Coaching dynamics in elite volleyball: The role of a need-supportive and need-thwarting coaching style during competitive games

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ABSTRACT

Grounded in Self-Determination Theory, this game-to-game study among Flemish volleyball coaches and athletes had two primary objectives. First, we examined how variations in need-supportive and need-thwarting coaching styles related to variations in athletes' basic psychological needs, motivation, and coach-rated performance. Second, we examined whether athletes who perceived their coach as need-thwarting during a specific game would experience different outcomes based on the overall need-supportive or need-thwarting coaching style they encountered across games. Linear mixed modeling on data from 190 elite volleyball athletes (M_{age} = 23.95, 32.6 % male) and their 26 coaches (M_{age} = 48.12, 95.7 % male) indicated positive associations between game-specific need-supportive coaching and athletes' reports of game-specific basic psychological need experiences and motivation, as well as coach-rated performance, whereas game-specific need-thwarting coaching showed opposite trends. Athlete perceptions of a coaching style were more predictive of the outcomes than coach perceptions. Second, the lack of systematic cross-level interactions between game-specific coaching and team-level coaching indicated that the observed correlates of game-specific need-thwarting and need-supportive coaching hold regardless of the perceived overall need-thwarting or need-supportive style of the coach across games.

Volleyball is one of the most popular team sports in Flanders, Belgium. In 2022, Flanders counted 879 sports clubs with more than 40,000 members, underlining the sport's widespread popularity (Sports Flanders, 2023). After soccer, volleyball is the sport with the highest number of elite athletes in Flanders. Elite athletes are defined as those who compete at both national and international levels (Statistics Flanders, 2023). The top level of competition is called the "League Series", followed by the National 1, National 2, and National 3 levels. At these elite levels, practices are held with a high frequency, ranging from several times a week to daily, reflecting the necessary dedication and commitment of players and coaches alike. Notably, the sport attracts significant public interest, with top-level games attracting large crowds of up to 12,000 fans in spacious indoor venues. Volleyball coaches, as in most other sports, are challenged not only to maximize their athletes' performance in each game, but also to ensure athletes' motivation and well-being (International Council for Coaching Excellence, 2013). Recognizing that this is a challenge for coaches, a government-funded project on motivational coaching has been established in Flanders. This project is called "Coach with the M-factor", where M refers to motivation. This project aims to improve the motivating style of coaches

by offering three skill-oriented workshops (Reynders et al., 2019). However, this project mainly focuses on youth coaches at lower competitive levels. Grounded in Self-Determination Theory (SDT; Ryan & Deci, 2017; Ryan et al., 2021), a broad theory of human motivation and development, our study explores the dynamics of different forms of elite coaching in Flemish volleyball, recognizing that coaches play a central role in shaping various athlete outcomes and that a coaching style can vary from game to game.

1. Need-supportive and need-thwarting coaching

SDT explains the variation in motivation, well-being, and behavior of athletes in terms of the satisfaction and frustration of three basic psychological needs, these are, the needs for autonomy, competence, and relatedness (Ryan & Deci, 2017; Ryan et al., 2021; Vansteenkiste et al., 2020). First, the need for autonomy implies that athletes experience a sense of freedom and room for authenticity in their actions, thoughts, and feelings. Second, the need for competence implies that athletes feel capable and confident in their ability to improve and achieve (challenging) goals. Finally, the need for relatedness implies that athletes feel

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a sense of care and connection with other people involved in their sports. In sports, studies found that need satisfaction is positively related to athletes' positive affect (Verner-Filion & Vallerand, 2018), autonomous motivation (Mallia et al., 2019), and engagement (De Francisco et al., 2020), and negatively related to dropout (Elsborg et al., 2023). Conversely, the frustration of these same basic psychological needs, manifested through experiences of pressure, failure, and social alienation, is associated with various costs (Vansteenkiste & Ryan, 2013). For example, athletes' need frustration is associated with burn-out (Vílchez Conesa et al., 2020), controlled motivation (Monteiro et al., 2020), and lower levels of perceived performance (Haraldsen et al., 2020).

Given the benefits associated with need satisfaction, considerable attention has been given to the question of which coaching style maximally supports athletes' three basic psychological needs. An autonomy-supportive coaching style is essential in this regard (Mossman et al., 2022). When coaches are autonomy-supportive, they allow athletes to take ownership, for instance, by providing choices or stimulating a sense of initiative (Mageau & Vallerand, 2003). They also incorporate exercises that match athletes' interests and preferences, and provide meaningful rationales for uninteresting but important tasks (Delrue et al., 2019). Autonomy support is best complemented by a structuring or competence-supportive coaching style, in which athletes are encouraged to improve and develop their skills to their maximum potential. Structure involves, for example, the expression of confidence in athletes' abilities and the provision of valuable feedback to guide athletes toward their goals (Curran et al., 2013). Research in the sports context has provided evidence that both autonomy-supportive (e.g., Lemelin et al., 2022) and competence-supportive (e.g., Mertens et al., 2018) coaching styles are associated with higher need satisfaction (Reinboth et al., 2004), intrinsic motivation (Mertens et al., 2018), and better performance (Lemelin et al., 2022) in athletes.

However, coaches can also undermine athletes' basic psychological needs by using a need-thwarting coaching style. Autonomy-thwarting or controlling coaches undermine athletes' autonomy by imposing their views and invalidating the athletes' perspective, or by using guilt trips or contingent regard to enforce cooperation (Bartholomew et al., 2010). Coaches who use a competence-thwarting style undermine their athletes' need for competence by openly questioning their athletes' abilities, highlighting failures, providing excessive negative feedback, or abandoning their athletes when they encounter barriers to their skill development (Mageau & Vallerand, 2003). When coaches use an autonomy-thwarting (e.g., Balaguer et al., 2012) or competence-thwarting (e.g., Fransen et al., 2018) coaching style, athletes report greater need frustration (Delrue et al., 2019), feelings of failure (Moreno-Murcia et al., 2019), burnout (Balaguer et al., 2012), lower intrinsic motivation (Fransen et al., 2018), and higher controlled motivation and amotivation (Mouratidis et al., 2010). Although many SDT-based studies confirmed the relations between need-supportive and need-thwarting coaching and athlete outcomes, our study advances this body of knowledge through three significant contributions, which are outlined in the following three subsections.

1.1. Elite context

First, although dozens of studies have demonstrated the benefits and pitfalls of, respectively, a need-supportive and need-thwarting coaching style with recreational or low-competitive athletes, far less research has been conducted with elite athletes. An important question is whether these findings can simply be generalized to the elite context. The scant empirical research at the elite level suggests that a need-supportive style is positively related to elite athletes' well-being (Adie et al., 2012; Berntsen et al., 2019) and quality of motivation (Banack et al., 2011; Stenling et al., 2015), whereas a need-thwarting style has opposite associations with well-being (Cheval et al., 2017; Isoard-Gautheur et al., 2012) and motivation (Haerens et al., 2018). These studies used both cross-sectional (e.g., Banack et al., 2011) and longitudinal (e.g.,

Berntsen et al., 2019) designs, among adolescent athletes from different team sports (e.g., handball; Isoard-Gautheur et al., 2012) and individual sports (e.g., skiing; Stenling et al., 2015), recruited through both sports clubs (e.g., Cheval et al., 2017) and elite sports schools (e.g., Haerens et al., 2018). Nonetheless, the few studies conducted at the elite level have not been in volleyball and have focused exclusively on psychological outcomes, capturing individuals' affective or motivational experiences in sports (e.g., Adie et al., 2012; Cheval et al., 2017). It is thus imperative to examine whether need-supportive elite coaching is preferable, not only in terms of psychological outcomes, but also in terms of performance outcomes. In elite sports, a need-thwarting coaching style is sometimes justified as essential to drive athletes to improved performance, despite its psychological costs (Stirling & Kerr, 2009). For example, qualitative research conducted with elite judo coaches revealed that provocation is viewed as a beneficial catalyst for optimizing performance (d'Arripe-Longueville et al., 1998). Given the potential for psychological harm, it is important to examine whether it is really the case that need-thwarting coaching at the elite level leads to better performance. Limited cross-sectional (Haerens et al., 2018), longitudinal (Lemelin et al., 2022), and experimental (Cheon et al., 2015) studies in elite settings suggest that an autonomy-supportive style predicts enhanced athlete performance. Yet, the relation between a need-thwarting coaching style and performance remains underexplored. A sole cross-sectional study observed a nonsignificant link between controlling coaching and coach-rated performance (Haerens et al., 2018). Therefore, the current study includes coach-rated performance-related measures (i.e., satisfaction with team performance and athletes' intrapersonal progress) next to athlete-reported need satisfaction, need frustration, and motivation as outcomes of elite volleyball coaching.

1.2. Multi-informant approach

Second, previous research mostly relied on a single-informant approach, with studies using data from a single source to map a coaching style, often athletes' reports of the coach's behavior (e.g., Reinboth et al., 2004). As a result, conclusions about the effects of coaching are drawn solely from the perceptions of the athletes. Few studies have used a multi-informant approach in which two or more sources, typically coaches and athletes, report on coaching styles. The few studies that included both athlete and coach perceptions found little agreement between the two informants (Boyce et al., 2009) and found that athlete perceptions are more predictive of athlete outcomes (Smith et al., 2016). This is in line with research among elite coaches, suggesting that elite coaches have limited awareness of how their own behavior is perceived by athletes (Partington & Cushion, 2013). Therefore, the current study uses a multi-informant approach in which both elite volleyball athletes and coaches report on, respectively, the perceived and used game-specific coaching styles.

1.3. Game-to-game fluctuations

Third, previous studies mostly focused on the (relatively stable) individual differences between coaches in terms of their coaching style. Although there exist reliable interindividual differences, coaches may also exhibit variation in their style from game to game. This game-to-game variation cannot be captured by cross-sectional or longitudinal designs with a limited number of measurement points or long time intervals. To more fully examine the functional role of need-supportive and need-thwarting coaching styles, a game-to-game design is needed. This approach goes beyond trait differences between coaches and also accounts for the variations in coach behavior from game to game. One study at the elite level (Balk et al., 2019) and two studies at the recreational or competitive level (Bartholomew et al., 2011; Delrue et al., 2017) considered the dynamic nature of coaching by employing a training-to-training (Balk et al., 2019; Bartholomew et al., 2011) or

game-to-game (Delrue et al., 2017) design. These studies identified fluctuations in need-supportive and need-thwarting coaching styles and also indicated that these fluctuations were associated with parallel fluctuations in athlete outcomes. Specifically, more need-supportive coaching during training and competitive games predicted higher levels of training- or game-specific psychological need satisfaction (Bartholomew et al., 2011) and adaptive behaviors (e.g., less antisocial behavior, more engagement; Balk et al., 2019; Delrue et al., 2017). Therefore, the current study adopts a game-to-game design.

This game-to-game design requires a multilevel approach that allows us to additionally examine whether the degree to which athletes are affected by need-thwarting coaching during a particular game depends on how the team as a whole is treated across games. Several of such cross-level interaction processes are plausible. First, based on SDT, we can expect a sensitization process in which athletes who experience their coach as need-thwarting across games would suffer more from additional need thwarting within a given game (Moller et al., 2010). In contrast to the SDT perspective, some lay beliefs suggest a compensation or habituation process. In the case of a compensation process, coaches' use of a need-supportive style across games would compensate for the effects of occasional (i.e., game-specific) need-thwarting behaviors. That is, the pitfalls of a game-specific need-thwarting style would be buffered or even reversed when a coach is generally need-supportive across games, because an intermittent, periodic (i.e., game-specific) harsh approach within an otherwise need-supportive climate would help keep everyone on their toes (Lefever et al., 2024). In the case of a habituation process, athletes of a coach who is need-thwarting across games would be less susceptible to need-thwarting behaviors during a specific game because they are used to dealing with such behaviors, or at least are required to learn to cope with them (d'Arripe-Longueville et al., 1998; Gucciardi et al., 2017; Jowett, 2003; Stirling & Kerr, 2009).

2. The present study

The first objective was to examine how elite volleyball coaches' need-supportive and need-thwarting styles relate to athletes' basic psychological needs, motivation, and coach-rated performance. Based on SDT (Ryan & Deci, 2017), we hypothesized that when coaches act in a more need-supportive way, athletes would report higher need satisfaction and autonomous motivation, and lower need frustration, controlled motivation, and amotivation (Hypothesis 1a). We expected an opposite pattern of correlates for need-thwarting coaching behaviors (Hypothesis 1b). Based on SDT (Ryan & Deci, 2017), but despite the belief in elite contexts that certain forms of need-thwarting coaching approaches are acceptable and even warranted for good performance (Stirling & Kerr, 2009), we hypothesized that need support and need thwarting would be associated with higher and lower coach-rated performance (i.e., progress and satisfaction with athlete performance), respectively (Hypothesis 1c). Furthermore, based on previous research indicating that athlete perceptions are more predictive of athlete outcomes (e.g., Smith et al., 2016), we hypothesized that primarily athlete perceptions of a coaching style (rather than how coaches rated themselves) would be related to athletes' basic psychological needs, motivation, and coach-rated performance (Hypothesis 1d).

The second objective was to examine whether the degree to which elite volleyball athletes are affected by need-thwarting coaching during a particular game depends on the coaches' general coaching style across games. Based on SDT, we hypothesized a sensitization process in which athletes who experience their coach as need-thwarting across games will suffer more from additional need thwarting within a given game (Moller et al., 2010) (Hypothesis 2a). We tested this sensitization hypothesis against two alternative hypotheses. That is, whether athletes would be less affected by additional need thwarting within a given game because they usually experience their coach as need-thwarting (habituation; Hypothesis 2b) or need-supportive (compensation; Hypothesis 2c).

3. Method

3.1. Design and procedure

The study was approved by the ethical board of the Faculty of Psychology and Educational Sciences of Ghent University (no. 2018/85). A flowchart of the study procedure is shown in Figure 1. First, a list of Flemish volleyball teams (both male and female) competing at the elite level was compiled from the national volleyball website (https://www. volleyscores.be/), resulting in 144 eligible teams. Contact information for the head coach of each team was obtained from the team websites, and invitations to participate were sent by e-mail. A total of 31 head coaches (from 31 different teams) provided informed consent to participate in the study, of which 26 began the game-to-game survey. Next, coaches were asked to forward a link to an online informed consent form to all of their athletes. To minimize the coach's workload, a sample email was prepared by the researchers. Minor athletes (under the age of 18) were required to have a parent or guardian sign the online consent form. A total of 212 athletes provided informed consent, of which 190 (an average of 7 athletes per coach) participated in the game-to-game surveys. Logistic drop-out analyses indicated that participation (or not) in the game-to-game survey after giving online consent could not be predicted by the sociodemographic variables for either coaches or athletes.

Coaches and athletes who consented to participate in the study were invited to complete a brief online survey after each competitive game for five consecutive games. The survey link was sent to both the coach and the athletes before each game to remind them to complete the survey immediately after the game. The online survey tool allowed the researchers to monitor completion. If the survey was not completed immediately after the game, the researchers sent a reminder to complete the survey as soon as possible. At the beginning of each athlete's questionnaire, the item "Did you participate in today's game?" was included. Athletes who indicated that they did not play (e.g., due to non-selection, illness, injury) were not required to complete the questionnaire and were therefore immediately moved to the end of the questionnaire. Athletes who indicated that they did play were asked to report on their perceived coaching style of their coach during the game, as well as on their basic psychological needs and motivation during the game. The coaches were asked to report on their coaching style during the game, as well as on their satisfaction with the team's performance and the individual progress of five of the athletes who also participated in the study. To this end, coaches were asked to randomly select five athletes whose weekly progress they would consistently report on. As a result, the analyses related to this outcome were conducted on a truncated dataset. Specifically, all 26 coaches reported on the progress of 5 athletes each, resulting in intrapersonal performance data on 130 athletes (instead of the full dataset of 190 athletes). To mitigate potential selection bias, coaches were required to identify these five athletes at the beginning of the study (i.e., during the first assessment) and to maintain the selected set of names for all subsequent measurements. This procedural requirement prevented coaches from selecting athletes with superior performance in each game. In addition, by focusing on individual progress rather than absolute performance, the specific selection of the five athletes, whether they generally performed better or worse than their teammates, played less of a role in the coaches' evaluations. The decision to leave the assessment of athlete performance exclusively to the coaches was driven by three considerations. First, we aimed to keep the athlete questionnaire short to reduce the response burden and prevent dropout over time. Also, athletes' performance can be easily observed and rated by coaches, whereas intrapersonal experiences such as psychological need satisfaction and motivation are more difficult to rate by coaches. Second, athletes' self-ratings of their performance may be susceptible to bias, either overly positive or overly negative. Third, by using a separate informant for the predictor (e.g., athletes' perceived coaching style) and the outcome (e.g., coach-rated athlete
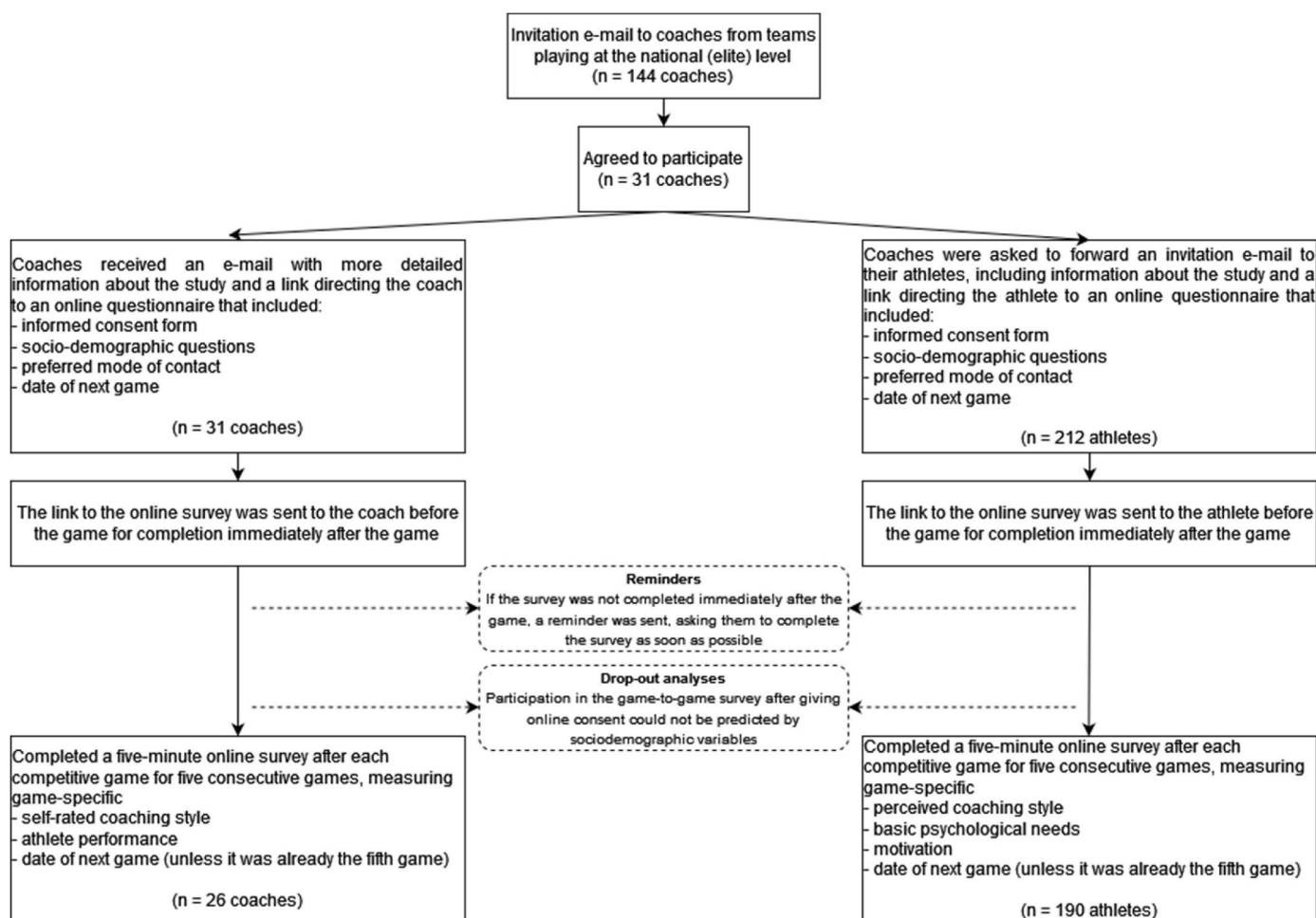
Figure 1. Flowchart of the study procedure.

performance), we addressed the problem of shared method variance. This approach helps to avoid potential biases observed in previous single-informant studies, where positive relations between study variables may have been influenced by participants' unique response patterns related to the valence of psychological constructs. Finally, both the coach and the athlete were asked when their next game would be so that the researchers could send the next email or text message on the correct day (unless they had already participated five times).

3.2. Participants

The final coach sample ($N = 26$) consisted of 95.7 % male coaches with a mean age of 48.12 years ($SD = 8.22$). The one female coach coached a female team, while the 25 male coaches coached 9 male teams and 16 female teams. The majority (96.2 %) of the coaches had a coaching diploma, most of which (86.6 %) were awarded by the Flemish government's certified training center. The coaches had an average of 21.72 years of coaching experience ($SD = 8.99$), including 12.48 years of coaching experience at the national level ($SD = 7.94$). The coaches had an average of 11.65 ($SD = 0.92$) athletes on their team per training session. The coaches trained their athletes an average of 6.90 hours per week ($SD = 4.21$).

Regarding the final sample of athletes ($N = 190$), the majority was female (67.4 %) and their mean age was 23.95 years ($SD = 3.88$). These athletes had played volleyball for a mean of 15.93 years ($SD = 4.30$) and had an average of 5.12 years ($SD = 3.57$) of experience at the national level. Regarding their level of competition, 15.3 % of the final sample was active at the highest level (League Series), 24.7 % at the second

highest level (National 1), 34.7 % at National 2, and 25.3 % at National 3.

3.3. Instruments

All questionnaires were administered in Dutch. Unless otherwise stated, the stem for all items was "During the past game …". Participants were asked to answer all items on a 7-point Likert scale ranging from 1 (*totally disagree*) to 7 (*totally agree*).

3.3.1. Coaching styles

Both coaches and athletes reported on the need-supportive and need-thwarting style of the coach during the past game using the Dutch version (De Muynck et al., 2021) of the Interpersonal Behaviors Questionnaire (IBQ; Rocchi et al., 2017). We focused on the autonomy and competence dimensions of the IBQ, omitting the relatedness support and/or thwarting items. We considered the relatedness items less relevant to our study objectives, because we expected minimal variation across games due to the general nature of these items in the IBQ (Rocchi et al., 2017). Thus, the need-supportive style was assessed using 8 items measuring both autonomy support (e.g., coach report "… I gave my athletes the freedom to make their own choices", and athlete report "… my coach gave me the freedom to make my own choices") and competence support (e.g., coach report "… I told my athletes that they can achieve things", and athlete report "… my coach told me I can achieve things"). The need-thwarting style was assessed by 8 items measuring both autonomy thwarting (e.g., coach report "… I limited the choice of my athletes", and athlete report "… my coach limited my choices") and

competence thwarting (e.g., coach report "… I gave my athletes the message that they are incompetent", and athlete report "… my coach gave me the message that I am incompetent"). Reliability of the need-supportive and need-thwarting styles was excellent at the between-subject level for both coaches ($\alpha_{\text{need-supportive}}$ = 0.98, $\alpha_{\text{need-thwarting}}$ = 0.86) and athletes ($\alpha_{\text{need-supportive}}$ = 0.95, $\alpha_{\text{need-thwarting}}$ = 0.93). At the within-subject level (i.e., the level of game-to-game variation), the reliability was rather low for coaches ($\alpha_{\text{need-supportive}}$ = 0.56, $\alpha_{\text{need-thwarting}}$ = 0.54), but good for athletes ($\alpha_{\text{need-supportive}}$ = 0.80, $\alpha_{\text{need-thwarting}}$ = 0.72).

3.3.2. Basic psychological needs

Athletes reported their experiences of need satisfaction and frustration by responding to items from the Basic Psychological Need Satisfaction Need Frustration Scale (Chen et al., 2015), which was translated into Dutch and adapted to the sports context by Delrue et al. (2019). The degree to which athletes' basic psychological needs were satisfied or frustrated during the last game was measured by six items each (e.g., satisfaction "… I had a sense of choice and freedom in what I did" and frustration "… I felt insecure about my skills"). The need satisfaction and frustration subscales had good reliability at both the between-athlete level ($\alpha_{\text{need satisfaction}}$ = 0.84, $\alpha_{\text{need frustration}}$ = 0.83) and within-athlete level ($\alpha_{\text{need satisfaction}}$ = 0.72, $\alpha_{\text{need frustration}}$ = 0.67).

3.3.3. Motivation

Athletes reported their motivation during the past game by answering 14 items from the original Dutch Behavioral Regulation in Sport Questionnaire-Revised 2 (Delrue et al., 2019). Following the stem "During the past game, I put effort into my sport …", athletes were asked to respond to 4 items for autonomous motivation (e.g., "… because I enjoy it"), 8 items for controlled motivation (e.g., "… because I would feel embarrassed if I didn't do it"), and 2 items for amotivation (e.g., "… but I actually wonder why"). The reliability of the three subscales was excellent at the between-athlete level ($\alpha_{\text{autonomous motivation}}$ = 0.94, $\alpha_{\text{controlled motivation}}$ = 0.96, $\alpha_{\text{amotivation}}$ = 0.98) and acceptable to good at the within-athlete level ($\alpha_{\text{autonomous motivation}}$ = 0.71, $\alpha_{\text{controlled motivation}}$ = 0.65, $\alpha_{\text{amotivation}}$ = 0.60).

3.3.4. Athlete performance

The coach rated the performance of the athletes in several ways. First, coaches rated how satisfied they were with the team's performance during the previous game using a 7-point Likert scale ranging from 1 (*very dissatisfied*) to 7 (*very satisfied*). Second, after each game, coaches individually assessed the intrapersonal progress of five of the participating athletes in four domains: technical, tactical, physical, and mental domain. This assessment has previously been successfully used in the Dutch language by Mouratidis et al. (2008) and Haerens et al. (2018). Scores were provided on a 7-point Likert scale, ranging from 1 (*very strong decline*) to 7 (*very strong progress*). The reliability of the intrapersonal progress scale across the four domains was excellent at the between-coach level (α = 0.94) and good at the within-coach level (α = 0.84).

3.4. Data analyses

3.4.1. Preliminary analyses

During preliminary analyses, we inspected the multilevel structure of our data and centered the study variables at each level to allow us to examine our two primary objectives in the main analyses. First, we assessed the multilevel structure of our data by analyzing the mean, standard deviation, and proportion of variance in each variable attributable to the three hierarchical levels: games (level 1), nested within athletes (level 2), and further nested within teams (level 3). *Game-level variance* reflects game-to-game variation among athletes on the same team. *Athlete-level variance* reflects inter-individual differences among athletes on the same team. *Team-level variance* reflects differences

between teams. In the second step, all variables were centered at different levels. Variables were centered at the *game level* by subtracting each athlete's average score across all games from the athlete's score in that game. Variables were centered at the *athlete level* by subtracting the unstandardized coach-centered score from each athlete's average score across all games. Finally, at the *team level*, each variable was centered by standardizing the average score per coach across all games. However, because coach-rated team performance had no variance at the athlete level (because coaches reported their satisfaction with team performance, thus giving each athlete on the team the same score), the centering of this variable was different. This variable was not centered at the athlete level and the centering at the game level consisted of subtracting each coach's average score across all games from the coach's score in that game. As a result, coach-rated team performance was not included in further analyses at the athlete level, and the game-to-game results should not be interpreted as game-to-game changes within an athlete (like the other dependent variables), but rather within a team. Similarly, there was no athlete-level variance in coaches' ratings of coaching style because coaches reported on their coaching style to the team as a whole, not to individual athletes. Therefore, it is not a viable predictor of game-level variance in individual athlete outcomes. As a result, coach ratings of need-supportive and need-thwarting coaching were not centered or included in subsequent athlete- or game-level analyses.

3.4.2. Primary analyses

For the first objective, we fit linear mixed models using the "lmer" function in the "lme4" package in R to account for the nested structure of the data (Bates et al., 2015). Coach and athlete age and gender were included as covariates. We included the athletes' perceptions (at each of the three levels) and coaches' self-ratings (at the team level) of the need-supportive and -thwarting coaching styles as predictors of athletes' basic psychological needs, motivation, and coach-rated performance. Running this model also allowed us to examine which informant reports, whether from coaches or athletes, provided the most predictive power regarding athlete outcomes (Objective 1).[1]

For the second objective, we added two cross-level interaction terms to this model. Specifically, to test the sensitization and habituation hypotheses, we included the interaction term between athletes' reports of coaches' need-thwarting coaching style during a specific game and the perceived need-thwarting coaching style across games (i.e., at the team level). To test the compensation hypothesis, we included the interaction term between athletes' reports of coaches' need-thwarting coaching style during a specific game and the perceived need-supportive coaching style across games (i.e., at the team level) (Objective 2).

4. Results

4.1. Preliminary analyses

First, to provide insight into the multilevel structure of the data, Table 1 provides a comprehensive overview of the mean, standard deviation, and variance of each study variable at each level of analysis. The findings suggest significant variability from one game to another in the use of need-supportive and need-thwarting coaching practices as reported by both athletes and coaches. In contrast, the variance in need-supportive and need-thwarting coaching styles as reported by athletes at the between-team level was relatively small.

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[1] To further explore the results of Objective 1, we examined the agreement between the two informants' perspectives (i.e., athletes and coaches) on coaches' need-supportive and need-thwarting coaching styles. Results suggest low to moderate agreement between coach and athlete reports, with coaches scoring higher on both their need-supportive and their need-thwarting behaviors compared to their athletes (see online Supplementary Material).

Table 1

Overview of all study variables' mean, standard deviation, and variance at each level.

Variables	M	SD	Proportion game-level variance (Level 1)	Proportion athlete-level variance (Level 2)	Proportion team-level variance (Level 3)
Predictor variables					
Athlete report					
Need-supportive style	4.29	1.03	44 %	47 %	9 %
Need-thwarting style	2.41	0.96	44 %	47 %	10 %
Coach report					
Need-supportive style	5.39	0.62	34 %	/	66 %
Need-thwarting style	2.74	0.91	36 %	/	64 %
Outcome variables					
Athlete report					
Need satisfaction	4.01	0.98	52 %	35 %	14 %
Need frustration	2.64	1.04	60 %	39 %	1 %
Autonomous motivation	5.90	1.01	33 %	66 %	1 %
Controlled motivation	3.27	1.38	21 %	79 %	0 %
Amotivation	2.01	1.34	36 %	64 %	0 %
Coach report					
Satisfaction with team performance	4.53	1.69	77 %	/	23 %
Intrapersonal progress	4.46	0.80	80 %	8 %	12 %

Note. M and *SD* represent mean and standard deviation, respectively.

Note. % denotes the proportion of variance of a variable attributed to the game-, athlete-, and team-levels. The total variance of a study variable (100 %) is the cumulative sum of variances across these three levels.

4.2. Primary analyses

4.2.1. How variation in coaching styles relates to variation in athlete outcomes (objective 1)

Based on the athlete reports of coaching styles, the results for the first objective (Table 2) indicated that in games in which an athlete experienced the coach as more need-supportive (compared to other games), the athlete reported higher need satisfaction and autonomous motivation, and lower need frustration and amotivation, compared to his or her own average. Contrary to our hypothesis, they also reported more controlled motivation (Hypothesis 1a). To gain further insight into this unexpected finding, we computed additional Pearson correlations. These analyses revealed that need support was not significantly correlated with either introjected regulation ($r = 0.01$, 95 %CI = [-0.06, 0.09]) or external regulation ($r = 0.04$, 95 %CI = [-0.03, 0.11]). Rather than the traditional distinction between introjected and external regulation, the distinction between the approach (e.g., seeking praise or rewards) and avoidance (e.g., avoiding guilt or criticism) components of controlled motivation seemed more relevant in explaining this unexpected finding. Specifically, need support was positively related to approach-oriented controlled motivation ($r = 0.08$, 95 %CI = [0.01, 0.15]), whereas it was not significantly related to avoidance-oriented controlled motivation ($r = -0.02$, 95 %CI = [-0.10, 0.05]).

Further, when athletes perceived their coach to be more need-thwarting during a particular game, they reported more need frustration, controlled motivation, and amotivation, and less need satisfaction relative to their own average (Hypothesis 1b).

Moreover, at the game level, the experienced need support was positively related to game-to-game variation in coach-rated intrapersonal progress. Finally, during games in which athletes perceived their coaches as more need-thwarting, coaches reported less satisfaction with team performance and less intrapersonal progress of individual athletes (Hypothesis 1c).

Some of these relations were also found at the athlete and team level (e.g., the association between need support and need satisfaction, and between need thwarting and need frustration), while others disappeared

Table 2

Need-supportive and need-thwarting coaching styles in the prediction of athlete outcomes at each of the three levels of analysis.

	Need satisfaction	Need frustration	Autonomous motivation	Controlled motivation	Amotivation	Satisfaction with performance	Intrapersonal progress
FIXED EFFECTS	β	β	β	β	β	β	β
Intercept	0.15***	−0.03***	−0.14***	−0.04***	0.09***	0.02***	−0.12***
Covariates							
Coach gender (woman)	0.19	−0.01	−0.84**	−0.22	0.40	−0.54	−0.92
Coach age	0.02	0.01	0.08	−0.01	−0.02	−0.11	−0.06
Athlete gender (woman)	−0.25**	0.04	0.22	0.02	−0.14	−0.05	0.18
Athlete age	0.05	0.01	−0.06	−0.10	0.08	0.00	−0.04
Game level (athlete report)							
Need-supportive style	0.34***	−0.21***	0.06*	0.05**	−0.06*	0.05	0.18***
Need-thwarting style	−0.13***	0.29***	−0.04	0.08***	0.05*	−0.10**	−0.13**
Athlete level (athlete report)							
Need-supportive style	0.46***	−0.11**	0.17*	0.07	−0.13*	/	0.08
Need-thwarting style	−0.08*	0.46***	−0.21**	0.24**	0.32***	/	−0.07
Team level (athlete report)							
Need-supportive style	0.40***	−0.07	0.11	0.17*	0.02	−0.19	0.05
Need-thwarting style	−0.01	0.22***	−0.09	0.02	0.13*	−0.17	−0.10
Team level (coach report)							
Need-supportive style	0.03	−0.00	0.10	−0.11	−0.14	0.34*	0.04
Need-thwarting style	0.01	0.07	−0.02	−0.03	0.00	0.00	−0.20
RANDOM EFFECTS	σ2 (SD)	σ2 (SD)	σ2 (SD)	σ2 (SD)	σ2 (SD)	σ2 (SD)	σ2 (SD)
Game level variance	0.27 (0.52)	0.39 (0.63)	0.35 (0.59)	0.39 (0.62)	0.60 (0.78)	2.07 (1.44)	0.43 (0.65)
Athlete level variance	0.11 (0.33)	0.15 (0.39)	0.57 (0.76)	1.39 (1.18)	0.92 (0.96)	0.00 (0.00)	0.02 (0.15)
Team level variance	0.01 (0.08)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.46 (0.68)	0.08 (0.29)
R2							
Marginal (fixed effects only)	0.62	0.51	0.17	0.09	0.20	0.14	0.16
Conditional (random and fixed effects)	0.73	0.65	0.69	0.80	0.68	0.30	0.33

*p < 0.05, **p < 0.01, ***p < 0.001.

(e.g., no associations were found between athlete ratings of the coaching styles and coach-rated performance outcomes).

The team-level analysis from the linear mixed model shed light on the predictive power of athlete versus coach reports. Interestingly, in contrast to athlete reports, coaches' self-reported coaching styles were not related to their team's basic psychological needs or motivation. However, coaches who reported a more need-supportive style expressed greater satisfaction with team performance, a relation that was not reflected in athlete reports of coaching styles at the team level (Hypothesis 1d).

4.2.2. Cross-level interactions: sensitization, habituation or compensation? (Objective 2)

In terms of cross-level interactions, the interaction term between a perceived need-thwarting coaching style during a specific game and a perceived general need-thwarting style across games was significant for three of our outcomes, namely need satisfaction ($\beta = 0.08$, $p < 0.001$), need frustration ($\beta = -0.06$, $p < 0.05$), and intrapersonal progress ($\beta = 0.13$, $p < 0.05$). The interaction plots provided evidence for a habituation process (rather than a sensitization process), in that the lower need satisfaction and intrapersonal progress scores, and the higher need frustration scores during a game in which athletes perceived their coach to be relatively high in need thwarting were relatively less pronounced for athletes who generally experienced high need thwarting across games (compared to low need thwarting) (Hypotheses 2a and 2b; Figure 2). Importantly, the athletes never benefited from an in-game need-thwarting style. The interaction term between a perceived need-thwarting coaching style during a specific game (i.e., game level) and a perceived general need-supportive style across games (i.e., team level) was never significant. Thus, no evidence for a compensation process was found (Hypothesis 2c).

5. Discussion

In Flanders, Belgium, volleyball is very popular, with a substantial percentage of the athletes playing at an elite level (Sports Flanders, 2023; Statistics Flanders, 2023). Especially at the elite level, each game is a new challenge for coaches, not only to guide their athletes to high performance and excellence, but also to ensure the athletes' well-being and motivation. Through this game-to-game study, we sought to shed light on coaching practices that promote both athletic performance and the overall well-being and motivation of elite volleyball athletes.

5.1. How variation in coaching styles relates to variation in athlete outcomes

The first objective of the current study was to examine how need-supportive and need-thwarting coaching styles are related to elite athletes' basic psychological needs, motivation, and coach-rated performance. The results of the preliminary analyses indicated that there is considerable game-to-game variability in coaches' use of need-supportive and need-thwarting practices. This dynamic nature of coaching is consistent with previous research (e.g., Balk et al., 2019). Apparently, coaches may (intentionally or unintentionally) use different coaching styles, not only between training and competition contexts (Smith & Cushion, 2006; Smith et al., 2017), but also from game to game within the competition context. Our results indicated that this variation in a coaching style was associated with parallel variations in elite athletes' basic psychological needs, motivation, and coach-rated performance. Regarding the basic psychological needs and motivation, the results indicated that when athletes perceived their coach as more need-supportive during a particular game (compared to other games), this was positively related to athletes' basic psychological needs (more need satisfaction and less need frustration) and quality of motivation (more autonomous motivation and less amotivation). In games where the coach was more need-thwarting, we saw the opposite pattern in terms of basic psychological needs (less need satisfaction and more need frustration) and quality of motivation (more amotivation).

These findings are consistent with previous research in elite contexts indicating that need-supportive and need-thwarting coaching styles, respectively, are positively and negatively associated with psychological outcomes such as athlete well-being (e.g., Adie et al., 2012) and quality of motivation (e.g., Banack et al., 2011). Although these findings are consistent with SDT's assumption that need-supportive and need-thwarting coaching styles are motivationally beneficial and detrimental, respectively (Ryan & Deci, 2017), it should be noted that these associations may also be indicative of athlete-to-coach effects to some extent. If, for some reason, athletes feel less motivated than usual during a game, they may perceive the coach as less need-supportive and more need-thwarting. In addition to this perceiver effect, they may even elicit an actual more need-thwarting response from the coach who notices the lack of motivation, suggesting an evocation effect. Most likely, associations between (perceived) coaching behaviors and athletes' motivational experiences are highly transactional in nature.

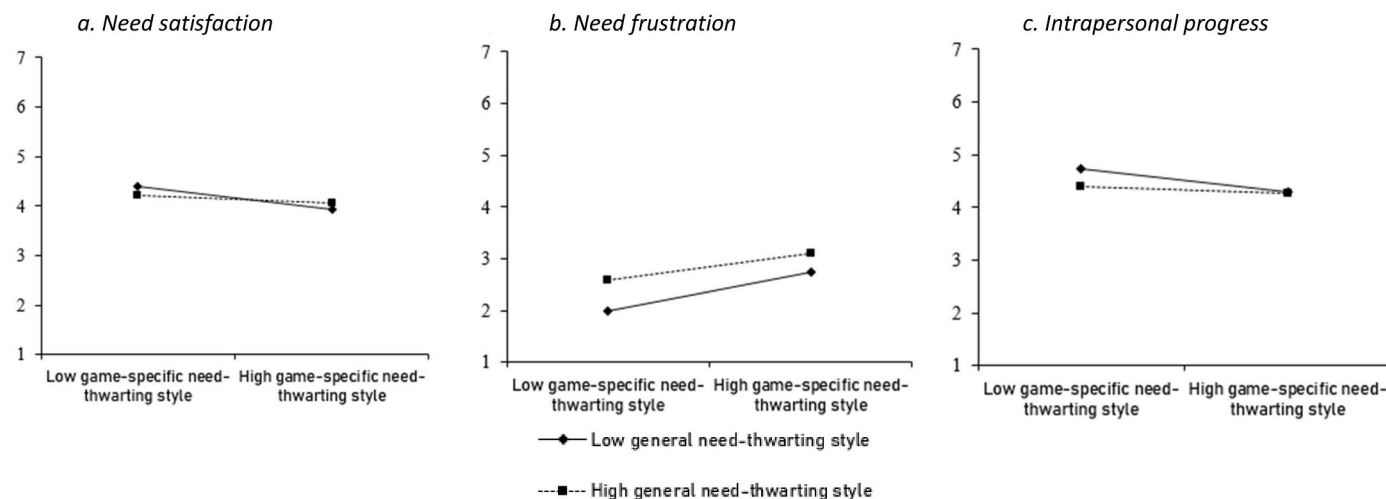An unexpected finding was that the athletes not only reported more

Figure 2. Plots of the significant cross-level interactions
Figure 2a. Need satisfaction
Figure 2b. Need frustration
Figure 2c. Intrapersonal progress.

controlled motivation during games in which they perceived their coach to be more need-thwarting, but also during games in which they perceived their coach to be more need-supportive. Previous studies with (non-elite) athletes have found the same association between need support and controlled motivation (De Muynck et al., 2021; Pelletier et al., 2001). These studies found that the link between need support and controlled motivation was primarily explained by its association with introjected regulation. More specifically, these studies suggested that because coaches sometimes (e.g., during a given game) engage in both need-supportive and need-thwarting behaviors, athletes partially internalize the behaviors (because of the need-supportive behaviors) but do not fully internalize them (because of the need-thwarting behaviors). However, our additional analyses did not provide evidence for the distinction between introjection and external regulation at the elite level. Instead, our findings highlight the importance of differentiating between the approach (e.g., seeking pride or rewards) and avoidance (e.g., avoiding guilt or criticism) side of controlled motivation. Because an approach orientation is more self-determined than an avoidance orientation (Assor et al., 2009; Guay et al., 2021), our study suggests that elite athletes may strive to achieve positive outcomes when exposed to a need-supportive style.

The current study contributes to our understanding of the link between need-supportive and need-thwarting coaching styles and coach-rated athlete performance. Consistent with prior research (e.g., Balk et al., 2019), results indicated that when athletes perceived their coach as more need-supportive during a game, it corresponded with higher coach-rated athlete progress. Conversely, when athletes perceived their coach as more need-thwarting during a game, the coach reported less intrapersonal progress and was less satisfied with the team's performance during that game.

Overall, the associations observed at the athlete and team levels mirrored those found at the game level and aligned with SDT principles. However, at these levels, a perceived need-supportive and need-thwarting style appeared to be primarily related to athletes' basic psychological needs and motivation, rather than to coach-rated performance. At the athlete level, this suggests that perceiving a coach as more need-supportive may enhance athletes' basic psychological needs and motivation, but not necessarily their progress relative to other athletes on the same team. Similarly, at the team level, a need-supportive coaching style during games may be crucial for fostering a positive team culture (e.g., Delrue et al., 2017), but it may not be sufficient to increase overall team performance relative to other teams. However, more studies in the elite context using a multilevel design and including both psychological and performance outcomes are needed to confirm this assumption.

In terms of predictive validity, both athlete and coach ratings of the coaching styles were included as simultaneous predictors at the team level. However, only the coach's self-reported need-supportive style correlated with higher coach-rated satisfaction with the team performance. The stronger predictive power of athlete perceptions of coaching style, as opposed to coach perceptions, in terms of basic psychological needs and motivation aligns with prior research (Smith et al., 2016) and highlights the importance for coaches to understand athletes' perspectives to promote positive outcomes.

5.2. Cross-level interactions: sensitization, habituation or compensation?

For the second objective, based on SDT, we expected that the interactions (if any) between a general coaching style across games and a game-specific coaching style would take the form of a sensitization process, with an overall need-thwarting style across games reinforcing the effects of in-game need thwarting. Alternatively, we examined the possibility that a need-thwarting style in a given game could be buffered by an overall need-thwarting (i.e., habituation process) or need-supportive (i.e., compensation process) coaching style across games. In general, we did not find systematic evidence for cross-level

interactions between game-specific coaching and an overall coaching style across games, indicating that the observed correlates of game-specific need-thwarting and need-supportive coaching hold regardless of the perceived overall need-thwarting or need-supportive style of the coach across games. However, for three outcomes, the results of the current study found significant cross-level interactions that point in the direction of a potential habituation process. Specifically, in a game where athletes perceived their coach to be high in need thwarting, the negative impact on need satisfaction, intrapersonal progress, and need frustration was relatively less pronounced for athletes who generally experienced high need-thwarting coaching across games, as opposed to those accustomed to low levels of need thwarting. Importantly, athletes never derived benefits from an in-game need-thwarting style. The optimal scenario emerged when athletes experienced low need thwarting, both at the general team level and during a specific game, as this resulted in the most favorable psychological need-based experiences reported by athletes and the best performance outcomes reported by coaches. Therefore, it can be concluded that even at the elite level of sports, coaches are advised to refrain from adopting a need-thwarting style.

5.3. Limitations and recommendations for future research

The results should be interpreted in light of some limitations. First, our non-probability sampling method may have resulted in a sample that was not fully representative of our population of interest. Only 21.5 % of the eligible elite volleyball coaches agreed to participate in our study, along with 7 of their athletes. Selection bias may have occurred if participating coaches or athletes had characteristics related to the study objectives. For example, if coaches were more likely to participate if they were more in favor of need-supportive coaching, or if motivated athletes were more likely to participate than amotivated athletes. For future research, using a probability sampling method (e.g., stratified sampling) would enhance the representativeness of the sample and reduce potential selection bias. Second, the omission of exploring the dynamics of relatedness, as well as the focus on coach-rated performance alone, may have limited our understanding of the interpersonal aspects critical to athlete outcomes. Future research may best include measures that capture the relational bond between the coach and athlete, and may include athlete self-reports of performance in addition to coach ratings. In addition, additional indicators of performance, such as successful passes completed during the game or external ratings of athlete performance, may improve the quality of the ratings. Third, the number of games included in this study was too limited to conduct more sophisticated analyses to determine the direction of effects in associations between coaching styles and athlete outcomes at the within-game level. Future research can expand the number of measurement points to examine cross-lagged effects between coaching styles and athlete outcomes. For example, it is possible that coaches are more need-supportive with motivated athletes or athletes who are performing well, while being more critical with amotivated athletes or athletes who are not progressing (e.g., Rocchi et al., 2013). Fourth, the present study did not include gender as a differentiating variable in the analyses, despite a notable imbalance in the distribution of female athletes and male coaches. Future research can explicitly address the gender dynamics within coach-athlete relationships. Investigating the influence of gender is critical to a gain more complete understanding of how coaching style affects athlete outcomes. Fifth, at each level, we found the most pronounced associations when both the independent and dependent variables were rated by the same informant (athlete or coach). This may indicate a problem of shared method variance. However, we also found some cross-informant associations (e.g. a need-supportive style as perceived by athletes during a particular game was associated with more progress as reported by the coach), suggesting that not all associations were driven by shared method variance. However, an optimal study design would involve both informants rating all study variables

(Fonteyn et al., 2022). Finally, future research could supplement quantitative surveys with qualitative data to provide insight into the contextual (e.g., course of the game) or personal (e.g., coach's current state) factors that cause the observed game-to-game variation. Such insights are also vital for a better understanding of the rather low within-coach reliability for the need-supportive and need-thwarting scales in the current study.

5.4. Strengths and practical implications

Despite these limitations, this study is unique in several ways. Specifically, it (a) used a unique game-to-game design, (b) took place at the elite level of sport, (c) included not only athletes' basic psychological needs and motivation, but also coach-rated performance of in-game coaching styles, and (d) considered the perspectives of both coaches and athletes. Based on the results of the current study, elite coaches are best encouraged to maintain a consistent need-supportive coaching style across games to promote psychological need satisfaction, autonomous motivation, and performance. At the same time, coaches need to be aware of the potential negative impact of a need-thwarting coaching style, as it was associated with suboptimal athlete outcomes. Given the dynamic nature of coaching, coaches can strive for continuity in their need-supportive behaviors. Especially since the experience of need-thwarting coaching during a game could not be buffered by an overall need-supportive coaching style. These findings highlight the need to enroll existing Flemish coach education programs that train coaches to use a more need-supportive and less need-thwarting style (Reynders et al., 2019) in elite contexts.

This study also showed that athlete perceptions are more critical in predicting outcomes than coach perceptions. Therefore, it is important for coach education programs to encourage coaches to engage in regular self-reflection about their coaching behaviors, paying particular attention to how they may be perceived by their athletes. To gain an unbiased view of how different athletes on their team experience their coaching style, coaches can engage in open and transparent communication with their athletes to bridge gaps in understanding and better meet individual athletes' psychological needs and motivational preferences.

6. Conclusion

This study found that game-to-game variation in coaches' need-supportive coaching style was positively related to corresponding variation in elite athletes' basic psychological needs, motivation, and coach-rated performance. In contrast, game-to-game variation in a need-thwarting coaching style was negatively related to variation in these outcomes. These findings highlight the importance of considering the dynamic nature of coaching when understanding the role of coaching style on elite athlete outcomes. Interestingly, athlete perceptions were more predictive of athletes' basic psychological needs and motivation than coach perceptions, supporting the importance of considering athlete perspectives in understanding coaching dynamics. Finally, the study examined cross-level interactions and found no systematic evidence for cross-level interactions between game-specific coaching and an overall coaching style across games, indicating that the observed correlates of game-specific need-thwarting and need-supportive coaching hold regardless of the perceived overall need-thwarting or need-supportive style of the coach across games. Importantly, a need-thwarting style was never beneficial as a low need-thwarting and high need-supportive style resulted in the best pattern of outcomes at all levels of analysis.

Declarations

The authors have no relevant financial or non-financial interests to disclose.

CRediT authorship contribution statement

Sofie Morbée: Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Leen Haerens:** Writing – review & editing, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Bart Soenens:** Writing – review & editing, Supervision, Methodology, Investigation. **Joke Thys:** Writing – review & editing, Project administration, Methodology, Data curation, Conceptualization. **Maarten Vansteenkiste:** Writing – review & editing, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors have no relevant financial or non-financial interests to disclose.

Data availability

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.psychsport.2024.102655.

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