moderate to large on intrinsic motivation and identified regulation and small on amotivation. For coaches, teachers, and instructors, the results suggest promise in increasing participants' motivation in physical activity settings with a need-supportive instruction style. However, more well-designed research in different contexts needs to be conducted to fully understand the variable effects of need-supportive instruction on motivational regulations of participants in physical activity.

References

*An asterisk indicates the studies used in the meta-analysis.

1. *Abula, K., Beckmann, J., He, Z., Cheong, C., Lu, F., & Gröpel, P. (2018). Autonomy support in physical education promotes autonomous motivation towards leisure-time physical activity: Evidence from a sample of Chinese college students. *Health Promotion International, 102,* 1-10. https://doi.org/10.1093/heapro/day102
2. Aelterman, N., Vansteenkiste, M., Van Keer, H., Van den Berghe, L., De Meyer, J., & Haerens, L. (2012). Students' objectively measured physical activity levels and engagement as a function of between-class and between-student differences in motivation toward physical education. *Journal of Sport and Exercise Psychology*, *34*, 457-480. https://doi.org/10.1123/jsep.34.4.457
3. Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C. (2011). Self-determination theory and diminished functioning: The role of interpersonal control and psychological need thwarting. *Personality and Social Psychology Bulletin*, *37*, 1459-1473. https://doi.org/10.1177/0146167211413125
4. Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., & Thøgersen-Ntoumani, C. (2011). Psychological need thwarting in the sport context: Assessing the darker side of athletic experience. *Journal of Sport and Exercise Psychology*, *33*, 75-102. https://doi.org/10.1123/jsep.33.1.75
5. Cerasoli, C. P., Nicklin, J. M., & Ford, M. T. (2014). Intrinsic motivation and extrinsic incentives jointly predict performance: A 40-year meta-analysis. *Psychological Bulletin*, *140*, 980-1008. http://dx.doi.org/10.1037/a0035661
6. *Chang, Y. K., Chen, S., Tu, K. W., & Chi, L. K. (2016). Effect of autonomy support on self-determined motivation in elementary physical education. *Journal of Sports Science & Medicine*, *15* (3), 460-466.
7. Charbonneau, D., Barling, J., & Kelloway, E. K. (2001). Transformational leadership and sports performance: The mediating role of intrinsic motivation. *Journal of Applied Social Psychology*, *31*, 1521-1534. https://doi.org/10.1111/j.1559-1816.2001.tb02686.x
8. Chatzisarantis, N. L., & Hagger, M. S. (2009). Effects of an intervention based on self-determination theory on self-reported leisure-time physical activity participation. *Psychology and Health*, *24*, 29-48. https://doi.org/10.1080/08870440701809533
9. *Cheon, S. H., & Moon, I. S. (2010). Implementing an autonomy-supportive fitness program to facilitate students' autonomy and engagement. *Korean Journal of Sport Psychology*, *21*(1), 175-195.
10. *Cheon, S. H., & Reeve, J. (2015). A classroom-based intervention to help teachers decrease students' amotivation. *Contemporary Educational Psychology*, *40*, 99-111. https://doi.org/10.1016/j.cedpsych.2014.06.004
11. *Cheon, S. H., Reeve, J., & Moon, I. S. (2012). Experimentally based, longitudinally designed, teacher-focused intervention to help physical education teachers be more autonomy supportive toward their students. *Journal of Sport and Exercise Psychology*, *34*, 365-396. https://doi.org/10.1123/jsep.34.3.365
12. *Cheon, S. H., Reeve, J., & Song, Y. G. (2016). A teacher-focused intervention to decrease PE students' amotivation by increasing need satisfaction and decreasing need

frustration. *Journal of Sport and Exercise Psychology*, *38*, 217-235. https://doi.org/10.1123/jsep.2015-0236

13. Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. New York, NY: Routledge Academic.
14. Cox, A. E., Smith, A. L., & Williams, L. (2008). Change in physical education motivation and physical activity behavior during middle school. *Journal of Adolescent Health*, *43*, 506-513. https://doi.org/10.1016/j.jadohealth.2008.04.020
15. Daley, A. J., & Duda, J. L. (2006). Self-determination, stage of readiness to change for exercise, and frequency of physical activity in young people. *European Journal of Sport Science*, *6*, 231-243. https://doi.org/10.1080/17461390601012637
16. Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum Press. http://dx.doi.org/10.1007/978-1-4899-2271-7
17. Deci, E. L., & Ryan, R. M. (2000). The 'what' and 'why' of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*, 227-268. https://doi.org/10.1207/S15327965PLI1104_01
18. Deeks, J. J., Higgins, J. P. T., & Altman, D. G. (2011). Chapter 9: Analysing data and undertaking meta-analyses. In: J. P. T. Higgins & S. Green (Eds). *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0. The Cochrane Collaboration, 2011. https://doi.org/10.1002/9780470712184.ch9
19. De Meyer, J., Tallir, I. B., Soenens, B., Vansteenkiste, M., Aelterman, N., … & Haerens, L. (2014). Does observed controlling teaching behavior relate to students' motivation in physical education? *Journal of Educational Psychology*, *106*, 541-554. http://dx.doi.org/10.1037/a0034399
20. Dishman, R. K., Mciver, K. L., Dowda, M., & Pate, R. R. (2018). Declining Physical Activity and Motivation from Middle School to High School. *Medicine and Science in Sports and Exercise*, *50*, 1206-1215. https://doi.org/10.1249/MSS.0000000000001542
21. Duncan, L. R., Hall, C. R., Wilson, P. M., & Jenny, O. (2010). Exercise motivation: A cross-sectional analysis examining its relationships with frequency, intensity, and duration of exercise. *International Journal of Behavioral Nutrition and Physical Activity*, *7*, 1-9. https://doi.org/10.1186/1479-5868-7-7
22. *Edmunds, J., Ntoumanis, N., & Duda, J. L. (2008). Testing a self-determination theory-based teaching style intervention in the exercise domain. *European Journal of Social Psychology*, *38*, 375-388. https://doi.org/10.1002/ejsp.463
23. Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ*, *315*, 629-634. https://doi.org/10.1136/bmj.315.7109.629
24. *Franco, E., & Coterón, J. (2017). The effects of a physical education intervention to support the satisfaction of basic psychological needs on the motivation and intentions to be physically active. *Journal of Human Kinetics*, *59*, 5-15. https://doi.org/10.1515/hukin-2017-0143
25. *Fransen, K., Boen, F., Vansteenkiste, M., Mertens, N., & Vande Broek, G. (2018a). The power of competence support: The impact of coaches and athlete leaders on intrinsic motivation and performance. *Scandinavian Journal of Medicine & Science in Sports*, *28*, 725-745. https://doi.org/10.1111/sms.12950

26. *Fransen, K., Vansteenkiste, M., Broek, G. V., & Boen, F. (2018b). The competence-supportive and competence-thwarting role of athlete leaders: An experimental test in a soccer context. *PloS One*, *13*, e0200480. https://doi.org/10.1371/journal.pone.0200480
27. Gillet, N., Berjot, S., Vallerand, R. J., & Amoura, S. (2012). The role of autonomy support and motivation in the prediction of interest and dropout intentions in sport and education settings. *Basic and Applied Social Psychology*. *34*, 278–286. https://doi.org/10.1080/01973533.2012.674754
28. Gillison, F. B., Rouse, P., Standage, M., Sebire, S. J., & Ryan, R. M. (2019). A meta-analysis of techniques to promote motivation for health behaviour change from a self-determination theory perspective. *Health psychology review*, *13*, 110-130. https://doi.org/10.1080/17437199.2018.1534071
29. *Gillison, F. B., Standage, M., & Skevington, S. M. (2013). The effects of manipulating goal content and autonomy support climate on outcomes of a physical education fitness class. *Psychology of Sport and Exercise*, *14*, 342-352. https://doi.org/10.1016/j.psychsport.2012.11.011
30. *González-Cutre, D., Sierra, A. C., Beltrán-Carrillo, V. J., Peláez-Pérez, M., & Cervelló, E. (2018). A school-based motivational intervention to promote physical activity from a self-determination theory perspective. *The Journal of Educational Research*, *111*, 320-330. https://doi.org/10.1080/00220671.2016.1255871
31. Haerens, L., Kirk, D., Cardon, G., De Bourdeaudhuij, I., & Vansteenkiste, M. (2010). Motivational profiles for secondary school physical education and its relationship to the adoption of a physically active lifestyle among university students. *European Physical Education Review*, *16*, 117-139. https://doi.org/10.1177%2F1356336X10381304
32. Hedges, L. V., & Olkin, I. (2014). *Statistical methods for meta-analysis*. Academic press.
33. Higgins, J. P., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *BMJ*, *327*, 557-560. https://doi.org/10.1136/bmj.327.7414.557
34. Howard, J. L., Gagné, M., Morin, A. J., & Forest, J. (2018). Using bifactor exploratory structural equation modeling to test for a continuum structure of motivation. *Journal of Management*, *44*, 2638-2664. https://doi.org/10.1177/0149206316645653
35. Hunter, J. E., & Schmidt, F. L. (2000). Fixed effects vs. random effects meta-analysis models: Implications for cumulative research knowledge. *International Journal of Selection and Assessment*, *8*, 275-292. https://doi.org/10.1111/1468-2389.00156
36. Iyengar, S. S., & Lepper, M. R. (1999). Rethinking the value of choice: a cultural perspective on intrinsic motivation. *Journal of Personality and Social Psychology*, *76*, 349. http://dx.doi.org/10.1037/0022-3514 .76.3.349
37. Lazowski, R. A., & Hulleman, C. S. (2016). Motivation interventions in education: A meta-analytic review. *Review of Educational Research*, *86*, 602-640. https://doi.org/10.3102%2F0034654315617832
38. *Leptokaridou, E. T., Vlachopoulos, S. P., & Papaioannou, A. G. (2016). Experimental longitudinal test of the influence of autonomy-supportive teaching on motivation for participation in elementary school physical education. *Educational Psychology*, *36*, 1138-1159. https://doi.org/10.1080/01443410.2014.950195
39. Lipsey, M. W., & Wilson, D. B. (2001). Practical meta-analysis. London, UK: Sage Publications.

40. Lochbaum, M., & Jean-Noel, J. (2015). Perceived autonomy-support instruction and student outcomes in physical education and leisure-time: A meta-analytic review of correlates. *Revista Internacional de Ciencias del Deporte*, *12*, 29-47. http://dx.doi.org/10.5232/ricyde2016.04302
41. Lonsdale, C., Sabiston, C. M., Raedeke, T. D., Ha, A. S., & Sum, R. K. (2009). Self-determined motivation and students' physical activity during structured physical education lessons and free choice periods. *Preventive Medicine*, *48*, 69-73. https://doi.org/10.1016/j.ypmed.2008.09.013
42. Markus, H. R., & Kitayama, S. (2003). Models of agency: Sociocultural diversity in the construction of action. In V. Murphy-Berman & J. J. Berman (Eds.), Nebraska Symposium on Motivation: Vol. 9. *Cross-cultural differences in perspectives on the self* (pp. 1-57). Lincoln: University of Nebraska Press.
43. McDonough, M. H., & Crocker, P. R. (2007). Testing self-determined motivation as a mediator of the relationship between psychological needs and affective and behavioral outcomes. *Journal of Sport and Exercise Psychology*, *29*, 645-663. https://doi.org/10.1123/jsep.29.5.645
44. *Mertens, N., Boen, F., Vande Broek, G., Vansteenkiste, M., & Fransen, K. (2018). An experiment on the impact of coaches' and athlete leaders' competence support on athletes' motivation and performance. *Scandinavian Journal of Medicine & Science in Sports*, *28*, 2734-2750. https://doi.org/10.1111/sms.13273
45. Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Prisma Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, *6*, e1000097. https://doi.org/10.1371/journal.pmed.1000097
46. *Moreno-Murcia, J. A., & Sánchez-Latorre, F. (2016). The effects of autonomy support in physical education classes. *Revista Internacional De Ciencias Del Deporte*, *12*, 79–89. https://doi.org/10.5232/ricyde2016.04305
47. *Moustaka, F. C., Vlachopoulos, S. P., Kabitsis, C., & Theodorakis, Y. (2012). Effects of an autonomy-supportive exercise instructing style on exercise motivation, psychological well-being, and exercise attendance in middle-age women. *Journal of Physical Activity and Health*, *9*, 138-150. https://doi.org/10.1123/jpah.9.1.138
48. Ng, J. Y., Ntoumanis, N., Thøgersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Duda, J. L., & Williams, G. C. (2012). Self-determination theory applied to health contexts: A meta-analysis. *Perspectives on Psychological Science*, *7*, 325-340. https://doi.org/10.1177%2F1745691612447309
49. Ntoumanis, N., Stenling, A., Thøgersen-Ntoumani, C., Vlachopoulos, S., Lindwall, M., … Tsakonitis, C. (2018). Longitudinal associations between exercise identity and exercise motivation: A multilevel growth curve model approach. *Scandinavian Journal of Medicine & Science in Sports*, *28*, 746-753. https://doi.org/10.1111/sms.12951
50. *Ntoumanis, N., Thøgersen-Ntoumani, C., Quested, E., & Hancox, J. (2017). The effects of training group exercise class instructors to adopt a motivationally adaptive communication style. *Scandinavian Journal of Medicine & Science in Sports*, *27*, 1026-1034. https://doi.org/10.1111/sms.12713
51. Pelletier, L. G., Fortier, M. S., Vallerand, R. J., & Briere, N. M. (2001). Associations among perceived autonomy support, forms of self-regulation, and persistence: A prospective study. *Motivation and Emotion*, *25*, 279-306. https://doi.org/10.1023/A:1014805132406

52. Pintrich, P. R. (2003). A motivational science perspective on the role of student motivation in learning and teaching contexts. *Journal of Educational Psychology, 95*, 667. http://dx.doi.org/10.1037/0022-0663.95.4.667
53. Pope, J. P., & Wilson, P. M. (2012). Understanding motivational processes in university rugby players: A preliminary test of the hierarchical model of intrinsic and extrinsic motivation at the contextual level. *International Journal of Sports Science & Coaching, 7*, 89-107. https://doi.org/10.1260%2F1747-9541.7.1.89
54. *Prusak, K. A., Treasure, D. C., Darst, P. W., & Pangrazi, R. P. (2004). The effects of choice on the motivation of adolescent girls in physical education. *Journal of Teaching in Physical Education*, 23, 19-29. https://doi.org/10.1123/jtpe.23.1.19
55. Reeve, J. (2016). Autonomy-supportive teaching: What it is, how to do it. In J. C. K. Wang, W. C. Liu, & R. M. Ryan's (Eds.), *Building autonomous learners: Perspectives from research and practice using self-determination theory* (Chap. 5, pp. 129–152). New York, NY: Springer.
56. Rottensteiner, C., Happonen, L., & Konttinen, N. (2015). The interplay of autonomous and controlled motivation in youth team sports. *International Journal of Sport Psychology, 46*, 225-243. https://doi.org/10.7352/IJSP.2015.46.225
57. Rosenberg, M. S. (2005). The file-drawer problem revisited: A general weighted method for calculating fail-safe numbers in meta-analysis. *Evolution, 59*, 464-468. https://doi.org/10.1111/j.0014-3820.2005.tb01004.x
58. Rosenthal, R., & DiMatteo, M. R. (2001). Meta-analysis: recent developments in quantitative methods for literature reviews. *Annual Reviews in Psychology*, 52, 59-82. https://doi.org/10.1146/annurev.psych.52.1.59
59. Ryan, R. M. (1993). Agency and organization: Intrinsic motivation, autonomy and the self in psychological development. In J. Jacobs (Ed.), *Nebraska symposium on motivation: Developmental perspectives on motivation* (Vol. *40*, pp. 1–56). Lincoln, NE: University of Nebraska Press
60. Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*, 749–761. http://dx.doi.org/10.1037/0022-3514.57.5.749
61. Ryan, R. M., Frederick, C. M., Lepes, D., Rubio, N., & Sheldon, K. M. (1997). Intrinsic motivation and exercise adherence. *International Journal of Sport Psychology, 28*(4), 335-354.
62. *Sánchez-Oliva, D., Pulido-González, J. J., Leo, F. M., González-Ponce, I., & García-Calvo, T. (2017). Effects of an intervention with teachers in the physical education context: A self-determination theory approach. *PloS One, 12*, e0189986. https://doi.org/10.1371/journal.pone.0189986
63. Sarrazin, P., Vallerand, R., Guillet, E., Pelletier, L., & Cury, F. (2002). Motivation and dropout in female handballers: A 21-month prospective study. *European Journal of Social Psychology, 32*, 395-418. https://doi.org/10.1002/ejsp.98
64. Silva, M. N., Markland, D., Carraça, E. V., Vieira, P. N., Coutinho, S. R., … Minderico, C. S., Teixeira, P. J. (2011). Exercise autonomous motivation predicts 3-yr weight loss in women. *Medicine & Science in Sports & Exercise, 43*, 728-737. https://doi.org/10.1249/MSS.0b013e3181f3818f
65. *Sparks, C., Lonsdale, C., Dimmock, J., & Jackson, B. (2017). An intervention to improve teachers' interpersonally involving instructional practices in high school

physical education: Implications for student relatedness support and in-class experiences. *Journal of Sport and Exercise Psychology*, *39*, 120-133. https://doi.org/10.1123/jsep.2016-0198

66. Standage, M., Duda, J. L., & Ntoumanis, N. (2003). A model of contextual motivation in physical education: Using constructs from self-determination and achievement goal theories to predict physical activity intentions. *Journal of Educational Psychology*, *95*, 97 http://dx.doi.org/10.1037/0022-0663.95.1.97
67. Standage, M., Duda, J. L., & Ntoumanis, N. (2006). Students' motivational processes and their relationship to teacher ratings in school physical education: A self-determination theory approach. *Research Quarterly for Exercise and Sport*, *77*, 100-110. https://doi.org/10.1080/02701367.2006.10599336
68. Standage, M., Gillison, F. B., Ntoumanis, N., & Treasure, D. C. (2012). Predicting students' physical activity and health-related well-being: A prospective cross-domain investigation of motivation across school physical education and exercise settings. *Journal of Sport and Exercise Psychology*, *34*, 37-60. https://doi.org/10.1123/jsep.34.1.37
69. Sterne, J. A., Gavaghan, D., & Egger, M. (2000). Publication and related bias in meta-analysis: Power of statistical tests and prevalence in the literature. *Journal of Clinical Epidemiology*, *53*, 1119-1129. https://doi.org/10.1016/S0895-4356(00)00242-0
70. Su, Y. L., & Reeve, J. (2011). A meta-analysis of the effectiveness of intervention programs designed to support autonomy. *Educational Psychology Review*, *23*, 159-188. https://doi.org/10.1007/s10648-010-9142-7
71. Stroet, K., Opdenakker, M. C., & Minnaert, A. (2013). Effects of need supportive teaching on early adolescents' motivation and engagement: A review of the literature. *Educational Research Review*, *9*, 65-87. https://doi.org/10.1016/j.edurev.2012.11.003
72. Taylor, I. M., & Lonsdale, C. (2010). Cultural differences in the relationships among autonomy support, psychological need satisfaction, subjective vitality, and effort in British and Chinese physical education. *Journal of Sport and Exercise Psychology*, *32*, 655-673. https://doi.org/10.1123/jsep.32.5.655
73. Taylor, I. M., Ntoumanis, N., Standage, M., & Spray, C. M. (2010). Motivational predictors of physical education students' effort, exercise intentions, and leisure-time physical activity: A multilevel linear growth analysis. *Journal of Sport and Exercise Psychology*, *32*, 99-120. https://doi.org/10.1123/jsep.32.1.99
74. Teixeira, P. J., Carraça, E. V., Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, *9*, 78. https://doi.org/10.1186/1479-5868-9-78
75. Thøgersen-Ntoumani, C., & Ntoumanis, N. (2006). The role of self-determined motivation in the understanding of exercise-related behaviours, cognitions and physical self-evaluations. *Journal of Sports Sciences*, *24*, 393-404. https://doi.org/10.1080/02640410500131670
76. Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In M. P. Zanna (Ed.), *Advances in Experimental Social Psychology* (pp. 271–359). New York: Academic Press. https://doi.org/10.1016/S0065-2601(08)60019-2
77. Vallerand, R. J. (2000). Deci and Ryan's self-determination theory: A view from the hierarchical model of intrinsic and extrinsic motivation. *Psychological Inquiry*, *11*, 312-318.

78. Vallerand, R. J., & Losier, G. F. (1999). An integrative analysis of intrinsic and extrinsic motivation in sport. *Journal of Applied Sport Psychology*, *11*(1), 142-169. https://doi.org/10.1080/10413209908402956
79. Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration*, 23, 263–280. https://doi.org/10.1037/a0032359
80. Viechtbauer, W. (2010) Conducting Meta-Analyses in R with the Metafor Package. *Journal of Statistical Software*, *36*, 1-48. https://doi.org/10.18637/jss.v036.i03
81. Werman-Josefsson, K., Lindwall, M., & Ivarsson, A. (2015). Need satisfaction, motivational regulations and exercise: Moderation and mediation effects. *International Journal of Behavioral Nutrition and Physical Activity*, *12*, 67. https://doi.org/10.1186/s129660150226-0
82. Wilson, P. M., & Rodgers, W. M. (2002). The relationship between exercise motives and physical self-esteem in female exercise participants: An application of self-determination theory. *Journal of Applied Biobehavioral Research*, *7*, 30-43. https://doi.org/10.1111/j.17519861.2002.tb00074.x
83. Wilson, P. M., Rodgers, W. M., Fraser, S. N., & Murray, T. C. (2004). Relationships between exercise regulations and motivational consequences in university students. *Research Quarterly for Exercise and Sport*, *75*, 81-91. https://doi.org/10.1080/02701367.2004.10609136
84. Yli-Piipari, S., Watt, A., Jaakkola, T., Liukkonen, J., & Nurmi, J.-E. (2009). Relationships between physical education students' motivational profiles, enjoyment, state anxiety and self-reported physical activity. *Journal of Sports Science and Medicine, 8*(3), 327–336.

Table 1.

Study Descriptions

Authors	n (sex)	Age	Country	Setting	Outcomes	Scale	Design	Conductor	Intervention	Control	Length(w)
Abula, 2018	258 (53% F)	19.9	China	PE	All	PLOC PE	TL CR	Teachers	ASIP (2) - T	As usual	12.
Chang, 2016	126 (48% F)	13.7	Taiwan	PE	All	SDM	SL CR	Teachers	AS (1) - P	No choices	6
Cheon, 2010	28 (100% M)	College	S-Korea	Fitness class	All	SRQ	GL CR	Instructor	AS (3) - P	Controlling	6
Cheon, 2015	598 (54% F)	MS & HS	S-Korea	PE	AM	AI	SL CR	Teachers	ASIP (2) -T	As usual	9
Cheon, 2012	1430 (47% F)	MS & HS	S-Korea	PE	AM	PLOC PE	SL CR	Teachers	ASIP (2) - T	As usual	9
Cheon, 2016	1017 (57% F)	MS & HS	S-Korea	PE	AM	AI + PRS	SL CR	Teachers	ASIP (2) - T	As usual	9
Edmunds, 2008	56 (100% F)	21.3	UK	Fitness class	All	BREQ-2	CL CR	Instructor	AS (3) - P	As usual	10
Franco, 2017	53 (43% F)	13.4	Spain	PE	IM	IM (PLOC PE)	CL CR	Teachers	NS (3) - T	As usual	13
Fransen, 2018a	60 (100% M)	14.9	Belgium	Club sport	IM	IM (PLOC PE)	GL CR	Researchers	CS (1) - P	No feedback	<1
Fransen, 2018b	96 (100% M)	14.2	Belgium	Club sport	IM	IM (SMS)	GL CR	Researchers	CS (1) - P	No feedback	<1
Gillison, 2013	190 (M&F)	13.7	UK	PE	All	SIMS	CL CR	Researchers	AS (1) - P	Controlling	<1
González-Cutre, 2018	88 (59% F)	14.7	Spain	Extracur. PE	All	PLOC PE	SL CR	Teachers	NS (3) - P	As usual	9
Leptokaridou, 2016	54 (46% F)	11 & 12 y	Greece	PE	All	PLOC PE	CLCR	Teacher	AS (3) - P	Lack of AS	9
Mertens, 2018	84 (100% M)	16	Belgium	Club sport	IM	IM (PLOC PE)	GL CR	Coach	CS (1) - P	No feedback	<1
Moreno-Murcia, 2015	145 (51% F)	10.4	Spain	PE	IM	IM (PLOC PE)	CL CR	Teachers	AS (2) - T	As usual	9
Moustaka, 2012	35 (100% F)	44.3	Greece	Fitness class	All	BREQ-2	CL CR	Instructor	AS (2) - P	Lack of AS	8
Ntoumanis, 2017	317 (79% F)	39.9	Australia	Fitness class	All	BREQ-2	GL CR	Instructors	NS (3) - T	As usual	13
Prusak, 2004.	1110 (100% F)	MS	USA	PE	No IJ	SIMS	TL CR	Teachers	AS (1) - T	No choices	2
Sánchez-Oliva, 2017	836 (49% F)	12.8	Spain	PE	AM	CMEF	TL CR	Teachers	NS (3) - T	As usual	13
Sparks, 2017	383 (72% F)	13.2	Australia	PE	AM	PLOC PE	SL CR	Teachers	RS (1) - T	As usual	17

Note. *MS* = Middle school*; HS* =High School; *AM* = Amotivation*; IM* = Intrinsic motivation; *IJ* = Introjected regulation; *PLOC PE* = Perceived locus of causality scale in PE*; SDM* = Self-determined motivation scale*; SRQ* = Self-regulation scale*; AI* = Amotivation Inventory*; PRS* = Problematic relationship scale; *BREQ-2* = Behavioral regulations in exercise scale*; SIMS* = Situational motivation scale*; CMEF* = Questionnaire in motivation scale, *TL* = Teacher level, *SL* = School level*; GL* = Group level*; CL* = Class level, *CR* = Cluster randomization; *ASIP* = Autonomy-supportive intervention program*; AS* = Autonomy support, *CS* = Competence support, *RS* = Relatedness support, *NS* = Need support; 1 = One need*;* 2 = Two needs*;* 3 = Three needs; *T* = Trained; *P* = Planned; *w* = week*;*

Table 2.

Mean Effect Sizes

Authors	n (sex)	Hedge's *g* (95% CI)				
		Intrinsic motivation	Identified regulation	Introjected regulation	External regulation	Amotivation
Abula, 2018	258	.61 (.36, .86)	.06 (-.18, .30)	.27 (.02, .51)	-.09 (-.33, .16)	.04 (-.20, .29)
Chang, 2016	126	.54 (.19, .90)	.12 (-.23, .47)	.31 (-.04, .66)	-.03 (-.38, .32)	-.35 (-.71, -.00)
Cheon, 2010	28	1.59 (.74, 2.44)	2.72 (1.69, 3.75)	-1.63 (-2.48, -.77)	-.44 (-1.19, .31)	-1.07 (-1.86, -.28)
Cheon, 2015	598					-.12 (-.29, .04)
Cheon, 2012	1430					-.10 (-.21, -.00)
Cheon, 2016	1017					-.27 (-.39, -.15)
Edmunds, 2008	56	.20 (-.32, .73)	.38 (-.16, .91)	-.74 (-1.28, -.19)	-.07 (-.59, .46)	.28 (-.25, .81)
Franco, 2017	53	.49 (-.06, 1.04)				
Fransen, 2018a	60	.56 (.05, 1.08)				
Fransen, 2018b	96	.15 (-.25, .55)				
Gillison, 2013	190	.18 (-.11, .47)	.21 (-.07, .50)	-.01 (-.29, .28)	-.51 (-.79, -.22)	-.28 (-.57, .00)
González-Cutre, 2018	88	.16 (-.28, .61)	-.14 (-.59, .30)	-.20 (-.65, .24)	.33 (-.12, .77)	-.07 (-.51, .38)
Leptokaridou, 2016	54	1.83 (1.19, 2.46)	2.76 (2.01, 3.50)	.08 (-.45, .62)	-1.87 (-2.50, -1.23)	-2.32 (-3.01, -1.63)
Mertens, 2018	84	.00 (-.43, .43)				
Moreno-Murcia, 2015	145	-.22 (-.56, .12)				
Moustaka, 2012	35	2,22 (1.37, 3.06)	1.47 (.72, 2.22)	1.41 (.67, 2.15)	-2.17 (-3.01, -1.34)	-1.78 (-2.57, -1.00)
Ntoumanis, 2017	317	.46 (.20, .72)	.20 (-.06, .46)	.24 (-.02, .50)	.03 (-.23, .29)	-.05 (-.31, .21)
Prusak, 2004.	1110	-.10 (-.22, .01)	.11 (-.00, .23)		-.31 (-.43, -.19)	-.25 (-.37, -.13)
Sánchez-Oliva, 2017	836					-.01 (-.14, .13)
Sparks, 2017	383					.03 (-.17, .23)
Total *n*	6964	2700	2262	1152	2262	6526
Overall mean effect		.51 (.19, .83)	.72 (.08, 1.37)	-.00 (-.47, .46)	-.46 (-.93, .01)	-.35 (-.66, -.05)

Table 3.

Univariate Moderator Analysis for All the Motivational Regulations

	Intrinsic		Identified		Introjected		External		Amotivation	
Effect moderator	*k*	g (95% CI)	*k*	g (95% CI)	*k*	g (95% CI)	*k*	g (95% CI)	*k*	g(95% CI)
Setting										
PE	8	.4034 (-.0404, .8472)	6	.4830 (-.3533, 1.3193)	5	.0935 (-.5578, .7449)	6	-.3872 (-1.0200, .2457)	11	-.2953 (-1.2247, .0976)
Exercise and (Sport)	7	.6517 (.1543, 1.1492)	4	1.1136 (.0536, 2.1737)	4	-.1487 (-.9167, .6194)	4	-.5957 (-1.4083, .2168)	4	-.5636 (-1.0238, .4872)
Scope of need support										
1 supported	6	.2125 (-.2589, .6839)	3	.1478 (-.9858, 1.2813)	2	.1505 (-.8823, 1.1832)	3	-.2821 (-1.1640, .5997)	4	-.2115 (-.8228, .3997)
2 or more supported	9	.7221 (.3161, 1.1281)	7	.9863 (.2158, 1.7568)	7	-.0576 (-.6336, .5184)	7	-.5526 (-1.1581, .0530)	11	-.4181 (-.8016, -.0345)
Type of intervention										
Trained	5	.2392 (-.2923, .7706)	3	.1258 (-.9926, 1.2443)	2	.2521 (-.7491, 1.2534)	3	-.1241 (-.9594, .7111)	8	-.0929 (-.4475, .2616)
Planned	10	.6618 (.2626, 1.0610)	7	.9977 (.2333, 1.7622)	7	-.0906 (-.6570, .4758)	7	-.6256 (-1.2068, -.0444)	7	-.7001 (-1.1286, -.2717)*
Type of control										
As usual	6	.2850 (-.2203, .7903)	4	.1229 (-.8108, 1.0566)	4	-.0904 (-.8266, .6457)	4	.0478 (-.5719, .6676)	9	-.0400 (-.3260, .2460)
Need deprivation	9	.6724 (.2467, 1.0980)	6	1.1319 (.3464, 1.9174)	5	.0631 (-.6218, .7480)	6	-.8010 (-1.3283, -.2737)*	6	-.8375 (-1.2297, -.4453)***
Length of the study										
One session	4	.2174 (-.3993, .8341)	1	.2120 (-1.8988, 2.3228)	1	-.0088 (-1.4795, 1.4619)	1	-.5051 (-2.0556, 1.0454)	1	-.2844 (-1.5237, .9549)
At least 2 weeks	11	.6229 (.2422, 1.0035)	9	.7896 (.0687, 1.5106)	8	-.0086 (-.5508, .5335)	9	-.4623 (-.9967, .0720)	14	-.3662 (-.7056, -.0268)
Age, y										
<18	10	.3256 (-.0408, .6919)	5	.5732 (-.3825, 1.5288)	4	.0474 (-.6974, .7922)	5	-.4499 (-1.1520, .2523)	10	-.3310 (-.7220, .0599)
>18	5	.8969 (.3522, 1.4403)	5	.8921 (-.0834, 1.8676)	5	-.0560 (-.7433, .6314)	5	-.4845 (-1.2077, .2388)	5	-.4257 (-1.0146, .1632)

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

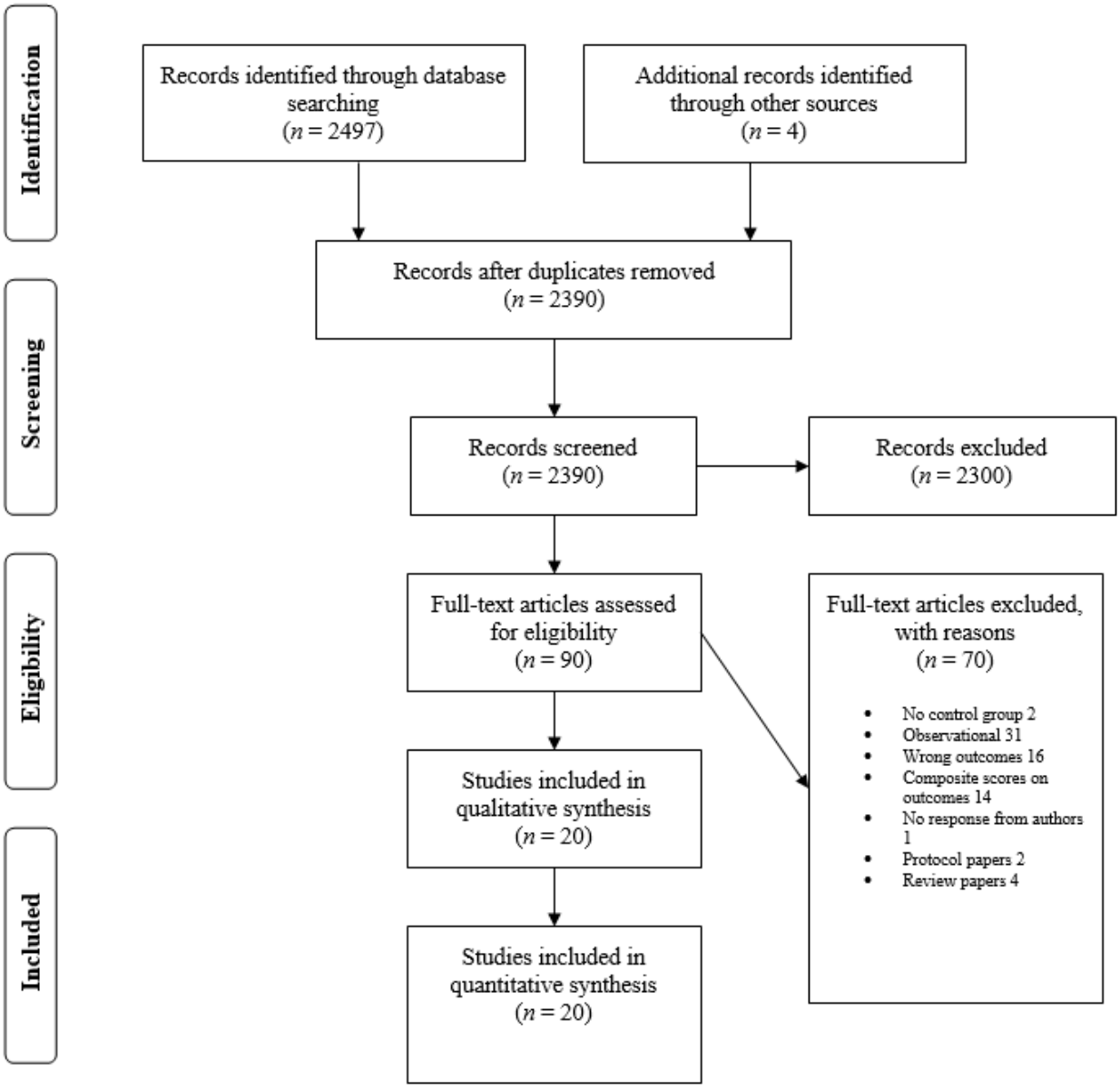


Figure 1. Flow diagram of study selection

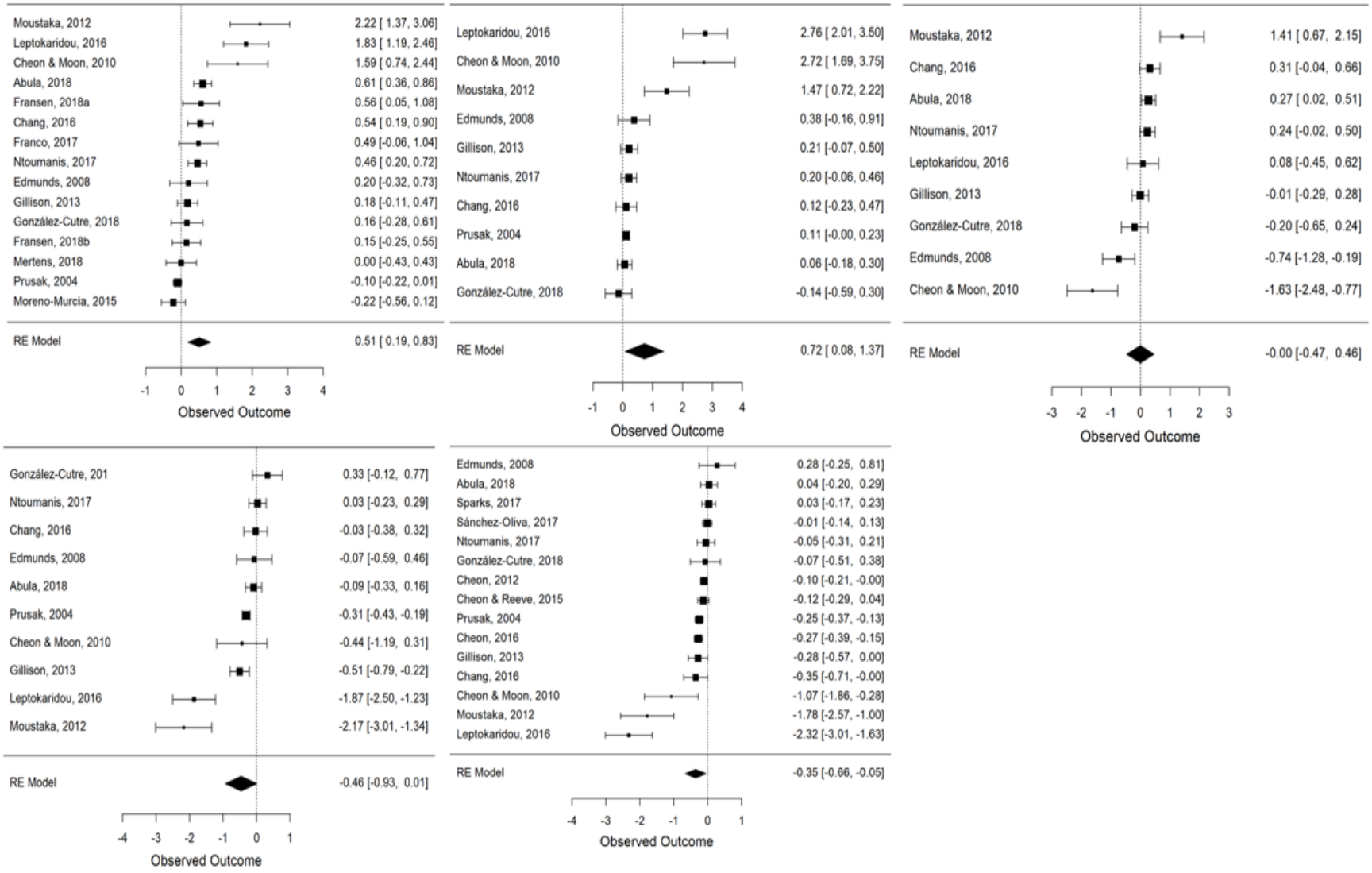


Figure 2. Forest plots of effect sizes from top left to bottom right: Intrinsic motivation, identified regulation, introjected regulation, external regulation, and amotivation . RE model refers to random effects model.

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	6
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	6-7
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	-
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	7-8
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	7-8
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	7
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	7-8
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	8
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	8-9
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	10
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	9
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	9-10

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	10
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	9-10
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Suppl.
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Figures
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	13-14
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	12-13
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	11-13
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	13-14
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	11-14
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	14-21
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	18-19
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	14-18
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	NA

Figure 3. PRISMA checklist

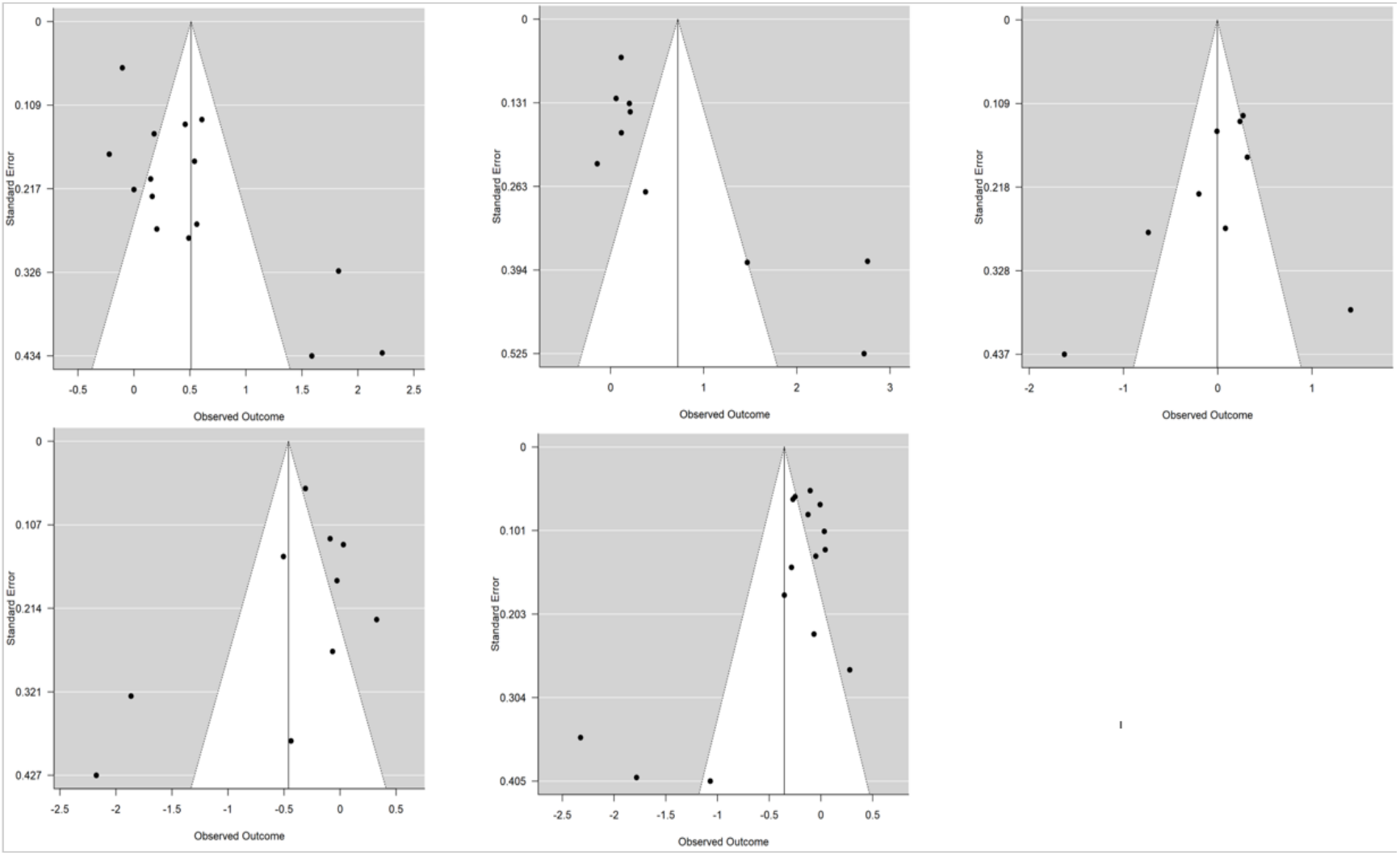


Figure 4. Funnel plots of effect sizes from top left to bottom right: Intrinsic motivation, identified regulation, introjected regulation, external regulation, and amotivation

CHAPTER 4

PSYCHOLOGICAL NEED-SUPPORTIVE INSTRUCTION IMPROVES SKILL PERFORMANCE, INTRINSIC MOTIVATION, AND ENJOYMENT: A CLUSTER RANDOMIZED STUDY[2]

[2]Manninen, M., Deng, Y., Hwang, Y. Waller, S., & Yli-Piipari, S. Submitted to *Psychology of Sport and Exercise.*

Abstract

Objectives: The first aim of this study was to test the efficacy of the self-determination theory centered need-supportive instruction on autonomous motivation, skill performance, enjoyment, and state anxiety among college students. The second aim of this study was to test whether the intervention impact followed the theoretical stipulation of the self-determination theory.

Design: A blinded cluster randomized trial.

Method: A sample was 59 college undergraduate students (M = 20.26±1.90; 75% female) allocated to the need-supportive and –depriving conditions. Motivational regulations, skill performance in juggling, enjoyment, and state anxiety were measured before and after two-weeks that involved the 5x45 min trial. The covariates assessed were time of the condition, gender, trait anxiety, causality orientations, and task interest.

Results: The intervention had a statistically significant between-group effect on intrinsic motivation ($F(1, 49) = 5.52$, $p < .05$, $\eta^2 = .10$), skill performance ($F(1, 48) = 9.23$, $p < 0.01$, $\eta^2 = 0.16$), and enjoyment ($F(1, 49) = 4.89$, $p < .05$, $\eta^2 = .09$), but no differences in state anxiety were detected. In addition, the path analysis showed a positive motivational pathway, with the intervention impacting intrinsic motivation ($\beta = .55$), integrated regulation ($\beta = .30$) and amotivation ($\beta = -.27$), which impacted positively skill performance ($R^2 = .42$) and enjoyment ($R^2 = .58$).

Conclusions: Need-supportive instruction is effective in improving intrinsic motivation, skill performance, and enjoyment when compared to need-depriving instruction. The instruction seemed to impact the skill performance and enjoyment through intrinsic motivation, integrated regulation, and amotivation.

Key words: physical education; autonomy; self-determination theory; motor skills; motor competency

1. Introduction

One of the most intriguing questions in human behavior is what motivates us and how motivation influences our performance, behavior, and experiences in life. This question is especially pertinent in the physical education (PE) domain as one of the main objectives of PE teachers is to facilitate learning experiences that facilitate students' lifelong physical activity habits (NASPE, 2004). This goal is of great public health importance, as PE is one of the most effective school-based approaches to increase children and adolescent physical activity (Bassett et al., 2013). PE can influence lifelong physical activity participation via multiple pathways (Institute of Medicine, 2013), such as motivating students, providing enjoyable experiences, and helping students to learn skills to participate in physical activities.

One of the current approaches to enhance the quality of PE is to examine the impact of instruction on student motivation and related outcomes (e.g., Lochbaum & Jean-Noel, 2015; name omitted for peer review, in review). Although observational studies have demonstrated the relationship between autonomous PE motivation and numerous positive PE-related outcomes (e.g., Aelterman et al., 2012; Standage, Duda, & Ntoumanis, 2006), there is a lack of experimental studies examining how different instructional styles in PE can impact students' motivation, performance, and affect (González-Cutre, Sierra, Beltrán-Carrillo, Peláez-Pérez, & Cervelló, 2014; Lonsdale et al., 2013; name omitted for peer review, in review). Thus, the overarching purpose of this study was to test the efficacy the Self-Determination Theory (SDT) -

based psychological need-supportive instruction on autonomous motivation, skill-performance, enjoyment, and state anxiety among college students.

SDT is a social-cognitive meta-theory of motivation with the central assumption that humans are innately active and in a search to achieve a unified sense of self (Deci & Ryan, 1985a, 2000). According to the theory, humans have three basic psychological needs, namely autonomy (a sense of being the origin of behavior), competence (feelings of capability and mastering one's environment), and relatedness (feeling of being connected to others in a meaningful way). SDT argues that the satisfaction of these needs leads to optimal motivation, growth, and well-being (Deci & Ryan, 2000).

A distinct feature of the SDT is that besides the quantity of motivation, the quality of motivation directs and regulates human functioning. This is mainly based on individuals' locus of control, i.e., the degree to which people believe that they have control over the outcome of events in their lives. SDT identifies six distinct motivational regulations: amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic motivation. These regulations are argued to vary in the continuum from intrinsic motivation to amotivation (Deci & Ryan, 2000). Intrinsic motivation (engaging in activity due to the inherent satisfaction driven from it) is the optimal and most autonomous and high quality form of motivation contrasted by amotivation – passivity and a total lack of intention. Between these two constructs lie four types of extrinsic motivation out of which external regulation represent the least amount of autonomy, and is characterized by behaviors acted for achieving reward or avoiding punishments (Deci & Ryan, 2008). In introjected regulation, the behavior is internalized but not truly accepted and is exemplified by acting due to feelings of guilt and pressure (Ryan & Deci, 2000). Identified regulation lies in the continuum next and is a relatively

autonomous form of motivation characterized by behaviors that are personally valued (Deci & Ryan, 2000). Integrated regulation - a total integration of the behavior to the personal values, goals, and needs of the individual - is the most autonomous form of the extrinsic types of motivation (Ryan & Deci, 2000). It has been theorized that the most autonomous forms of regulations, such as intrinsic motivation, integrated regulation, and identified regulation are adaptive, whereas the most controlling forms of motivation and amotivation are maladaptive styles of human functioning (Ryan & Deci, 2000).

According to the integrative model of motivation (Vallerand, 1997), the support, and consequent satisfaction, of the three psychological needs affects the quality and quantity of motivation, which further positively influences various cognitive, affective, and behavioral outcomes. In PE and physical activity contexts, an instructor can either support, disregard or thwart the needs, which in turn have consequences on participant motivation and outcomes such as skill performance, enjoyment, and state anxiety (Vallerand, 2000). Need-supportive instruction nurtures the psychological needs, whereas need-depriving instruction ignores them (Haerens, Aelterman, Vansteenkiste, Soenens, & Van Petegem, 2015). In addition, need-supportive instruction extends widely researched autonomy-supportive instruction (Cheon, Reeve, Lee, & Lee, 2018; Reeve & Jang, 2006) by not only supporting participant autonomy, but also emphasizing instructor decisions and behaviors that support the needs of competence and relatedness (Tessier, Sarrazin, & Ntoumanis, 2010). Need-depriving instruction, i.e., disregard of need-support, on the other hand, differs from need-thwarting instruction, which is characterized by deliberate undermining of the satisfaction of the basic needs by enhancing feelings of pressure (autonomy frustration), social alienation (relatedness frustration), and a sense of insufficiency (competence frustration) (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani.,

2011; De Meyer, Soenens, Aelterman, De Bourdeaudhuij, & Haerens, 2016; Vansteenkiste & Ryan, 2013).

Research derived from physical activity context has supported the notion that need-supportive instruction can increase intrinsic motivation and identified regulation (e.g., Franco & Coteron, 2017; Moustaka, Vlachopoulos, Kabitsis, & Theodorakis, 2012) and decrease amotivation (Leptokaridou, Vlachopoulos, & Papaioannou, 2016; Moustaka et al., 2012). However, the research on the impact of need-supportive instruction on integrated regulation has been scarce (name omitted for peer review, in review), and no causality has been shown in the few studies examining the relationship (Edmunds, Ntoumanis, & Duda, 2008; González-Cutre, et al., & Cervelló, 2018). The majority of the correlational evidence shows a negative relationship between perceived need-supportive instruction and external regulation and introjected regulation (Lochbaum & Jean-Noel, 2015).

Although it has been theorized that teacher's need-depriving behaviors can lead to a lack of need satisfaction, suboptimal motivation, and other maladaptive outcomes (Cheon, Reeve, Ntoumanis, 2018; Vallerand, 1997), previous research has primarily examined only autonomy-thwarting instruction (e.g., Haerens et al., 2015). Autonomy-thwarting instructional style has been found to positively correlate with maladaptive motivational outcomes of amotivation and controlled motivation and negatively with autonomous motivation (Batholomew et al., 2018; Haerens et al., 2015).

Meta-analytic research summarizing the research evidence derived from the interventions with experimental and control conditions has shown need-supportive interventions impacting mainly intrinsic motivation and amotivation (inverse impact) (name omitted for peer review, in review). The effect has, however, been shown to depend to some extent on the training of

instructors and the number of needs that were manipulated (one or two+ needs) (name omitted for peer review, in review). In addition, [name omitted for peer review]'s (in review) showed that the evidence regarding need-supportive interventions was heterogeneous partly due to variation in design and variability in the operationalizing the need-supportive instruction (name omitted for peer review, in review).

Although an essential aspect of PE (NASPE, 2004), a lack of studies examining need-supportive instruction and motor performance and motor learning is evident (see Behzadnia, Mohammadzadeh, & Ahmadi, 2017 for an exception). However, two studies suggests that enhanced perceived competence manipulated by positive feedback leads to better basketball performance among teenage adolescents (Fransen, Boen, Vansteenkiste, Mertens, & Vande Broek, 2018; Mertens, Boen, Vande Broek, Vansteenkiste, & Fransen, 2018), and a third study showed that college students' badminton skills can be improved by autonomy-supportive teaching compared to conventional teaching strategies (Behzadnia et al., 2017). In addition, a line of studies with some similarities to SDT has been conducted using a motor learning theory called Optimal Performance Through Intrinsic Motivation and Attention for Learning (OPTIMAL; Wulf & Lewthwaite, 2016; Lewthwaite & Wulf, 2017). Experimental research following this theory has shown that increased perceived competence manipulated by reducing performance-criteria (Chiviacowsky, Wulf, & Lewthwaite, 2012), as well as autonomy-supportive instructional language (Hooyman, Wulf, & Lewthwaite, 2014), lead to improved motor learning in university students. Similarly, it has been shown that environments allowing self-controlled practice lead to increased motor learning (Sanli, Patterson, Bray, & Lee, 2013), hypothetically due to the learner's increased responsibility for learning, improved self-

confidence, and the opportunity to match practice strategies with their own preferences (Janelle, Barba, Frehlich, Tennant, & Cauraugh, 1997; Wulf & Lewthwaite, 2016).

On the affective outcomes, the research has shown perceptions of need-supportive instruction to relate positively to positive psychological outcomes and to have no correlation with negative psychological outcomes (Lochbaum & Jean-Noel, 2015). More specifically, need-supportive instruction has been shown to improve perceived enjoyment in an exercise setting (Edmunds et al., 2008), but there is no evidence on the effect of need-supportive instruction on improved psychological states such as lower state anxiety in physical activity. One study by Black and Deci (2000) showed that autonomy-supportive instruction reduced university students' anxiety levels during an organic chemistry course. In PE, however, research has shown that the middle school students with "high motivation profile" experience more enjoyment and higher state anxiety compared to the students with "low motivation profile" (Yli-Piipari, Watt, Jaakkola, Liukkonen, & Nurmi, 2009).

Several gaps in the motivation literature warrant the current study. Previous studies have suggested that there is a need for studies employing a rigorous experimental research design and careful and transparent conceptualization of the dose and content of the intervention (Gillison Rouse, Standage, Sebire, & Ryan, 2019; name omitted for peer review, in review). This study applied a cluster randomized trial design, carefully operationalizing the need-supportive and depriving strategies, and controlling the task and teacher effect. In addition, a set of a priori covariates were controlled in the analyses, and treatment fidelity was analyzed. In addition, most of the experimental need-supportive studies on skill performance have been conducted in a laboratory setting and have manipulated only a single dimension of need-support. Better outcomes may be realized using a more comprehensive and authentic approach, which

manipulates all three psychological needs and conducts the intervention in a real physical activity setting with meaningful skills. Finally, this study expanded the efficacy testing by looking into change patterns, and whether the change followed the central theorization of the SDT. The structural equation modeling approach enables to determine the pathways that impact the outcomes by controlling the complex relations of the variables. Thus, the first aim of this study was to test the efficacy of the SDT-centered need-supportive instruction on autonomous motivation, skill-performance, enjoyment, and state anxiety among college students. The second aim of this study was to test whether the intervention impact followed the theoretical stipulation of the SDT.

2. Method

2.1. Study Design and Participants

This study was a cluster randomized trial, and the participants were blinded (masked) from knowing which intervention they received. The duration and dose was two weeks and 3.75 hours of contact time and the intervention was delivered by the first author. A sample consisted of 59 undergraduate students (M = 20.26±1.90; 75.0% females) participating in a university's basic PE course, entitled Fitness for Life (two courses in Fall and two in Spring). All students in the participating university are required to complete one course of basic PE as part of their undergraduate degree and they selected the Fitness for Life course freely out of several options. All participating students were recruited during the first lesson of the course. Only participants who could not juggle were allowed to participate in the study. The participant's skill level was tested during the first lesson screening process. Initially, 69 eligible students agreed to participate in the study, but two dropped out during the first week of the study. Further, eight students were excluded from the analyses due to various other reasons (see Table 1). The study protocol was

approved by the Institutional Review Board of the University of [name omitted for peer review], and all participants provided written consent before the study,

2.2. Randomization

The sample was randomized by different classes as a unit. The randomization was completed using the website (www.randomizer.org), and the classes were allocated to the need-supportive and need-depriving conditions. In total, the need supportive-condition included 28 participants (M = 19.68±1.68; age range = 17-23; 64.3% females), whereas the need-depriving condition comprised 31 participants (ranging from of age (M = 20.74± 1.44; age range = 19-24; 83.9% females). The full details of the participants' characteristics are displayed in Table 1.

2.3. Intervention and Procedure

To control the instructor effect, one instructor taught all the lessons of the study. The instructor was a 28-year-old male with three years of experience teaching public school PE. As a Ph.D. candidate in PE pedagogy with the specialization in the SDT, the teacher was well aware of the theory, empirical findings, and practical implications of the SDT and need-supportive teaching. The intervention was conducted during the Fitness for Life classes, with two classes undertaken in fall 2018 (met 3-times/wk) and two classes in spring 2019 (met 2-times /wk). Two need-supportive and two need-depriving conditions were randomized.

The research consisted of five 45 min juggling lessons as well as pre- and posttests on the outcome variables. In the three times/w groups, the five lessons were held in 11 days, whereas in the two times/w groups, the lessons were held within 15 days. Prior to the testing, both groups were asked to watch a two-minute 13-second video clip, in which the instructor of the course explained and demonstrated the future skills and the content of the five juggling lessons. Next, participants responded to the online questionnaires tapping on their task interest, causality

orientations, instructor's need supportive strategy, motivational regulations, enjoyment, and trait, and state anxiety. Finally, participants' pre-skills on the future motor skill were tested. After the intervention, the participants were tested using a similar testing protocol.

The lessons commenced with a standardized 10-minute warm-up (attendance roll included) segment not relating to the practiced skill to allow students who came late to the class not to miss the skill component of the lesson (only one student missed a part of the skill segment during the whole study). The warm-up was followed by a 25 min skill-learning section using a standardized structure. Each of the three first lessons introduced a new technique of 3-ball juggling and progressive drills to learn the techniques, whereas the last two lessons were planned mainly to practice the full techniques of the three juggling skills (full lesson plans are provided in the supplemental files). At the end of each lesson, the participants practiced freely for 10-minutes without the instructor's presence. At this time, the instructor was outside of the aerobic studio located in a place visible to the students. Participants were given juggling equipment for the entire length of the study.

2.4. The content of the conditions

Four groups were randomly allocated to the need-supportive and need-depriving instruction conditions. Both conditions followed the same dose, content, and lesson structure. The instructional styles manipulated instructor's a) communication style, b) movement in the studio and c) provision of flexibility regarding the practiced drills in 10 instructional strategies guided by SDT (Table 2.). Need-supportive instruction focused on nurturing the psychological needs, whereas need-depriving instruction simply neglected the same basic needs. In this study, we did not aim to facilitate need-frustration by implementing need-thwarting strategies, i.e., chaotic class management and behaviors including extensively controlling language, as we argue

that it is ethically questionable to teach real students in that manner (De Meyer et al., 2014). Instead, we manipulated the instructional environment by delivering need-depriving instruction; in other words, more realistic instructional behaviors, which display indifference for the students' need satisfaction but do not actively thwart them. The organization of the lessons in the two conditions followed the same lesson plans. The teacher also demonstrated the skills, offered the same technical cues to the groups the same way, and followed the same minute-to-minute schedule as it related to task progression.

2.5. Measures

2.5.1. Primary outcomes

Juggling skill performance. Skill performance was measured using traditional three-ball juggling tests: the Basic, Reverse, and Mills Mess Cascade. The tests were conducted with three tennis balls in a standing position in a 1m x 1m designated area. The participants did not have the chance to warm-up/practice juggling before the tests. A single score from one technique was the total of successful catches excluding the catch of the very first ball thrown. If a ball was dropped, it rotated in a wrong formation, or the participant moved out of the designated area, the trial was terminated with a score. The participants had two trials with each technique, and an average score was reported as a subtest score. The aggregated scores for each of the three subtests were then added together to get a composite and final score for juggling performance. Students who scored 0.5 (at least two successful catches on one of the trials) or more in the pretest (n = 2) were excluded from the juggling performance analyses. The lead author, an experienced circus teacher, and an outside circus professional and teacher reviewed the face validity of the tests.

Behavioral regulations. The Behavioral Regulations Questionnaire-3 (Markland & Tobin, 2004; Wilson, Rodgers, Loitz, & Scime, 2006) was used to measure participants' behavioral

regulations toward the juggling lessons. The scale was originally prepared for exercise and later modified for the PE/Sport contexts. For this study, we revised PE/sport statements to focus on circus skill training and the PE course specifically. The participants were asked to respond to the following stem: "I am going to take part in the basic PE course and its juggling module because (pre-test)" / "Thinking about the five last lessons of the course (juggling), I have taken part in this PE course because (posttest)." Twenty-four statements reflecting the participants' intrinsic motivation integrated, identified, introjected, and extrinsic regulation, as well as 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 answered to 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 internal consistency of the scale have been found to be acceptable (Markland & Tobin, 2004). In this study the internal consistencies of the pre- and post-test scales were for amotivation .78 and .83, for external regulation .70 and .67, for introjected regulation .78 and .83, for identified regulation (one item removed) .69 and .75, for integrated regulation .73 and .77, and for intrinsic motivation .80 and .93.

Enjoyment. The participants' enjoyment was assessed with the Physical Activity Enjoyment Scale (Kendzierski & DeCarlo, 1991) assuming a unidimensional structure of enjoyment. The scale consists of 18 items, which the participants were asked to rate 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 was developed for college students and has demonstrated good internal consistency, test-retest reliability, and criterion validity among this population (Kendzierski & Carlo, 1991). For this study the internal consistency of the pre- and post-test scales were excellent (Cronbach's α.96 and .92).

State anxiety. The levels of the students' state anxiety toward the course's lessons were assessed using an adapted 20-item version of the State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The inventory includes self-report measures for state (e.g., "I feel nervous") anxiety. The participants rated their levels of anxiety using a 7-point Likert-scale (1 = *very untrue for me*; 7 *very true for me*) after reading the following stem: 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). In this study, the internal consistency of the scale was excellent (Cronbach's α.95 and .95).

2.5.2. Exploratory outcomes

In-class free-choice practice time. Participants' time spent in practicing juggling during the pre-meditated free-choice practice time was observed by a modified version of the systematic observation method SOPLAY (System of Observing Play and Leisure Activity in Youth; McKenzie, Marshall, Sallis, & Conway, 2000) on three randomly selected lessons (same lesson for each condition). SOPLAY utilizes momentary time sampling to record participants' behavior whether they are practicing or not practicing. Two independent observers did five concurrent

observation scans of the participants' behavior (practicing/not practicing) during the 10 minutes (scans started every two minutes) of the free-choice period. The interrater reliability measured with an intra-class correlation (ICC [2,1]; two-way random model; absolute agreement) over twelve observations was excellent (.96). The rate of the participants' activity 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).

Out-of-class practice time. Daily out-of-class practice time was measured using self-report recall log. The recall log asked the participants how many minutes of daily practice they conducted on each day between the pre-test and posttest. The participants returned the log on the posttest day.

2.5.3 Covariates

Situational interest. Participants' interest in juggling was assessed with the total interest subscale from the Situational Interest Scale (Chen, Darst, & Pangrazi, 1999). The scale consists of four items (e.g., "this activity is interesting") that were scored on a 7-point Likert scale (1 = *strongly disagree*; 7 = *strongly agree*) after reading the following stem: "What do you think about the activity (juggling) presented in the video?" The scale has shown to be internally consistent and to have good validity using confirmatory factor analysis (Chen et al., 1999). The internal consistency of the scale was excellent in this study (Cronbach's alpha .91).

Causality orientations: The General Causality Orientations Scale (Deci & Ryan, 1985b) was used to assess participants' orientations to respond to different situations. Autonomous orientation refers to the tendency to find opportunities for self-determination. Control orientation refers to people's inclination to select and interpret events as being controlling, for example, because they feel that they should. The scale consists of 12 vignettes (e.g., "You are embarking

on a new career. The most important consideration is likely to be") and 24 items (e.g., "How interested you are in that kind of work" and "Whether there are good possibilities for advancement." The participants' rated on a 7-point Likert scale (1 = *very unlikely*; 7 = *very likely*) how likely they would be to respond to the situations in two different ways. Each of the two subscales was added together to get a composite score for the two orientations. The scale has shown to be internally consistent and temporally unchanging. This 7-point Likert scale based questionnaire has shown to have good validity and reliability (Koestner, Bernieri, & Zuckerman, 1992). In this study, the internal consistencies for the scales of autonomy orientation (.80) and control orientation (.76) were good.

Trait anxiety. The levels of the students' trait anxiety were assessed using an adapted version of the trait anxiety section of the State-Trait Anxiety Inventory (Spielberger et al., 1983). The inventory includes 20-items (e.g., "I feel nervous and restless") representing the level of participants' trait anxiety. Participants 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 good internal consistency (r =. 89) as well as good test-retest reliability (r = .88) (Barnes et al. 2002). The concurrent validity of the scale has also been good when comparing to the scale of other measures of anxiety (Spielberger, Sydeman, Owen, & Marsh, 1999). In this study, the internal consistency of the scale was excellent (Cronbach's α.91).

2.5.4. Fidelity measure

Instructor adherence. A systematic observation rating system based on SDT was used to assess teacher's adherence to need-supportive and need-depriving instructional strategies (Haerens et al., 2013). The observation checklist comprised of 10 specific behaviors categorized into three dimensions of autonomy-support (e.g., provision of choice), structure/competence-

support (e.g., provision of feedback), and involvement/relatedness-support (e.g., interpersonal involvement). At a time, two trained raters (blinded to the conditions) rated the described dimensions of the teachers instruction every seven minutes (five times in total) during the warm-up and the skill sections of the lesson using a 4-point frequency scale (0 = *never observed*, 1 = *sometimes observed*, 2 = *often observed*, 3 = *observed all the time*. The first interval (enroll and most of the warm-up) was excluded from the analyses as this interval on some classes included only a short amount of instruction. The observations were done on two of the five lessons. Interrater reliability of the observation checklist over eight observed lessons was adequate (Two-way random model; 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 students' perceived need-support was measured with the Perceived Environmental Supportiveness Scale (Markland & Tobin, 2010). The scale comprises of 15 items with five items evaluating each of the three dimensions of need-support. The participants were asked to respond to 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), "help me feel confident" (structure). The items were rated on a 7-point Likert scale (1 = *strongly disagree*; 7 = *strongly agree*). The scale has shown to be valid and internally consistent (Markland & Tobin, 2010). In this study the internal

consistencies of the scales for autonomy support (.93 and .91), structure (.93 and .93), and teacher involvement (.93 and .92) were excellent.

2.6. Sample size

Statistical power was calculated for the repeated measures analysis of variance using G*Power 3.1.2. Based on [name omitted for peer review]'s (in review) findings, we conservatively estimated 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 was adjusted by design effect (Kish, 1965) of 1 + (m-1) x ICC, where m is the sample size of each cluster (15 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 + (15–1) x .05 = 1.70. Thus, the total minimum sample was 1.70 x 34 = 58.

2.7. Statistical analyses

Descriptive and correlations data of the study variables are presented in Table 3. Cronbach alphas were used to test the internal consistencies of the measured constructs and ICC (2,1) for the interrater reliability of the fidelity checks for instruction style adherence and the free-choice practice observation reliability. Group differences at the pretests were tested with a one-way analysis of variance. To compare the effects of the 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 groups effects on the outcome variables, an analysis of covariance was conducted with trait anxiety, task interest, causality orientations, gender, time (fall and spring), and the pretest scores as covariates. Partial eta squared (η^2) was used as the measure of effect sizes for the between-group differences.

To test whether the intervention effect followed the theorized model, the path analysis using changes scores was conducted (Fig. 1). The change scores were residual scores from the linear regression analyses. Change score analysis approach was used over the latent strategy due to the variance of the skill pretest being zero (Pedersen, Halvari, & Williams, 2018). This was due to the exclusion criteria, which only allowed participants with no juggling skills to participate in the study. First, a zero order correlational analysis of the change scores was performed. Second, a dummy (0 = need-supportive instruction, 1 = need-depriving instruction) intervention variable and change scores were set up to the model to test the theorized change model. In the analysis, all the correlating change scores were allowed to correlate to each other. Finally, the regressive paths from the covariates of gender, time (whether intervention followed by the 2- or 3-times/w schedule), trait anxiety, autonomous orientation, controlling orientation, and task interest were estimated to each variable.

All analyses were performed using the SPSS (version 22) and Mplus (Version 7.1; Muthén & Muthén, 1998–2013). Alpha was 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). A model fits the data well when the *p*-value associated with the chi-square test is non-significant. In addition, if the values of the Bentler comparative fit index (CFI; Hair, Anderson, Tatham, & Black 2010) and Tucker-Lewis index (TLI; Awang, 2012) are above .95 and the values of the Root Mean Squared Error of Approximation (RMSEA) are below .06, a good fit between the hypothesized model and the observed data exists (Awang, 2012; Hair et al., 2010).

3. Results

3.1. Preliminary analyses

3.1.1. Missing values and normal distribution of the scores

Based on the outlier labeling rule (Hoaglin, Iglewich, & Tukey, 1986) four participants were excluded from all the analyses for having several outlier values on the psychological and performance measures. Moreover, two single values from the psychological measures and two values from juggling performance posttests were omitted from analyses due to their outlying values based on the same criteria. One pre- and posttest questionnaire could not be analyzed due to imperfect completion of the questionnaires.

Skewness and kurtosis values of the 30 examined variables for both groups suggested only slight deviation from normality (all values less than $\left|1.6\right|$) except for minutes of average practice outside of class for the need-supportive group (Table 3). Due to the significant bivariate correlation between gender and the juggling performance at posttest, gender was added as a covariate along with the five *a priori* moderators of time, task interest, trait anxiety, autonomy orientation and control orientation in the between groups and path analyses.

3.1.2. Reliabilities and descriptive statistics

Reliability as internal consistency statistics, means, standard deviations and bivariate correlations were computed for all the variables for both conditions (Table 3). Except for the post-measure of external regulation (.67) and for the pre-measure of identified regulation (.69) being marginally acceptable, the internal consistency of the scales was acceptable (Cronbach's $\alpha > .70$). To test the reliability of participants' free-choice activity measurements and the observed teaching adherence measures, ICC (2,1) were computed. The ICC for the free-choice activity observation was .96 and .71 for the teaching adherence.

3.1.3. Baseline results

The two conditions differed significantly in age ($t(57) = -2.62$, $p = .011$), with need-depriving group being older. There were no between-condition differences in gender distribution $\chi^2(1) = 2.98$, $p = .084$, ethnicity ($\chi^2(4) = 4.30$, $p = .367$) nor any of the outcome and covariate variables at baseline. Further, there were no differences between the conditions in self-reported out-of-class practice time ($U(56) = 315.5$, $p = .105$) nor absences ($t(57) = .24$, $p = .808$).

At baseline, there were no statistically significant differences between time, i.e., whether the participants followed a 2- or 3-times/w schedule in any of the covariates or main outcomes except for self-reported out-of-class practice ($U(56) = 832.0$, $p = .001$, with the 3-times/w group practicing more out-of-class. The 2-times/w group was older than the 3-times/w ($t(57) = -2.87$, $p = .006$), but there were no differences regarding gender $\chi^2(1) = 1.34$, $p = .248$ nor ethnicity ($\chi^2(4) = 2.97$, $p = .562$) between the groups.

Based on the observations, on average 87.1% of the students in the need-support condition were actively practicing during the free-choice activity across five measurement points, whereas in the need-depriving condition the percentage was 77.8%.

3.2. Fidelity measures

Based on the observed ratings of instructor's provision of need-support, there were no statistically significant differences between the conditions in the instructor provision of the goals and overview of the lesson $t(6) = .85$, $p = .426$, instructor support of ownership $t(6) = 1.06$, $p = .329$, and instructor use of names $t(3.043) = 3.04$, $p = .055$. Favoring the need-support condition, there were, however, between-group differences in the instructor provision of task difficulty and differentiation $t(6) = 5.31$, $p = .002$, instructor provision of positive and informational feedback ($t(6) = 4.99$, $p = .002$), instructor provision of choice $t(6) = 11.22$, $p < .001$, instructor provision of value and relevance $t(6) = 3.37$, $p = .015$, instructor use of empathetic language $t(6) = 4.43$, $p =$

.004, instructor involvement $t(6) = 8.03$, $p < .001$, and instructor physical distance $t(6) = 4.02$, $p = .007$. On the student perceptions, there were significant differences between the conditions in the perceptions of autonomy-support $F(1) = 7.13$, $p = .010$, structure/competence-support $F(1) = 4.74$, $p = .034$, and interpersonal involvement/relatedness-support $F(1) = 4.55$, $p = .038$, with the students in the need-supportive condition perceiving more need-support.

Both the objective assessments and students' self-reports showed that the instructor was able to adhere to the preplanned instructional strategy in both conditions. Firstly, compared to the students in the need-depriving condition, the students' in the need-supportive condition perceived the instructor to support more their needs of autonomy, relatedness, and competence from pretest to posttest. Secondly, the instructor was observed to use more need-supportive strategies and behaviors in seven out of ten possible categories.

3.3. Primary outcomes

3.3.1. Between-group differences

The results showed a significant difference between the conditions on intrinsic motivation $F(1, 49) = 5.52$, $p = .023$, $\eta^2 = .10$, skill performance, $F(1, 48) = 9.23$, $p = .04$, $\eta^2 = .16$, and enjoyment $F(1, 49) = 4.89$, $p = .032$, $\eta^2 = .09$. There were no statistically significant differences between the conditions on state anxiety $F(1, 49) = .00$, $p = .977$, amotivation $F(1, 49) = .79$, $p = .378$, external regulation $F(1, 49) = .38$, $p = .539$, introjected regulation $F(1, 49) = 3.36$, $p = .073$, identified regulation $F(1, 49) = 3.24$, $p = .078$ nor integrated regulation $F(1, 49) = 2.38$, $p = .129$. The mean level comparisons showed participants in the need-supportive condition to have greater intrinsic motivation and enjoyment compared to the need-depriving condition. In addition, the improvement in the skill test was greater in the need-support condition than in the need-depriving condition (Table 4.).

3.3.2. Test of the theoretical model

The zero order correlational analysis on the change scores showed that the need-support variables were positively associated with intrinsic motivation, integrated regulation (no relation to competence support), identified regulation, and enjoyment. The need-support variables were negatively related with amotivation and state anxiety. Enjoyment was positively correlated to identified regulation, integrated regulation, and intrinsic motivation, whereas state anxiety was negatively linked to identified regulation, intrinsic motivation, and enjoyment and positively to amotivation. Skill performance was positively linked to integrated regulation, intrinsic motivation, and enjoyment, and negatively linked with introjected regulation.

The hypothesized path model had an acceptable data fit: $\chi^2(24) = 72.15$, $p < .001$, CFI = .90, TLI = .91, RMSEA = .074, CI 90% [.05, .09]). As hypothesized, the intervention had a positive effect on all three variables of perceived need-support (β ranging between .30 and .37). In addition, perceived autonomy support had a positive effect on intrinsic motivation (β = .55[.22]) and integrated regulation (β = .45[.21]) and a negative effect on amotivation (β = -.83[.21]). Perceived relatedness support had a positive effect on intrinsic motivation (β = .39[.14]) and integrated regulation (β = .37[.12]), and negative effect on extrinsic regulation (β = -.83[.30]) and amotivation (β = -.59[.27]). Furthermore, intrinsic motivation (β = .37[.14]) and integrated regulation (β = .35[.12]) had a positive effect on skill performance, whereas the effect of introjected regulation (β = -.28[.13]) and amotivation (β = -.38[.17]) on skill performance was negative. Finally, amotivation (β = -.23[.12]) had a negative effect on enjoyment, whereas intrinsic motivation (β = .27[.14]) had a positive effect on enjoyment. The hypothesized model explained 42%, 58%, and 39% of the variance, skill performance, enjoyment, and state anxiety,

respectively. The effect from the covariates to the independent and dependent variables are presented in Table 6.

4. Discussion

This study aimed to test the efficacy of the SDT-centered need-supportive instruction on autonomous motivation, skill-performance, enjoyment, and state anxiety among college students. In addition, this study aimed to test whether the intervention impact followed the theoretical stipulation of the SDT. The results supported partly the central tenets of the SDT showing that need-supportive instruction improved participants' intrinsic motivation, skill performance, and enjoyment. In addition, a positive pattern emerged in which the intervention impacted intrinsic motivation which, in turn, impacted skill performance and enjoyment.

In line with the central tenets of the SDT (Deci & Ryan, 1985a; 2000), our study showed that need-supportive instruction was beneficial in improving participant intrinsic motivation. These findings support the findings of the previous meta-analytic reviews (Lochbaum & Jean-Noel, 2015; name omitted for peer review, in review) and experimental studies (Moustaka, 2012; Fransen et al., 2018). This effect was smaller than previously reported (name omitted for peer review, in review), which is likely due the limited power of our sample. These previous studies have shown that need-supportive instruction, with supporting one or more needs, has a positive impact on adaptive motivation. On the other hand, this study did not find any effect on the other motivational regulations. This finding conflicts with the findings of the meta-analysis of [name omitted for peer review] (in review) and previous studies (Cheon, Reeve, & Song, 2016), that have shown need-supportive instruction to have a moderately adverse effect on amotivation. Surprisingly, need-support did not affect identified regulation, although this relationship has been demonstrated consistently (Texeira, Carraca, Markaland, Silva, & Ryan, 2012). We did, however,

find an indication of need-support positively impacting identified regulation, although the effect was not strong enough to be statistically significant.

This study showed need-supportive instruction to be more beneficial for skill performance compared to need-depriving instruction. The effect was moderate, showing that need-supportive condition improved their performance more than need-depriving. In addition, the participants in the need-supportive condition practiced more frequently during the free-choice periods compared to the students in the need-depriving condition. The finding regarding improved skill adds to the scarce existing literature providing early evidence on the efficacy of need-supportive instruction on skill performance. These findings support the findings that have shown autonomy-support to improve self-reported skill learning (Cheon, Reeve, & Moon, 2012) and badminton skill performance (Behzadnia et al., 2017). In addition, our results, in part, corroborate the findings derived applying the OPTIMAL theory of motor learning (Chiviacowsky et al., 2012; Hooyman, et al., 2014). These findings have suggested that the perceptions of autonomy and competence can lead to enhanced skill learning (Wulf & Lethwaite, 2016). The findings of present this study are novel with a contribution to the literature in the area of need-supportive instruction and skill performance. The usage of juggling as a skill was beneficial as it abled us to objectively measure participants' improvement in performance and to control participants' baseline skills.

Finally, our findings corroborated the previous findings that have shown need-supportive instruction to increase participant enjoyment (Edmunds et al., 2008; Leptokaridou et al., 2016; Sparks, Lonsdale, Dimmock, & Jackson, 2017). Although the previous findings have shown need-supportive instruction to relate negatively to maladaptive emotions (Black & Deci, 2000), our study did not find any indication that need-supportive instruction decreases or need-depriving increases state anxiety. The results, however, are in line with the recent meta-analytic findings, in

which negative affect have not found to correlate with PE students' perceptions of autonomy-supportive instruction (Lochbaum & Jean-Noel, 2015). Our results are novel, as state anxiety has not been thoroughly examined. This line of study is potentially important, considering how negatively anxiety may affect performance (Nieuwenhuys & Oudejans, 2017; Runswick, Roca, Williams, Bezodis, & North, 2018). In addition, the central assumption of the SDT is that need-thwarting undermines human functioning and wellbeing (Deci & Ryan, 2000; Vansteenkiste & Ryan, 2013). It might be that merely need-depriving conditions and the resulting need dissatisfaction are not potent enough to make college students anxious about skill performance implemented during Basic PE. Maybe the effect of need-depriving instruction is stronger during the tasks and environments that have a greater meaning for participants, such as sports for elite competitors (Hodge, Lonsdale, & Ng, 2008). Alternatively, it may be that the effect of instruction, and the resulting need-satisfaction or dissatisfaction will be more evident over a longer duration.

The results of the path analysis partly supported the postulations of the SDT as well as prior findings (name omitted for peer review, in review). Our study showed that the intervention had a positive effect on students' perceptions of autonomy-, competence-, and relatedness-support. In addition, perceived autonomy- and relatedness-support impacted positively intrinsic motivation, integrated regulation, external regulation (relatedness only), and amotivation (inverse relationship). Interestingly, there was no relationship between the change in perceived need-support and identified and introjected regulations. Similarly, there was no relationship between perceived competence-support and motivational regulations. This was partly expected as the taught lessons were designed to be structurally similar in both conditions. However, the need-supportive condition contained higher levels of positive feedback and offered more opportunities to practice at an appropriate skill level. It is reasonable to conclude that the highly structured

environment in both conditions overshadowed the effect of the other competence-support strategies on the motivational regulations. In addition, intrinsic motivation, integrated regulation, and amotivation (inverse effect) predicted improvements in performance, and intrinsic motivation and amotivation (inverse effect) predicted enjoyment (integrated regulation predicted skills only). These findings on intrinsic motivation and amotivation supported the efficacy findings of this current study as well as the previous meta-analytic findings (Lochbaum & Jean-Noel, 2015; name omitted for review, in review), corroborating the notion that need-supportive instruction relates to skill performance and enjoyment via the endpoints of the motivational continuum as stipulated by SDT (Deci & Ryan, 2000).

Our path analysis suggested that integrated motivation may have a similar positive effect on skills and enjoyment as intrinsic motivation, although this was not identified in our efficacy analysis. Additionally, introjected regulation had a negative independent link to skill performance. This finding indicates that perceptions of guilt and shame relating to participants' success in the juggling course may have negatively impacted the skill performance. Finally, this path analysis supported our efficacy findings showing that need-supportive instruction did not impact state anxiety.

In conclusion, this study showed that need-supportive instruction was effective in improving participants' intrinsic motivation, skill performance, and enjoyment. Moreover, the effect on enjoyment and skill performance seems to be mediated by enhanced intrinsic motivation and integrated regulations (only for skill performance) and decreased amotivation, which in turn are mediated by perceptions of autonomy and relatedness support.

Strengths and limitations

This study had many strengths. Firstly, this study employed a rigorous experimental research design, careful transparent conceptualization of the dose and content of the intervention as well as a control for the teacher effect. In addition, we controlled possible confounding variables previously showed relate to the study outcomes (Gillison et al., 2019). Finally, this study expanded the efficacy testing by looking into the change patterns, and whether the change followed the central theorization of the SDT. This enabled us to determine the pathways that impact the outcomes by controlling the complex relations of the variables.

Despite the strengths of the study, this study is not free of limitations. Firstly, the number of participants in the conditions is relatively small. Although sufficient for efficacy testing, this study lacked in power as it relates to path modeling approach. It may be that some paths would have been statistically significant, if powered adequately. This is, however, unlikely considering the similarity of the results derived from the efficacy and path analyses. Second, this study was a cluster randomized study, thus a random sampling and true randomization of participants was not possible.

4.1. Future research

The results of this study indicate a need for further investigations. Although the ethical aspects of need-thwarting instruction need to be carefully considered, it would be essential to examine the influence of need-thwarting practices on motivation, skill performance, and affect. Correlational evidence on the detrimental effects of need-thwarting are well established (e.g., Bartholomew et al., 2018; Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011), but the evidence on causal relationships are lacking. The relationship between negative affect and need-thwarting experiences should be examined, as it seems that need-deprivation does not impact negative affect. Similarly, future interventions are needed to help the internalization process of

transforming highly extrinsically motivated participants to be more intrinsically motivated. This would have important practical implications to the teaching and coaching community working in the broad area of physical activity. In addition, careful consideration of the experimental design is important. Previous meta-analyses have shown the evidence on the efficacy of need-supportive instruction to be very heterogenous (name omitted for peer review, in press). Careful consideration of the nature of the controlling condition, e.g., whether the control is need-thwarting, need-depriving, or "as-usual", would make the comparisons between different studies more feasible. Similarly, transparent description of the need-supportive and control group practices would further reduce heterogeneity. Additionally, study designs employing retention and transfer skill tests should be implemented to examine the effect of need-supportive instruction on skill learning. Finally, although teacher professional development programs focusing on autonomy-supportive teaching (e.g., Cheon et al., 2012; Cheon et al., 2016) have been designed and examined, it would be beneficial to test comprehensively the indirect effects of these professional development programs on negative affect and skill development. Previous meta-analysis (name omitted for peer review, in review), showed that the effect of the intervention varied based on whether the intervention was conducted by research specialists or research group trained practitioner PE teachers and exercise instructors.

5. Conclusions

This study showed that need-supportive instruction, compared to need-depriving instruction, was beneficial in improving participants' intrinsic motivation, skill performance, and enjoyment. The study showed that although amotivation was a negative predictor on the change in skill performance, the effect was not evident in efficacy testing. PE teachers and physical activity

professionals are encouraged to employ need-supportive strategies in their instruction to increase performance and positive affect.

Acknowledgments

This research was supported by the SHAPE America foundations' Graduate Student Award.

References

1. Aelterman, N., Vansteenkiste, M., Van Keer, H., Van den Berghe, L., De Meyer, J., & Haerens, L. (2012). Students' objectively measured physical activity levels and engagement as a function of between-class and between-student differences in motivation toward physical education. *Journal of Sport and Exercise Psychology*, *34*, 457-480. https://doi.org/10.1123/jsep.34.4.457
2. Awang, Z. (2012). Structural equation modeling using AMOS graphic. Penerbit Universiti Teknologi MARA. Retrieved from https://www.researchgate.net/.../Structural+equation+modeling+using+AMOS.pdf
3. Barnes, L. L., Harp, D., & Jung, W. S. (2002). Reliability generalization of scores on the Spielberger state-trait anxiety inventory. *Educational and Psychological Measurement*, *62*, 603-618. https://doi.org/10.1177/0013164402062004005
4. Bartholomew, K. J., Ntoumanis, N., Mouratidis, A., Katartzi, E., Thøgersen-Ntoumani, C., & Vlachopoulos, S. (2018). Beware of your teaching style: A school-year long investigation of controlling teaching and student motivational experiences. *Learning and Instruction*, *53*, 50-63. https://doi.org/10.1016/j.learninstruc.2017.07.006
5. Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C. (2011). Self-determination theory and diminished functioning: The role of interpersonal control and psychological need thwarting. *Personality and Social Psychology Bulletin*, *37*, 1459-1473. https://doi.org/10.1177/0146167211413125
6. Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., & Thøgersen-Ntoumani, C. (2011). Psychological need thwarting in the sport context: Assessing the darker side of athletic experience. *Journal of Sport and Exercise Psychology*, *33*, 75-102. https://doi.org/10.1123/jsep.33.1.75
7. Bassett, D. R., Fitzhugh, E. C., Heath, G. W., Erwin, P. C., Frederick, G. M., Wolff, D. L., ... Stout, A. B. (2013). Estimated energy expenditures for school-based policies and active living. *American Journal of Preventive Medicine*, *44*, 108-113. https://doi.org/10.1016/j.amepre.2012.10.017
8. Behzadnia, B., Adachi, P. J., Deci, E. L., & Mohammadzadeh, H. (2018). Associations between students' perceptions of physical education teachers' interpersonal styles and students' wellness, knowledge, performance, and intentions to persist at physical activity: A self-determination theory approach. *Psychology of Sport and Exercise*, *39*, 10-19. https://doi.org/10.1016/j.psychsport.2018.07.003
9. Behzadnia, B., Mohammadzadeh, H., & Ahmadi, M. (2017). Autonomy-supportive behaviors promote autonomous motivation, knowledge structures, motor skills learning and performance in physical education. *Current Psychology*, 1-14. https://doi.org/10.1007/s12144-017-9727-0
10. Black, A. E., & Deci, E. L. (2000). The effects of instructors' autonomy support and students' autonomous motivation on learning organic chemistry: A self-determination theory perspective. *Science Education*, *84*, 740-756. https://doi.org/10.1002/1098-237X(200011)84:6<740::AID-SCE4>3.0.CO;2-3
11. Chen, A., Darst, P. W., & Pangrazi, R. P. (1999). What constitutes situational interest? Validating a construct in physical education. *Measurement in Physical Education and Exercise Science*, *3*, 157-180. https://doi.org/10.1207/s15327841mpee0303_3

12. Cheon, S. H., Reeve, J., Lee, Y., & Lee, J. W. (2018). Why autonomy-supportive interventions work: Explaining the professional development of teachers' motivating style. *Teaching and Teacher Education*, *69*, 43-51. https://doi.org/10.1016/j.tate.2017.09.022
13. Cheon, S. H., Reeve, J., & Moon, I. S. (2012). Experimentally based, longitudinally designed, teacher-focused intervention to help physical education teachers be more autonomy supportive toward their students. *Journal of Sport and Exercise Psychology*, *34*, 365-396. https://doi.org/10.1123/jsep.34.3.365
14. Cheon, S. H., Reeve, J., & Ntoumanis, N. (2018). A needs-supportive intervention to help PE teachers enhance students' prosocial behavior and diminish antisocial behavior. *Psychology of Sport and Exercise*, *35*, 74-88. https://doi.org/10.1016/j.psychsport.2017.11.010
15. Cheon, S. H., Reeve, J., & Song, Y. G. (2016). A teacher-focused intervention to decrease PE students' amotivation by increasing need satisfaction and decreasing need frustration. *Journal of Sport and Exercise Psychology*, *38*, 217-235. https://doi.org/10.1123/jsep.2015-0236
16. Chiviacowsky, S., Wulf, G., & Lewthwaite, R. (2012). Self-controlled learning: the importance of protecting perceptions of competence. *Frontiers in Psychology*, *3*, 458. https://doi.org/10.3389/fpsyg.2012.00458
17. Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd edition.). Hillsdale, NJ: Erlbaum.
18. Deci, E. L., & Ryan, R. M. (1985a*). Intrinsic motivation & self-determination in human behavior*. New York, NY: Plenum Press. http://dx.doi.org/10.1007/978-1-4899-2271-7
19. Deci, E. L., & Ryan, R. M. (1985b). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality*, *19*, 109-134. https://doi.org/10.1016/0092-6566(85)90023-6
20. Deci, E. L., & Ryan, R. M. (2000). The 'what' and 'why' of goal pursuits: human needs and the self-determination of behavior. *Psychological Inquiry*, *11*, 227-268. https://doi.org/10.1207/S15327965PLI1104_01
21. Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology*, *49*, 182-185. http://dx.doi.org/10.1037/a0012801
22. De Meyer, J., Tallir, I. B., Soenens, B., Vansteenkiste, M., Aelterman, N., … Haerens, L. (2014). Does observed controlling teaching behavior relate to students' motivation in physical education? *Journal of Educational Psychology*, *106*, 541-554. http://dx.doi.org/10.1037/a0034399
23. De Meyer, J., Soenens, B., Aelterman, N., De Bourdeaudhuij, I., & Haerens, L. (2016). The different faces of controlling teaching: implications of a distinction between externally and internally controlling teaching for students' motivation in physical education. *Physical Education and Sport Pedagogy*, *21*, 632-652. https://doi.org/10.1080/17408989.2015.1112777
24. Edmunds, J., Ntoumanis, N., & Duda, J. L. (2008). Testing a self-determination theory-based teaching style intervention in the exercise domain. *European Journal of Social Psychology*, *38*, 375-388. https://doi.org/10.1002/ejsp.463
25. Fransen, K., Boen, F., Vansteenkiste, M., Mertens, N., & Vande Broek, G. (2018a). The power of competence support: The impact of coaches and athlete leaders on intrinsic

motivation and performance. *Scandinavian Journal of Medicine & Science in Sports*, *28*, 725-745. https://doi.org/10.1111/sms.12950

26. González-Cutre, D., Sierra, A. C., Beltrán-Carrillo, V. J., Peláez-Pérez, M., & Cervelló, E. (2018). A school-based motivational intervention to promote physical activity from a self-determination theory perspective. *The Journal of Educational Research*, *111*, 320-330. https://doi.org/10.1080/00220671.2016.1255871
27. Gillison, F. B., Rouse, P., Standage, M., Sebire, S. J., & Ryan, R. M. (2019). A meta-analysis of techniques to promote motivation for health behaviour change from a self-determination theory perspective. *Health Psychology Review*, *13*, 110-130. https://doi.org/10.1080/17437199.2018.1534071
28. Haerens, L., Aelterman, N., Van den Berghe, L., De Meyer, J., Soenens, B., & Vansteenkiste, M. (2013). Observing physical education teachers' need-supportive interactions in classroom settings. *Journal of Sport and Exercise Psychology*, *35*, 3-17. https://doi.org/10.1123/jsep.35.1.3
29. Haerens, L., Aelterman, N., Vansteenkiste, M., Soenens, B., & Van Petegem, S. (2015). Do perceived autonomy-supportive and controlling teaching relate to physical education students' motivational experiences through unique pathways? Distinguishing between the bright and dark side of motivation. *Psychology of Sport and Exercise*, *16*, 26-36. https://doi.org/10.1016/j.psychsport.2014.08.013
30. Hair, J., Anderson, R., Tatham, R. & Black, W. (2010). *Multivariate Data Analysis* (7th edition). New Jersey, NJ: Prentice Hall.
31. Hoaglin, D. C., Iglewicz, B., & Tukey, J. W. (1986). Performance of some resistant rules for outlier labeling. *Journal of the American Statistical Association*, *81*, 991-999. https://doi.org/10.1080/01621459.1986.10478363
32. Hodge, K., Lonsdale, C., & Ng, J. Y. (2008). Burnout in elite rugby: Relationships with basic psychological needs fulfilment. *Journal of Sports Sciences*, *26*, 835-844. https://doi.org/10.1080/02640410701784525
33. Hooyman, A., Wulf, G., & Lewthwaite, R. (2014). Impacts of autonomy-supportive versus controlling instructional language on motor learning. *Human Movement Science*, *36*, 190-198. https://doi.org/10.1016/j.humov.2014.04.005
34. Institute of Medicine. (2013). Educating the student body: *Taking physical activity and physical education to school*. Washington, DC: The National Academies.
35. Janelle, C. M., Barba, D. A., Frehlich, S. G., Tennant, L. K., & Cauraugh, J. H. (1997). Maximizing performance feedback effectiveness through videotape replay and a self-controlled learning environment. *Research Quarterly for Exercise and Sport*, *68*, 269-279. https://doi.org/10.1080/02701367.1997.10608008
36. Kendzierski, D., & DeCarlo, K. J. (1991). Physical activity enjoyment scale: Two validation studies. *Journal of Sport and Exercise Psychology*, *13*, 50-64. https://doi.org/10.1123/jsep.13.1.50
37. Kish, L. (1965). *Survey sampling*. New York, NY: Wiley.
38. Koestner, R., Bernieri, F., & Zuckerman, M. (1992). Self-regulation and consistency between attitudes, traits, and behaviors. *Personality and Social Psychology Bulletin*, *18*, 52-59. https://doi.org/10.1177/0146167292181008
39. Lewthwaite, R., & Wulf, G. (2017). Optimizing motivation and attention for motor performance and learning. *Current Opinion in Psychology*, *16*, 38-42. https://doi.org/10.1016/j.copsyc.2017.04.005

40. Leptokaridou, E. T., Vlachopoulos, S. P., & Papaioannou, A. G. (2016). Experimental longitudinal test of the influence of autonomy-supportive teaching on motivation for participation in elementary school physical education. *Educational Psychology*, *36*, 1138-1159. https://doi.org/10.1080/01443410.2014.950195
41. Lochbaum, M., & Jean-Noel, J. (2015). Perceived autonomy-support instruction and student outcomes in physical education and leisure-time: A meta-analytic review of correlates. *Revista Internacional de Ciencias del Deporte*, *12*, 29-47. http://dx.doi.org/10.5232/ricyde2016.04302
42. Lonsdale, C., Rosenkranz, R. R., Peralta, L. R., Bennie, A., Fahey, P., & Lubans, D. R. (2013). A systematic review and meta-analysis of interventions designed to increase moderate-to-vigorous physical activity in school physical education lessons. *Preventive Medicine*, *56*, 152-161. https://doi.org/10.1016/j.ypmed.2012.12.004
43. Markland, D., & Tobin, V. (2004). A modification to the behavioural regulation in exercise questionnaire to include an assessment of amotivation. *Journal of Sport and Exercise Psychology*, *26*, 191-196. https://doi.org/10.1123/jsep.26.2.191
44. Markland, D. & Tobin, V. J. (2010). Need support and behavioral regulations for exercise among exercise referral scheme clients: The mediating role of psychological need satisfaction. *Psychology of Sport and Exercise*, *11*, 91-99. https://doi.org/10.1016/j.psychsport.2009.07.001
45. Mertens, N., Boen, F., Vande Broek, G., Vansteenkiste, M., & Fransen, K. (2018). An experiment on the impact of coaches' and athlete leaders' competence support on athletes' motivation and performance. *Scandinavian Journal of Medicine & Science in Sports*, *28*, 2734-2750. https://doi.org/10.1111/sms.13273
46. McKenzie, T. L., Marshall, S. J., Sallis, J. F., & Conway, T. L. (2000). Leisure-time physical activity in school environments: an observational study using SOPLAY. *Preventive Medicine*, *30*, 70-77. https://doi.org/10.1006/pmed.1999.0591
47. Moustaka, F. C., Vlachopoulos, S. P., Kabitsis, C., & Theodorakis, Y. (2012). Effects of an autonomy-supportive exercise instructing style on exercise motivation, psychological well-being, and exercise attendance in middle-age women. *Journal of Physical Activity and Health*, *9*, 138-150. https://doi.org/10.1123/jpah.9.1.138
48. Muthén, L.K., & Muthén, B.O. (1998 – 2013). *Mplus user's guide* (6th edition). Los Angeles, CA: Author.
49. National Association for Sport and Physical Education [NASPE], (2004). *Moving into the future: The National Standards for Physical Education* (2nd ed.). Reston, VA: AAHPERD.
50. Nieuwenhuys, A., & Oudejans, R. R. (2017). Anxiety and performance: Perceptual-motor behavior in high-pressure contexts. *Current Opinion in Psychology*, *16*, 28-33. https://doi.org/10.1016/j.copsyc.2017.03.019
51. Pedersen, C., Halvari, H., & Williams, G. C. (2018). Worksite intervention effects on motivation, physical activity, and health: A cluster randomized controlled trial. *Psychology of Sport and Exercise*, *35*, 171-180. https://doi.org/10.1016/j.psychsport.2017.11.004Get
52. Reeve, J., & Jang, H. (2006). What teachers say and do to support students' autonomy during a learning activity. *Journal of Educational Psychology*, *98*, 209-218. http://dx.doi.org/10.1037/0022-0663.98.1.209

53. Reference omitted for peer review (in review). Need-supportive instruction and motivational regulations in physical activity: A Meta-analysis and a systematic review.
54. Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*, 68-78. https://doi.org/10.1037/0003-066X.55.1.68
55. Runswick, O. R., Roca, A., Williams, A. M., Bezodis, N. E., & North, J. S. (2018). The effects of anxiety and situation-specific context on perceptual–motor skill: A multi-level investigation. *Psychological Research, 82*, 708-719. https://doi.org/10.1007/s00426-017-0856-8
56. Sanli, E. A., Patterson, J. T., Bray, S. R., & Lee, T. D. (2013). Understanding self-controlled motor learning protocols through the self-determination theory. *Frontiers in Psychology*, *3*, 611. https://doi.org/10.3389/fpsyg.2012.00611
57. Sparks, C., Lonsdale, C., Dimmock, J., & Jackson, B. (2017). An intervention to improve teachers' interpersonally involving instructional practices in high school physical education: Implications for student relatedness support and in-class experiences. *Journal of Sport and Exercise Psychology, 39*, 120-133. https://doi.org/10.1123/jsep.2016-0198
58. Spielberger, C., Gorsuch, R., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). Manual for the state-trait anxiety inventory. *Palo Alto, CA: Consulting Psychologists*.
59. Spielberger, C. D., Sydeman, S. J., Owen, A. E., & Marsh, B. J. (1999). Measuring anxiety and anger with the State-Trait Anxiety Inventory (STAI) and the State-Trait Anger Expression Inventory (STAXI). In M. E. Maruish (Ed.), *The use of psychological testing for treatment planning and outcomes assessment* (pp. 993-1021). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.
60. Standage, M., Duda, J. L., & Ntoumanis, N. (2006). Students' motivational processes and their relationship to teacher ratings in school physical education: A self-determination theory approach. *Research Quarterly for Exercise and Sport*, *77*, 100-110. https://doi.org/10.1080/02701367.2006.10599336
61. Tessier, D., Sarrazin, P., & Ntoumanis, N. (2010). The effect of an intervention to improve newly qualified teachers' interpersonal style, students motivation and psychological need satisfaction in sport-based physical education. *Contemporary Educational Psychology*, *35*, 242-253. https://doi.org/10.1016/j.cedpsych.2010.05.005
62. Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In *Advances in Experimental Social Psychology* (Vol. 29, pp. 271-360). New York, NY: Academic Press. https://doi.org/10.1016/S0065-2601(08)60019-2
63. Vallerand, R. J. (2000). Deci and Ryan's self-determination theory: A view from the hierarchical model of intrinsic and extrinsic motivation. *Psychological Inquiry*, *11*(4), 312-318.
64. Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration*, 23, 263–280. https://doi.org/10.1037/a0032359
65. Wilson, P.M., Rodgers, W.M., Loitz, C.C., & Scime, G. (2006). "It's who I am…really!" The importance of integrated regulation in exercise contexts. *Journal of Biobehavioral Research, 11*, 79-104.
66. Wulf, G., & Lewthwaite, R. (2016). Optimizing performance through intrinsic motivation and attention for learning: The OPTIMAL theory of motor learning. *Psychonomic Bulletin & Review, 23*, 1382-1414. https://doi.org/10.3758/s13423-015-0999-9

67. Yli-Piipari, S., Layne, T., Hinson, J., & Irwin, C. (2018). Motivational pathways to leisure-time physical activity participation in urban physical education: A cluster-randomized trial. *Journal of Teaching in Physical Education*, *37*(2), 123-132. https://doi.org/10.1123/jtpe.2017-0099

68. Yli-Piipari, S., Watt, A., Jaakkola, T., Liukkonen, J., & Nurmi, J. E. (2009). Relationships between physical education students' motivational profiles, enjoyment, state anxiety, and self-reported physical activity. *Journal of Sports Science & Medicine*, *8*(3), 321-327.

Table 1

Characteristics of the Participants

Measure	Need-support	Need-deprivation
n	28	31
Participation term (excluded)		
Fall	15 (2)	9 (3)
Spring	13 (1)	22 (2)
Mean age (SD)	19.68 (1.68)	20.74 (1.44)
Gender (%)		
Male	10 (35.7%)	5 (16.1%)
Female	18 (64.3%)	26 (83.9%)
Ethnic group (%)		
White Caucasian	19 (67.9%)	27 (87.1%)
Black African American	2 (7.1%)	1 (3.2%)
Asian	5 (17.9%)	2 (6.5%)
Pacific Islander	1 (3.6%)	0 (0%)
Hispanic	1 (3.6%)	1 (3.2%)
Class rank (%)		
Freshman	10 (35.7%)	3 (9.7%)
Sophomore	6 (21.4%)	8 (25.8%)
Junior	5 (17.9%)	3 (9.7%)
Senior	7 (25.0%)	17 (54.8 %)
Exclusion reasons		
3 or more absences	0	2
2 or more outlier scores	2	2
Prior juggling experience	1	1
Mean trait anxiety (SD)	2.87 (0.79)	3.03 (0.92)
Total interest (SD)	5.67 (1.13)	6.03 (0.79)
Mean autonomy orientation (SD)	5.58 (0.79)	5.87 (0.51)
Mean control orientation (SD)	4.64 (0.80)	4.45 (0.79)

Table 2

Descriptions of the Conditions

Needs	Instructional dimensions	Need supportive instr.	Need-neglecting instr.
Competence	Goals	Intrinsic goals.	Extrinsic goals.
	Task difficulty	Chances to choose drills at an optimal skill level.	Same tasks for everyone at the same time.
	Feedback	Positive and informational feedback that signifies competence or how people will be more competent is provided.	No positive feedback is provided.
Autonomy	Ownership	The instructor wants students to feel in control and tells them this.	The instructor makes all the decisions and lets students know this.
	Provision of choice	Provision of meaningful choice within the skill drills and flexibility with appropriate technique.	No choice is offered, and only one correct technique is highlighted.
	Value	Providing relevance and meaning to the activities.	Relevance is not provided to the activities.
	Language	Use of emphatic, informational, non-controlling ("suggest, may, might"), and responsive language.	Use of controlling language ("You must, are required, have to).
Relatedness	Interpersonal involvement	The instructor encourages students to ask questions, is friendly and warm, and shares personal information.	The instructor is formal, distant, does not share personal information and is disinterested in the students.
	Physical distance	The instructor is close to the students and moves around.	The instructor does not move and is far away from the students.
	Use of names	Frequent and systematic use of names.	No use of names.

Table 3

Bivariate Correlations, Descriptive Statistics, and Normality Values

Variables	1	2	3	4	5		7	8	9	10	11	12	13	14	15	16	17
1. Gender	-	-.08	-.24	-.16	-.35	-.20	-.02	-.18	-.12	-.23	.04	-.15	-.07	-.41*	-.16	-.39*	-.02
2. Trait anxiety	.01	-	.01	.07	.08	-.19	-.42*	-.26	-.42*	-.17	-.42*	.11	.57**	-.06	.19	-.11	.09
3. Total interest	.16	-.39*	-	.21	-.02	.71***	.18	.63***	.19	.60**	.08	.21	.01	-.05	.17	.02	.16
4. Autonomy OR	.22	-.55**	.57**	-	.32	.27	-.03	.26	-.01	.21	-.07	.03	-.02	.33	.19	-.00	-.10
5. Control OR	-.02	-.14	.06	.50**	-	.13	.03	.10	-.04	.15	.07	.16	.42*	.38*	.17	.29	.17
6. PAS Pre	.16	-.33	.81***	.35	-.11	-	.23	.96***	.24	.93***	.24	.12	-.13	.03	.05	-.04	-.01
7. PAS Post	.26	-.41*	.72***	.58**	.11	.65***	-	0.17	.93***	.22	.91***	.15	-.16	-.14	.02	.03	.05
8. PCS Pre	.27	-.35	.81***	.35	-.12	.93***	.63***	-	.20	.92***	.22	.08	-.21	.12	.12	-.08	-.02
9. PCS Post	.33	-.31	.64***	.51**	.10	.62***	.93***	.64***	-	.20	.81***	.04	-.30	-.13	-.01	.01	-.00
10. PRS Pre	.18	-.34	.75***	.34	-.04	.95***	.66***	.92***	.65***	-	.31	.13	-.12	.06	.08	-.07	.01
11. PRS Post	.33	-.34	.61***	.52**	.13	.55**	.94***	.54**	.94***	.58**	-	.06	-.19	-.07	-.02	.06	.14
12. Amot. Pre	-.19	.10	-.51**	-.45*	.08	-.34	-.28	-.36	-.15	-.29	-.14	-	.43*	.25	.35	-.03	.16
13. Amot. Post	-.28	.06	-.48*	-.20	.19	-.25	-.40*	-.35	-.36	-.23	-.36	.57**	-	.22	.37*	.34	.45*
14. Exter. Pre	-.14	-.13	-.38*	.07	.46*	-.27	-.17	-.28	-.06	-.22	-.03	.43*	.39*	-	.58**	.36	.07
15. Exter. Post	-.15	-.24	-.11	.19	.48**	.08	.15	-.03	.16	.10	.18	.43*	.46*	.68***	-	.22	.38*
16. Intro. Pre	.03	.03	-.27	.26	.63***	-.28	-.09	-.32	-.02	-.23	-.02	.37	.30	.55**	.54**	-	.63***
17. Intro. Post	.41*	.20	-.03	.20	.29	.05	.19	.00	.27	.03	.27	.23	.18	.21	.36	.57**	-
18. Iden. Pre	.37*	-.28	.50**	.65***	.24	.44*	.27	.45*	.31	.44*	.29	-.44**	-.19	.09	-.03	.10	.28
19. Iden. Post	.27	-.20	.60***	.56**	.16	.39*	.57**	.38*	.57**	.35	.55**	-.43*	-.63***	-.19	-.13	-.01	.30
20. Integ. Pre	.24	-.44*	.35	.55**	.29	.19	.30	.13	.32	.17	.34	-.12	-.01	.23	.09	.31	.45*
21. Integ. Post	-.20	-.24	.13	.40*	.11	.04	.21	-.02	.16	.02	.15	-.12	.10	.06	.14	.14	.32
22. Intrinsic Pre	.29	-.27	.73***	.67***	.25	.61**	.47*	.61**	.50**	.60**	.45*	-.51**	-.29	-.09	-.01	.10	.18
23. Intrinsic Post	.33	-.11	.45*	.37	-.04	.33	.56**	.31	.57**	.30	.54**	-.37*	-.61**	-.37	-.21	-.23	.26
24. Enjoym. Pre	.12	-.11	.34	.33	.56**	.22	.15	.13	.15	.21	.15	-.06	.10	.26	.30	.10	.21
25. Enjoym. Post	.03	-.27	.62***	.41*	.09	.47*	.71***	.47*	.72***	.50**	.65***	-.18	-.43*	-.26	-.13	-.16	.11
26. St. anxiety Pre	.14	.46*	-.79***	-.38*	.06	-.65***	-.43*	-.62***	-.30	-.60**	-.30	.56**	.40*	.28	.04	.41*	.30
27. St. anxiety Post	.02	.49**	-.67***	-.54*	-.26	-.50**	-.67***	-.47	-.57**	-.50**	-.57**	.36	.57**	.12	-.07	.11	.11
28. Skill per. Pre	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
29. Skill per. Post	-.52**	-.12	.08	-.04	-.06	.13	-.06	.12	-.11	.13	-.21	-.19	-.25	-.06	-.19	-.27	-.61**
30. Absences	.14	.28	-.00	-.02	.23	.03	-.28	.02	-.19	.03	-.20	.07	.34	.10	.15	.21	.12
31. Practice time	-.00	-.09	0.17	.10	-.17	.09	.16	.18	.12	.01	.10	-.27	-.15	-.30	-.13	-.17	-.08
M		2.87	5.67	5.58	4.64	5.9	6.14	5.96	6.18	5.76	5.99	1.93	1.92	2.47	2.88	3.56	3.93
SD		.79	1.13	.79	.80	1.08	1.06	1.07	1.12	1.11	1.25	.89	1.11	.99	1.11	1.5	3.47
KU		.27	-1	-.22	.00	-1.32	-.77	-.44	-.59	-.39	-1.14	-1.54	.00	-1.29	.07	-.43	-.64
SK		.72	-.16	-.74	.36	-.22	-.76	-.70	-.97	-.55	-.66	.38	1.07	.03	.32	.40	-.15
α		.91	.91	.80	.76	.93	.91	.93	.93	.93	.92	.78	.83	.70	.67	.78	.83

Variables	18	19	20	21	22	23	24	25	26	27	28	29	30	31	M	SD	KU	SK
1. Gender	-.08	.11	-.38	-.18	.06	-.06	.10	-.04	-.23	-.05	NV	.06	-.01	-.33				
2. Trait anxiety	-.11	-.54**	-.13	-.30	-.37*	-.44*	-.18	-.41*	.56**	.72***	NV	-.32	.17	.21	3.03	.92	.07	-.75
3. Total interest	.13	.01	.10	.20	.52**	.40*	.50**	.51**	-.23	-.14	NV	.00	.07	-.08	6.03	.79	-.73	.06
4. Autonomy OR	.47**	.07	.12	.06	.16	.35	.16	.31	-.00	-.06	NV	-.17	.33	.04	5.87	.51	-.55	.30
5. Control OR	.00	-.33	.28	.09	-.14	.02	-.13	.02	.24	.13	NV	-.23	.37*	.24	4.45	.79	-.03	-.33
6. PAS Pre	.11	.14	.15	.14	.44*	.41*	.60**	.60**	-.51**	-.38*	NV	.15	.12	-.22	6.09	.88	-.77	-.18
7. PAS Post	.06	.56**	.05	.34	.25	.37*	.05	.25	-.32	-.34	NV	-.22	.22	.04	5.54	1.16	-.53	-.02
8. PCS Pre	.06	.14	.14	.15	.45*	.49**	.61***	.64***	-.54**	-.42*	NV	.18	.06	-.24	6.23	.82	-.10	.53
9. PCS Post	.07	.61***	.00	.40*	.34	.45*	.11	.32	-.34	-.34	NV	-.10	.30	.04	5.79	1.05	-.86	.76
10. PRS Pre	-.04	.13	.11	.12	.33	.35	.56**	.50**	-.54**	-.31	NV	.09	.11	-.15	5.91	.93	-.52	-.74
11. PRS Post	.03	.54**	.07	.27	.14	.25	.08	.14	-.43	-.25	NV	-.26	.17	.20	5.35	1.18	.08	-1.45
12. Amot. Pre	-.47*	-.12	.09	.18	-.31	.20	-.19	.26	.05	.08	NV	-.14	-.09	-.29	1.89	.81	.53	-1.03
13. Amot. Post	-.14	-.53**	.26	.11	-.29	-.36*	-.23	-.25	.63**	.63**	NV	-.41*	-.00	-.05	1.88	.75	.43	-.43
14. Exter. Pre	.09	-.03	.66***	.38*	.05	.23	-.14	.01	.07	.06	NV	-.15	-.28	.06	2.16	1.13	1.07	.59
15. Exter. Post	-.12	-.06	.44*	.56**	.07	.34	.02	.20	.11	.13	NV	-.21	-.15	-.25	2.48	1.05	.45	-.18
16. Intro. Pre	.14	-.16	.71***	.44*	-.00	-.23	-.26	-.26	.31	.22	NV	-.29	-.23	.11	3.45	1.37	.39	-.10
17. Intro. Post	-.09	-.06	.34	.47**	-.07	-.02	.05	.02	.15	.23	NV	-.32	-.16	-.08	3.47	1.58	.36	-1.06
18. Iden. Pre	-	.32	.32	.07	.50**	.09	.23	.01	-.08	-.15	NV	-.10	.13	.26	5.22	1.04	-.10	-.70
19. Iden. Post	.61**	-	.11	.38*	.33	.48**	.36	.31	-.60**	-.53**	NV	-.06	-.02	-.18	5.21	.85	-.70	-.08
20. Integ. Pre	.61**	.48*	-	.57**	.17	.06	-.11	-.10	.06	-.01	NV	-.30	-.43*	-.05	2.91	1.00	-.27	-.30
21. Integ. Post	.26	.44*	.49**	-	.37*	.48**	.19	.31	-.22	-.23	NV	-.20	-.12	-.22	3.1	1.00	.84	1.37
22. Intrinsic Pre	.81***	.56**	.61**	.12	-	.43*	.50**	.41*	-.42*	-.48**	NV	.15	.01	-.03	5.26	.97	.12	.04
23. Intrinsic Post	.31	.82**	.24	.32	.28	-	.53**	.80***	-.55**	-.59**	NV	.08	.16	-.28	5.51	1.13	-.41	-.53
24. Enjoym. Pre	.37	.21	.43*	.05	.32	.08	-	.71***	-.56**	-.32	NV	.21	.18	-.19	4.90	1.05	-.32	.05
25. Enjoym. Post	.29	.72***	.27	.31	.34	.70***	.20	-	-.56**	-.54**	NV	.27	.21	-.43*	5.00	1.12	-.76	1.46
26. St. anxiety Pre	-.40*	-.44*	-.17	-.08	-.56**	-.32	-.26	-.46	-	.74***	NV	-.19	-.04	.22	2.98	1.05	-.05	-.84
27. St. anxiety Post	-.34	-.67***	-.25	-.14	-.46*	-.62***	-.20	-.71***	.69***	-	NV	-.35	.06	.30	2.51	1.14	.56	-.36
28. Skill Pre	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	-	NV	NV	NV	0	NV		
29. Skill Post	-.11	-.11	-.32	-.19	-.15	-.19	-.00	.13	-.19	-.17	NV	-	-.13	-.23	3.85	2.72	.08	-.92
30. Absences	.24	-.27	-.09	-0.30	.25	-.35	.26	-.40*	.13	.31	NV	-.21	-	.24	.39	.62	1.45	1.16
31. Practice time	-.11	.11	-.14	.27	-.02	.12	-.23	.01	-.04	.05	NV	.01	-.02	-	3.95	4.83	1.16	.50
M	5.25	5.38	3.39	3.78	5.42	5.75	4.94	5.42	2.75	2.47	0	7.79	.43	5.71				
SD	.98	5.22	1.19	1.29	1.02	1.28	1.37	1.31	1.09	1.08	NV	4.62	.69	5.97				
KU	.64	-.77	1.21	-.47	-.37	-.52	-0.2	-.74	-.47	.53		.67	.80	5.76				
SK	-.51	-.30	.55	.12	-.34	-.87	-0.15	-.79	.07	.70		.82	1.47	2.35				
α	.69	.75	.73	.77	.80	.93	0.96	.92	.95	.95								

Note. OR = Orientation; PAS = Perceived autonomy support; PCS = Perceived competence support; PRS = Perceived relatedness support; Amot. = Amotivation; Exter. = External regulation; Intro. = Introjected regulation; Iden. = Identified regulation; Integ. = Integrated regulation; Enjoym. = Enjoyment; St. = State; NV = No variation; M = Mean; SD = Standard deviation; KU = Kurtosis; SK = Skewness; Females coded as 1 and Males as 2; Bottom = Need-support; Top = Need-deprivation. ***p<.001, **p<.01, *p<.05.

Table 4

Analysis of Covariance for the Need-Support and Need-Deprivation Conditions

		Pre-test		Post-test						
				Unadjusted		Adjusted				
Variable	Range	NS *M (SD)*	ND *M (SD)*	NS *M (SD)*	ND *M (SD)*	NS *M (SE)*	ND *M (SE)*	*F*-statistic	*p*-value	ES (η2)
Motivational regulations										
Amotivation	1-7	1.93 (0.89)	1.89 (0.81)	1.92 (1.11)	1.94 (0.74)	1.83 (0.154)	2.03 (0.151)	0.793	0.378	0.016
External regulation	1-7	2.47 (0.99)	2.16 (1.13)	2.88 (1.11)	2.51 (1.05)	2.78 (0.76)	2.61 (0.172)	0.382	0.539	0.008
Introjected regulation	1-7	3.56 (1.50)	3.45 (1.37)	3.93 (1.40)	3.60 (1.54)	4.09 (0.234)	3.45 (0.229)	3.356	0.073	0.065
Identified regulation	1-7	5.25 (0.98)	5.22 (1.04)	5.38 (1.18)	5.17 (0.85)	5.51 (0.173)	5.05 (0.170)	3.239	0.078	0.063
Integrated regulation	1-7	3.39 (1.19)	2.91 (1.00)	3.82 (1.29)	3.07 (1.00)	3.68 (0.202)	3.21 (0.194)	2.383	0.129	0.048
Intrinsic motivation	1-7	5.42 (1.02)	5.26 (0.97)	5.75 (1.28)	5.44 (1.13)	5.99 (0.221)	5.21 (0.217)	5.519	0.023	0.103
Affective outcomes										
Enjoyment	1-7	4.94 (1.37)	4.90 (1.05)	5.42 (1.31)	4.93 (1.20)	5.52 (0.207)	4.84 (0.203)	4.888	0.032	0.092
State anxiety	1-7	2.75 (1.09)	2.98 (1.05)	2.47 (1.08)	2.57 (1.15)	2.52 (0.149)	2.53 (0.146)	0.001	0.977	0
Motor performance	0-40	0	0	7.79 (4.62)	3.84 (2.76)	7.38 (0.723)	4.21 (0.681)	9.226	0.004	0.164

Table 5

Zero-Order Correlations between the Change Scores Derived from Linear Regression Residuals

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Autonomy support post	-											
2. Structure post	.932***	-										
3. Involvement support	.932***	.904***	-									
4. Amotivation post	-.274*	-.269*	-.298*	-								
5. External regulation post	0.19	0.19	0.08	0.19	-							
6. Introjected regulation post	0.15	0.19	0.20	0.05	.381**	-						
7. Identified regulation post	.542***	.530***	.540***	-.611***	0.09	.290*	-					
8. Integrated regulation post	.317*	.293*	0.23	0.06	.410**	.289*	.349**	-				
9. Intrinsic regulation post	.337*	.339*	.329*	-.510***	0.15	.385**	.632***	.351**	-			
10. Enjoyment post	.385**	.394**	.323*	-0.462	0.13	0.24	.518***	.329*	.653***	-		
11. State anxiety post	-321*	-.285*	-263*	.392**	-0.03	0.11	-.308*	-0.01	-.364**	-.382**	-	
12. Skill performance post	-0.014	-0.032	-0.123	-0.247	-0.096	-300*	0.02	.283*	.301*	.276*	-0.097	-

Table 6

Statistically Significant Effects on the Change Scores

Covarying Effects	*β(SE)*
Trait Anxiety → Autonomy support	-.31(.12)
Trait Anxiety → Competence support	-.22(.11)
Trait Anxiety → Relatedness support	-.32(.11)
Trait Anxiety → Introjected Regulation	.30(.11)
Trait Anxiety → Skill Performance	-.22(.10)
Gender → Integrated Regulation	-.38(.15)
Gender → Skill Performance	-.47(.15)
Interest → Enjoyment	.27(.12)

Note: SE = Standard error

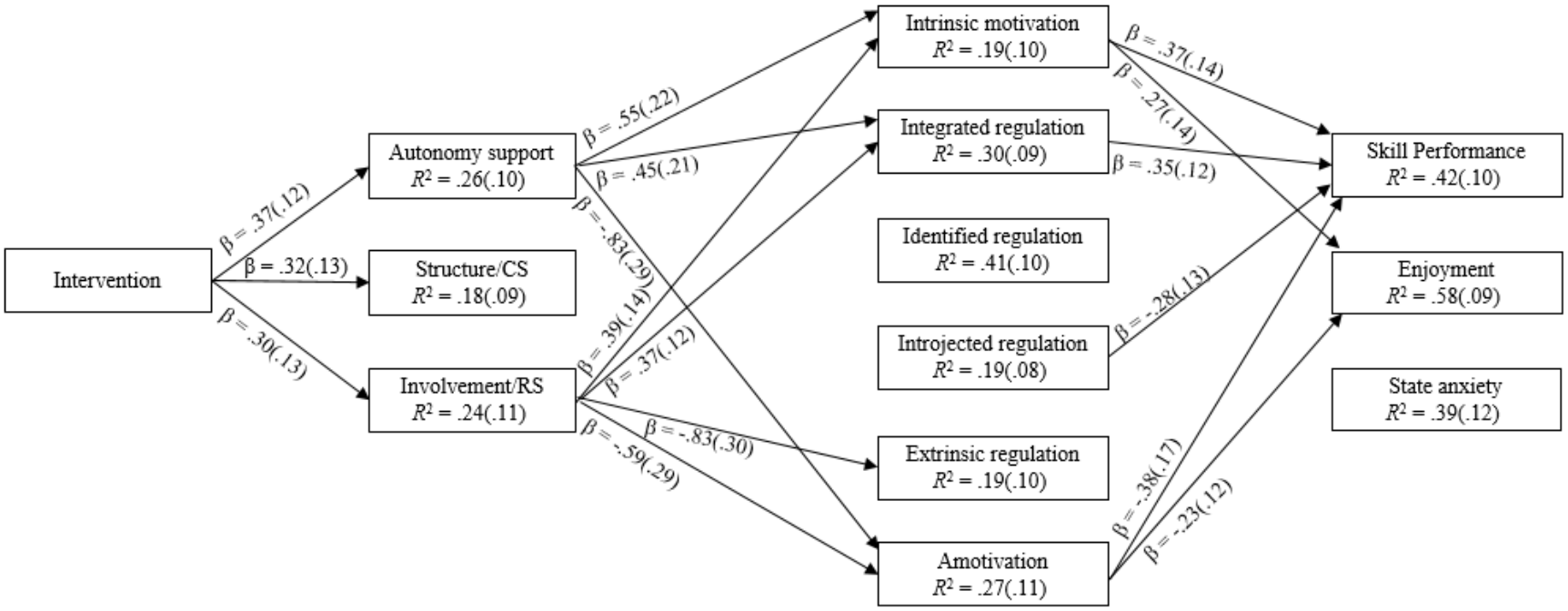


Fig. 1. The SEM model on the effects of need-supportive instruction compared to need-depriving instruction. Only significant paths as regression weights are displayed. Correlations between the change variables (presented in Table 5) as well as the paths (Presented in Table 6) are not included in this illustration to improve readability. *Note. CS* = Competence support; *RS* = Relatedness support

CHAPTER 5

CONCLUSION

The purpose of this dissertation was to examine the extent, which need-supportive instruction affects motivational regulations proposed by the SDT (Deci & Ryan, 1985, 2000) in physical activity, and to test how need-supportive instruction influences motivational regulations, skill performance, and affective outcomes. Finally, this dissertation tested if the effect of need-supportive instruction followed the theoretical models of the SDT and hierarchical model of intrinsic and extrinsic motivation (Vallerand, 1997; 2000).

SDT conceptualizes motivation to vary in quantity and specifically in quality in terms of the amount of autonomy present in human behavior (Deci & Ryan, 2000). Motivational regulations hypothesized by the SDT have previously been found to be linked to various outcomes relating to physical activity. The autonomous forms of motivation (intrinsic motivation and identified regulation) are mainly shown to relate to positive outcomes, such as enjoyment (Edmunds, Ntoumanis, & Duda, 2008) and exercise adherence (Teixera, Carraca, Markland, Silva, & Ryan, 2012). In addition, the controlling forms of extrinsic motivation (introjected regulation and external regulation) and amotivation have usually been found to be related to negative consequences such as disengagement in PE (Aelterman et al., 2012; Standage, Duda, Ntoumanis, 2003) and lack of adherence to exercise (Teixera et al., 2012).

The first study of the dissertation aggregated data from 20 experimental studies in physical activity examining the use of need-supportive instruction (e.g., strategies and behaviors supporting three basic needs proposed by the SDT) and its effect on participants' motivational

regulations. The findings indicated that need-supportive instruction in physical activity affects intrinsic motivation and identified regulation by a medium-to-large effect size. Moreover, need-supportive instruction seems to reduce the experience of amotivation in physical activity by a small effect size. Need-supportive instruction, however, does not seem to affect the controlling forms of extrinsic motivation (i.e., introjected regulation and external regulation). Furthermore, the effects on intrinsic motivation identified regulation, and amotivation seem to be very heterogeneous, i.e., varying in different contexts and from study to study. The a priori selected moderators largely failed to explain the variability except for external regulation (a significant moderating effect on control condition) and amotivation (significant moderating effect on intervention type and control condition).

The results of the second study - an experiment testing the effect of need-supportive instruction on motivational, skill performance, and affective outcomes - supported previous experimental findings (Edmunds et al., 2008; Sparks, Lonsdale, Dimmock, & Jackson, 2017; Fransen, Boen, Vansteenkiste, Mertens, & Vande Broek, 2018), showing the effect of need-supportive instruction on intrinsic motivation and enjoyment. However, the study showed no between-condition differences on state anxiety and the other motivational regulations conflicting in part the previous findings (e.g., Cheon, Reeve, & Song, 2016).

The novel finding of this experiment was that need-supportive instruction leads to improved skill performance. This finding contributes to the limited existing research on the effect of need-supportive instruction on motor skill performance in natural settings (Behzadnia, Mohammadzadeh, & Ahmadi, 2017). Lastly, the path model suggested that need-supportive instruction was linked to increased enjoyment and skill performance via perceived autonomy and relatedness support and improved intrinsic motivation, integrated regulation, and decreased

amotivation supporting in part the postulations of SDT (Deci & Ryan, 1985, 2000) and the hierarchical model of intrinsic and extrinsic motivation (Vallerand, 1997, 2000).

The results of this dissertation highlight the benefits of need-supportive behaviors and strategies in physical activity in terms of enhancing skill performance, motivation, and enjoyment. PE teachers, sports coaches, and other physical activity professionals should use need-supportive instructional strategies in their daily work and interactions to improve motivation, skill performance, and positive affect. Teachers should, for example, make sure they are interpersonally involving with their students, ensure that their informational and positive feedback enhances students' perception of competence, and provide optimal challenges and personal modifications for class activities.

This dissertation suggests that need-supportive instruction may not be effective in helping participants to integrate controlled forms of motivation to more autonomous as the mean level examination showed that extrinsic motivation increased in both conditions. It may be that the internationalizing process, i.e., transfer from extrinsic motivation towards more autonomous motivation, does not occur during a 2-week intervention. The instructional efforts to improve extrinsic regulation might demand more profound measures to help participants to see the value in the given activity and integrate it in their identity (Ntoumanis et al., 2018; Wassekampf & Kleinert, 2016). This process may also take time beyond a 2-week intervention. To facilitate internalization, PE teachers should offer students rationales that include discussion of the value and importance of PE and physical activity. Increasing awareness of the benefits of activities at the beginning of the lesson may be more effective, especially when the outcomes of the activity are highly valued. For example, teachers can talk to participants about the likely outcomes and possible benefits of the activity (e.g., learning teamwork, decreasing stress, and enhancing self-

esteem) to participants and help participants to experience these and other positive outcomes (e.g., feeling competence and developing relationships).

For the research community, this study leaves several unanswered questions. First, although the research supports partially the effect of need-supportive instruction, heterogeneity in research designs and the conceptualization of need-support prohibit definite conclusions. In addition, the effect of the instruction on motivational regulations and other outcomes in different contexts, such as PE and exercise, needs to be carefully examined. Moreover, it is mostly undetermined, which need satisfaction strategies are the most beneficial on participant outcomes. Lastly, there does not seem to be a clear consensus on how need-supportive instruction should be conceptualized and what type of nomenclature should be used in the research literature (Cheon, Reeve, Ntoumanis, 2018).

Following the theorizing of SDT, it has been shown that thwarting the three basic needs is linked to ill-being and adverse affective outcomes (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011 Deci & Ryan, 2000). Based on this study, it would seem that, compared to need-supportive instruction, participants do not perceive need-depriving instruction threatening and thwarting enough to increase state anxiety. Moreover, the findings between need-thwarting and adverse affective outcomes have mostly derived from sport contexts that are most likely profoundly meaningful life domains for participants, and thus more sensitive to lead to maladaptive affects compared to compulsory school PE.

In the future, studies should conceptualize need-supportive instructional strategies and behaviors more precisely and try to see what strategies are the most influential ones in terms of the participants' motivational regulations, affect, and other educational outcomes. Also, larger sample sizes should try to replicate the findings of this experimental study, and use standardized

learning measures to examine if the finding of performance can be extended beyond improved motor skill performance. Comparing the effect of need-supportive instruction to the conditions other than need-deprivation would also add new knowledge as well as examining the effect of instruction in different life contexts varying in their subjective importance for the participants. Better conceptualizations of the used behavior measures of practice time could also be incorporated in the future. Finally, future studies are needed to examine the role of need-supportive instruction, not only on the direct outcomes of school PE, but also on more broad and vital outcomes of self-esteem, wellbeing, and educational adjustment. It is likely that need-supportive instruction has long-lasting and overreaching effects beyond the objectives of school PE.

References

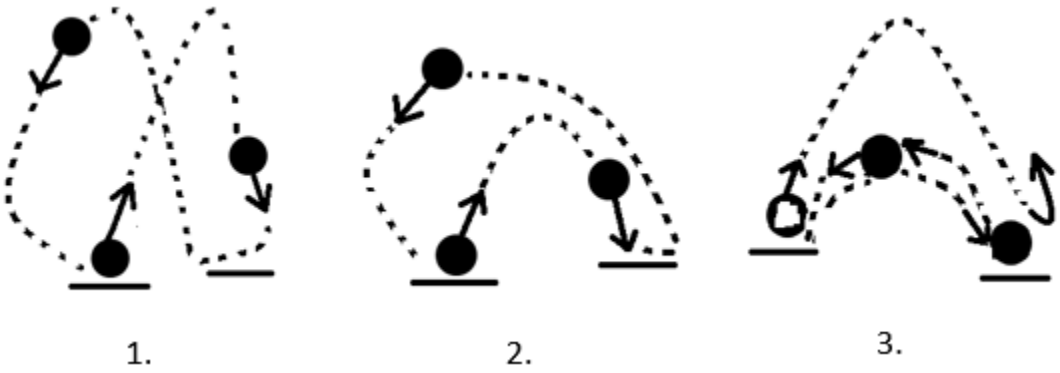
1. Aelterman, N., Vansteenkiste, M., Van Keer, H., Van den Berghe, L., De Meyer, J., & Haerens, L. (2012). Students' objectively measured physical activity levels and engagement as a function of between-class and between-student differences in motivation toward physical education. *Journal of sport and exercise psychology*, *34*(4), 457-480.
2. Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C. (2011). Self-determination theory and diminished functioning: The role of interpersonal control and psychological need thwarting. *Personality and Social Psychology Bulletin*, *37*, 1459-1473.
3. Behzadnia, B., Mohammadzadeh, H., & Ahmadi, M. (2017). Autonomy-supportive behaviors promote autonomous motivation, knowledge structures, motor skills learning and performance in physical education. *Current Psychology*, 1-14.
4. Cheon, S. H., Reeve, J., & Song, Y. G. (2016). A teacher-focused intervention to decrease PE students' amotivation by increasing need satisfaction and decreasing need frustration. *Journal of Sport and Exercise Psychology*, *38*(3), 217-235.
5. Cheon, S. H., Reeve, J., & Ntoumanis, N. (2018). A needs-supportive intervention to help PE teachers enhance students' prosocial behavior and diminish antisocial behavior. *Psychology of Sport and Exercise*, *35*(3), 74-88.
6. Deci, E. L., & Ryan, R. M. (1985*). Intrinsic motivation & self-determination in human behavior*. New York, NY: Plenum Press.
7. Deci, E. L., & Ryan, R. M. (2000). The 'what' and 'why' of goal pursuits: human needs and the self-determination of behavior. *Psychological Inquiry, 11,* 227-268.
8. Edmunds, J., Ntoumanis, N., & Duda, J. L. (2008). Testing a self-determination theory-based teaching style intervention in the exercise domain. *European Journal of Social Psychology*, *38*, 375-388.
9. Fransen, K., Boen, F., Vansteenkiste, M., Mertens, N., & Vande Broek, G. (2018a). The power of competence support: The impact of coaches and athlete leaders on intrinsic motivation and performance. *Scandinavian Journal of Medicine & Science in Sports*, *28*, 725-745.
10. Ntoumanis, N., Stenling, A., Thøgersen-Ntoumani, C., Vlachopoulos, S., Lindwall, M., Gucciardi, D. F., & Tsakonitis, C. (2018). Longitudinal associations between exercise identity and exercise motivation: A multilevel growth curve model approach. *Scandinavian Journal of Medicine & Science in Sports*, *28*(2), 746-753.
11. Sparks, C., Lonsdale, C., Dimmock, J., & Jackson, B. (2017). An intervention to improve teachers' interpersonally involving instructional practices in high school physical education: Implications for student relatedness support and in-class experiences. *Journal of Sport and Exercise Psychology*, *39*, 120-133.
12. Standage, M., Duda, J. L., & Ntoumanis, N. (2003). A model of contextual motivation in physical education: Using constructs from self-determination and achievement goal theories to predict physical activity intentions. *Journal of Educational Psychology*, *95*(1), 97-110.
13. Teixeira, P. J., Carraça, E. V., Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 78.

14. Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 29, pp. 271–360). San Diego: Academic.
15. Vallerand, R. J. (2000). Deci and Ryan's self-determination theory: A view from the hierarchical model of intrinsic and extrinsic motivation. *Psychological Inquiry*, *11*(4), 312-318.
16. Wasserkampf, A., & Kleinert, J. (2016). Organismic integration as a dynamic process: A systematic review of empirical studies on change in behavioral regulations in exercise in adults. *International Review of Sport and Exercise Psychology*, *9*(1), 65-95.

APPENDICES

Juggling test description

The juggling test consisted of three three-ball juggling techniques; the Basic Cascade, the Reverse Cascade, and the Mills Mess Cascade. In the Basic Cascade, each ball is thrown from one hand to the other so that there is at least one ball 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 is in the air. In the Mills Mess Cascade, the first two balls are thrown like in the Reverse Cascade, but the third ball is crossed to the opposite side and then thrown under the other hand towards the side it was crossed from.



Juggling test techniques (1. The Basic cascade; 2. The Reverse cascade; 3. The Mills Mess cascade)

Lesson plans

1st lesson

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

- Lunges going across the gym (forward/sideways/backward)
- Trunk rotation and reaching across and down with the back of the hand
- Core strengthening (plank type of activity) in all fours on the floor
- Basic squat progression exercise
- Shoulder rotations

Juggling content (instructor led 25 min):

- 0-3 min - Intro to the content of the next five lessons
- 3-4 min – 1-ball from one hand to the other
- 4-6 min – 2-balls with the Basic cascade technique without catching the balls
- 6-8 min – 2-balls with the Basic cascade technique with a catch
- 8-11 min – 3-balls with the Basic cascade technique without catching the balls
- 11-13 min – 3-balls with the Basic cascade technique with a catch
- 13-14 min – Break and feedback
- 14-16 min – 3-ball Basic cascade juggling continuously
- 16-20 min – 3-ball juggling technique (elbows, palms, the height of the throw, being stationary)
- 20-25 min – 3-ball Basic cascade juggling continuously with the correct technique in mind

Free-choice period (10 min):

- The students practice without the supervision of the instructor (the instructor is visible to the students at all times)

2nd lesson

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

- Jumping jacks
- Dynamic activation of the hamstrings, quadriceps and gluteus muscles going across the floor
- Core strengthening (plank type of activity) in all fours on the floor
- Basic squat progression exercise
- Shoulder rotations

Juggling content (instructor led 25 min):

- 0-3 min – Reiteration of the progressions from 1 to 2 balls from the last class and introduction of day's agenda
- 3-7 min – 3 ball Basic cascade juggling reiteration
- 7-10 min – Highlighting the correct technique
- 10-11 min – Explaining the Reverse cascade technique
- 11-14 min – 2 balls Reverse cascade with a catch
- 14-16 min - 3 balls Reverse cascade without a catch
- 16-18 min – 3 ball Reverse cascade with a catch
- 18-19 min – Break and feedback
- 19-22 – 3 ball Reverse cascade continuously
- 22-25 min - 3 ball basic cascade

Free-choice period (10 min):

- The students practice without the supervision of the instructor (the instructor is visible to the students at all times)

3rd lesson

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

- Forward lunges going across the gym
- Push-ups with a T-rotation
- Squat jumps
- Core strengthening (plank type of activity) in all fours on the floor
- Shoulder rotations

Juggling content (instructor led 25 min):

- 0-3 min – Introduction of the day's content/demo of the basic and reverse cascade
- 3-6 min – Basic cascade practice
- 6-7 min – Break and feedback / Intro to the reverse cascade
- 7-10 min – Reverse cascade practice
- 10-11 min – Break and feedback
- 11-13 min – Introduction to the Mill's Mess technique
- 13-18 min – Two throws with the basic cascade technique + the third under and across – no catch
- 18-19 min – Break and feedback
- 19-22 min - Two throws with the basic cascade technique + the third under and across with a catch
- 22-25 min – Two throws with the Basic cascade + the under and across – first without a catch and then with a catch

Free-choice period (10 min):

- The students practice without the supervision of the instructor (the instructor is visible to the students at all times)

4th lesson

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

- Forward lunges going across the floor
- Deep lunge forward with a contrasting movement stretching the hamstring
- Basic squat progression exercise
- Trunk rotation and reaching across and down with the back of the hand
- Shoulder rotations

Juggling content (instructor led 25 min):

- 0-2 min - Intro to the content of the day and repeating the three practiced techniques
- 2-7 min – Basic cascade practice
- 7-8 min – Break and feedback
- 8-13 min – Reverse cascade practice
- 13-14 min – Break and feedback
- 14-15 min – Explanation of the Mill's Mess technique
- 15-18 min – Practice with Mill's Mess without a catch
- 18-23 min – Practice with Mill's Mess with a catch
- 23-25 min – Feedback and technique reiteration

Free-choice period (15 min):

- The students practice without the supervision of the instructor (the instructor is visible to students at all times)

5th lesson

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

- Activation of the hamstrings, quadriceps and gluteus muscles going across the floor
- Deep lunge forward with a contrasting movement stretching the hamstring
- Push-ups with a T-rotation
- Balance exercise standing on one foot at a time touching the ground ten times
- Shoulder rotations

Juggling content (instructor led 25 min):

- 0-2 min - Intro to the content of the day's lesson
- 2-5 min – Practice Basic cascade
- 5-6 min – Break and feedback
- 6-7 min – Intro to Reverse cascade
- 7-11 min – Practice Reverse cascade
- 11-25 min – Practice Mill's Mess technique

Free-choice period (10 min):

- The students practice without the supervision of the instructor (the instructor is visible to students at all times)

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: A number of statements which people have used to describe themselves are given below. Reach each statement and then choose a number for each statement that indicates **how you generally feel.** There is no right or wrong answer. Do not spend too much time on any one statement but give the answer, which seems to describe how you generally feel.

Q7. Indicate how you generally feel (1= Never & 7= Always)

	1	2	3	4	5	6	7
1. I feel pleasant							
2. I feel nervous and restless							
3. I feel satisfied with myself							
4. I wish I could be as happy as others seem to be							
5. I feel like a failure							
6. I feel rested							
7. I am calm, cool, and collected							
8. I feel that difficulties are piling up so that I cannot overcome them							
9. I worry too much over something that really doesn't matter							
10. I am happy							
11. I have disturbing thoughts							
12. I lack self-confidence							
13. I feel secure							
14. I make decisions easily							
15. I feel inadequate							
16. I am content							
17. Some unimportant thoughts run through my mind and bother me							
18. I take disappointments so keenly that I can't put them out of my mind							
19. I am a steady person							
20. I get in a state of tension or turmoil as I think over my recent concerns and interests							

DIRECTIONS: These items pertain to a series of hypothetical sketches. Each sketch describes an incident and lists three ways of responding to it. Please read each sketch, imagine yourself in that situation, and then consider each of the possible responses. Think of each response option in terms of how likely it is that you would respond that way. (We all respond in a variety of ways to situations, and probably most or all responses are at least slightly likely for you). If it is very unlikely that you would respond the way described in a given response, you should circle answer 1 or 2. If it were moderately likely, you would select a number in the mid-range, and if it were very likely that you would respond as described, you would circle answer 6 or 7.

Q1. You have been offered a new position in a company where you have worked for some time. The first question that is likely to come to mind is.

	1	2	3	4	5	6	7
1. Will I make more at this position?							
2. I wonder if the new work will be interesting.							

Q2. You have a school-age daughter. On parents' night, the teacher tells you that your daughter is doing poorly and does not seem involved in the work. You are likely to:

	1	2	3	4	5	6	7
1. Talk it over with your daughter to understand further what the problem is.							
2. Make sure she does the assignments, because she should be working harder.							

Q3. You had a job interview several weeks ago. In the mail, you received a form letter, which states that the position has been filled. It is likely that you might think:

	1	2	3	4	5	6	7
1. It's not what you know, but who you know.							
2. Somehow they didn't see my qualifications as matching their needs.							

Q4. You are a plant supervisor and have been charged with the task of allotting coffee breaks to three workers who cannot all break at once. You would likely handle this by:

	1	2	3	4	5	6	7
1. Telling the three workers the situation and having them work with you on the schedule.							
2. Simply assigning times that each can break to avoid any problems.							

Q5. A close (same-sex) friend of yours has been moody lately, and a couple of times has become very angry with you over "nothing." You might:

	1	2	3	4	5	6	7

1. Share your observations with him/her and try to find out what is going on for him/her.							
2. Tell him/her that you're willing to spend time together if and only if he/she makes more effort to him/herself .							

Q6. You have just received the results of a test you took, and you discovered that you did very poorly. Your initial reaction is likely to be:

	1	2	3	4	5	6	7
1. "I wonder how it is I did so poorly," and feel disappointed.							
2. "That stupid test doesn't show anything," and feel angry.							

Q7. You have been invited to a large party where you know very few people. As you look forward to the evening, you would likely expect that:

	1	2	3	4	5	6	7
1. You'll try to fit in with whatever is happening in order to have a good time and not look bad .							
2. You'll find some people with whom you can relate .							

Q8. You are asked to plan a picnic for yourself and your fellow employees. Your style for approaching this project could most likely be characterized as:

	1	2	3	4	5	6	7
1. Take charge: that is, you would make most of the major decisions yourself.							
2. Seek participation: get inputs from others who want to make them before you make the final plans.							

Q9. Recently a position opened up at your place of work that could have meant a promotion for you. However, a person you work with was offered the job rather than you. In evaluating the situation, you're likely to think:

	1	2	3	4	5	6	7
1. The other person probably "did the right things" politically to get the job.							
2. You would probably take a look at factors in your own performance that led you to be passed over.							

Q10. You are embarking on a new career. The most important consideration is likely to be:

	1	2	3	4	5	6	7
1. How interested you are in that kind of work.							
2. Whether there are good possibilities for advancement							

Q11. A woman who works for you has generally done an adequate job. However, for the past

two weeks, her work has not been up to par and she appears to be less actively interested in her work. Your reaction is likely to be:

	1	2	3	4	5	6	7
1. Tell her that her work is below what is expected and that she should start working harder.							
2. Ask her about the problem and let her know you are available to help work it out.							

Q12. Your company has promoted you to a position in a city far from your present location. As you think about the move you would probably:

	1	2	3	4	5	6	7
1. Feel interested in the new challenge and a little nervous at the same time.							
2. Feel excited about the higher status and salary that is involved.							

Q13. 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.

	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							

Q14. 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 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.

Q15. 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.

Q16. 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 activies (							
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							

Q17. 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 now 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 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							

Free-choice observation sheet

Date:

1st class

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

2nd class

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

Out of class practice log

Day	Juggling
	minutes
Day 1	
Day 2	
Day 3	
Day 4	
Day 5	
Day 6	
Day 7	
Day 8	
Day 9	
Day 10	
Day 11	
Day 12	
Day 13	
Day 14	
Day 15	
Total	

Fidelity observation sheet

Date:_____ Hour: _____ **Name:_____** **The teacher . . .**	**Minutes 0 to 7** 0 = never observed 1 = sometimes observed 2 = often observed 3 = observed all the time	**Minutes 7 to 14** 0 = never observed 1 = sometimes observed 2 = often observed 3 = observed all the time	**Minutes 14 to 21** 0 = never observed 1 = sometimes observed 2 = often observed 3 = observed all the time	**Minutes 21 to 28** 0 = never observed 1 = sometimes observed 2 = often observed 3 = observed all the time	**Minutes 28 to 35** 0 = never observed 1 = sometimes observed 2 = often observed 3 = observed all the time
Nature of the class (Warm-Up; Activity; Cool-Down, write NA if not available)					
COMPETENCE					
1. Goals: Overview and the goals of the lesson, especially intrinsic goals e.g. “It’s important you set your own goals and focus on your own progress.”					
2. Task difficulty and differentiation e.g., the teacher provides exercises with a different degree of difficulty, taking into account the possibilities of different students.					
3. Feedback: Informational, positive and clear feedback signifying competence or how to be more competent. Positive feedback on positive student initiated behavior.					
AUTONOMY					
4. Ownership: The teacher wants the students to feel in control and tells them this					
5. Provision of choice e.g., choice in the order or variation of the exercises.					

6. Value and relevance e.g. offers the students a specific explanation, rationale for rules, tasks or exercises (e.g., "This is important because.., Don't bounce with the ball during the instruction so that everyone is capable of hearing me, which will allow to start with the exercises faster").					
7. Language: Empathetic language and informational language e.g. "I suggest, you may, you might". Non-controlling and responsive.					
RELATEDNESS					
8. Interpersonal involvement: Friendly, warm, shares personal information e.g. Asks questions about interests, problems, wishes or values e.g. "Does everyone understands what we are going to do? "Which exercises do you find hard to engage in?, Did you understand the explanation?", Are you not feeling well today?"					
9. Physical distance: Close proximity and moves around – isn't distant					
10. Use of names: addresses students by their first name when the opportunity occurs.					