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Latent Profiles of Sport Motivation in Czech University Students: An Exploratory Person-Centered Approach Using the Sport Motivation Scale

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ABSTRACT

Numerous studies have now documented that athletes of different competition levels vary in their motivational styles. Some are internally motivated and train to be better based on intrinsic values, whereas others are controlled by external pressures that drive performance. A third style does not make causal attributions regarding their performance and are amotivated. In the current study, we used latent profile analysis to examine unique typologies of sports motivation in 456 Czech university students comprised of both recreational and more elite athletes participating in various sports and attending a sport education program. Four qualitatively distinct profiles were distinguished varying in the composition of intrinsic, extrinsic, and amotivation. The four profiles differed in their mean levels of social physique anxiety, global self-esteem, and physical self-worth, three markers of how a person feels about themselves in terms of normative standards. Multiple group comparisons based on gender, individual versus team sports, and level of competition reinforced relative consistency in profile composition. Results are discussed in terms of how people can blend different motivational styles, what this portends for self-beliefs, and whether there is relative consistency across meaningful groups.

1 | Introduction

Studies of sports motivation in young adults suggest there are unique "motivational styles" that characterize the reasons why some athletes are willing to train hard, persevere in the face of challenges, and compete at high levels. Most of these studies are guided by self-determination theory (SDT: Deci 1975; Deci and Ryan 1985), which posits that humans are agents of their own destiny and achieve optimal life conditions through volition and self-regulation (Ryan and Deci 2000a, 2006). Considerable studies of physical activities and sport participation have been built around SDT and suggest that differences between individuals in their athletic prowess arise from the degree to which they are autonomous or self-determined (Ryan and Connell 1989; Deci and Ryan 2000). This has led to the proposition that individuals differ with respect to their motivation styles, whether they are intrinsically motivated, extrinsically motivated, or in some cases even amotivated (Deci and Ryan 1985; Ryan and Deci 2000b). According to SDT, individuals differ with regard to the orientation of their desire to act, and that "impetus" for action takes shape as a form of self-regulation. As such, a person's goals and achievement (outcomes) will differ based on their motivational orientation.

Summary

- University students attending a sport education (coaches and physical education teachers) program fall into four unique profiles of sport motivation.
- The four profiles include (1) moderately autonomous profile, (2) moderately controlled and amotivated profile, (3) low motivation profile, and (4) highly amotivated profile.
- Multigroup latent profile analysis supported partial metric invariance (equality of latent indicators means) across gender (males vs. females), type of sport (individual vs. team), and competition level (recreational vs. competitive).
- Membership in each profile is associated differently with the evaluated outcomes and the most autonomous profile (1—moderately autonomous profile) had the lowest social physique anxiety, the highest global self-esteem, and physical self-worth.
- Findings point to different ways sports coaches and educators can improve self-evaluative processes by emphasizing internal motivational focus.

In keeping with the basic tenets of SDT, individuals that are intrinsically motivated engage in sports of their own volition and will and are considered highest in autonomy. They pursue physical activities because of the pure feeling of enjoyment, pleasure, and satisfaction that derives from the physical activity alone, and they do not require external rewards or contingencies. Individuals with intrinsically rewarding styles of motivation believe their effort results from their own control (i.e., self-determined) and are apt to remain more engaged and train in a more determined fashion (Teixeira et al. 2012; Vink et al. 2015). This is akin to what Mallett and Hanrahan (2004) suggested was the "fire that burns so brightly" (p. 183) in elite athletes who are internally motivated to achieve new heights and success in their sport.

An extrinsically motivated person sees control of their behavior resulting from external contingencies. Extrinsically motivated individuals see their behavior as a means to an end to secure a tangible reward (i.e., financial success), some form of social recognition or to avoid punishment or criticism. For example, an extrinsically motivated person will find impetus to action when they are exhorted to train harder by their coach or some other social agent who conveys influence (e.g., a parent insisting their child plays a sport). As a result of their external locus of control, they possess less self-direction or volition in their actions. An extrinsically motivated individual will behave to comport with the wishes of those around him or her and feel pressured to act. In the absence of these contingencies, the individual is less likely to engage in activities of their own volition (Ryan et al. 2009). Ryan and Deci (2000b) were careful to point out that extrinsic motivation also consists of different "styles" and was not a unitary phenomenon. (Ryan et al. (2009), and they were also careful to call this a "differentiated taxonomy of the varied types of regulations underlying extrinsic motivations, each of which has unique characteristics" (p. 111). Ryan and Deci (2000a,b) also suggested that people differ not only in their level of motivation but also orientation of motivation. By this, they meant the attitudes, reasons, and goals that give rise to the impetus for a person to act in some fashion. This is perhaps what prompted researchers to initiate a search for unique profiles corresponding to the taxonomies.) This is because at some point, external instigators can be "internalized" and feel as if they are expressions of the individual's efforts to self-regulate (i.e., incorporating norms consistent with one's values or goals). Specifically, SDT differentiates four types of extrinsic motivation based on the degree of relative autonomy perceived by the individual: external regulation (i.e., behavior is controlled by external demands or reward contingencies such as the threat of punishment), introjected regulation (i.e., behavior is regulated by cognitive reflections owing to feelings of guilt, pride, or shame as with ego involvement in the service of self-esteem), identified regulation (i.e., behavior is regulated by a person's willingness to introject the values, purpose, and benefit from engagement and consider them personally important, incorporating it into their identity), and integrated regulation (i.e., behavior is consistent with a person's identity and comports with their values, goals, and needs). The latter style is closest to intrinsic motivation in terms of where it falls on the continuum of autonomy.

A third regulatory style, termed "amotivated", poses that there are no linkages between the individual's actions and outcomes of these actions. In other words, amotivation reflects a lack of concerted intentions and reasons for sport participation. Amotivated individuals may compete at high levels, and even perform well, but cannot attribute their participation to any "drive" or internal (self-regulated) goals and they feign interest in external rewards (Vallerand 1997). They demonstrate the lowest levels of self-determination, which usually arises, according to SDT, because an amotivated individual lacks competence (i.e., efficacy), does not possess the skills or knowledge to carry out an activity (Bandura 1986), or they feel helpless to achieve the desired outcome (e.g., Abramson et al. 1978).

1.1 | Profiles of Motivation

Numerous studies using person-centered approaches (This approach differs from a variable-centered approach in that the focus or statistical emphasis is not on variable-to-variable relations (i.e., correlational techniques) but rather on the relations between people. The similarity within profiles is based on the probability of being assigned to a particular motivational profile given the individuals' response patterns. More details on the use of profile analyses can be found in Spurk et al. (2020) and a primer on using latent profile analysis can be found in Ferguson et al. (2020). Marsh et al. (2009) demonstrate the synergy of using person- and variable-centered analyses in combination.) have now empirically verified uniquely different motivational regulatory "styles" related to sport and physical activities. The styles vary in composition and capture the level or degree to which an individual chooses to see themselves in terms of volitional control, autonomy, and perceived causality (internal vs. external). Styles can be equated with unique subgroups of individuals that share certain motivational characteristics (e.g., level of autonomous or controlled behavior). The numbers of styles have varied considerably depending on the type of

analysis technique used (e.g., cluster-based vs. mixture-based) and the number of indicators used to establish the profile composition. For example, studies using cluster-analytic approaches have found anywhere from three to five clusters of motivational regulation (e.g., Chu et al. 2018; Cox et al. 2013; Friederichs et al. 2015; Gillet et al. 2009; Haerens et al. 2010; Murcia et al. 2007; Ntoumanis 2002) differing in their composition based on the degree of perceived autonomy and control. These studies involved a broad cross-section of participants including both regular high school students, competitive athletes, university students, and older adults that were somewhat sedentary by nature.

A different set of studies have used latent profile analysis (LPA), framed by SDT to extract unique "profiles" corresponding to motivational styles. LPA is a type of mixture model that uses continuous indicators to ascertain unique profiles of sport motivation. Profiles are "hidden" or unobserved groups that exist in the data and represent population hetereogeneity (Lubke & Muthén 2005; Marsh et al. 2009). Members within a particular profile differ from those assigned to different profiles in terms of their sheer "levels" of autonomy or control (e.g., high vs. low) as well as the distinct shape (i.e., configuration) of their profile across multiple indicators (e.g., high on one indicator and low on another). The end result is a collection of qualitatively unique profiles that are homogeneous with regard to the patterning of their motivational regulatory behaviors. One benefit of this approach is the ability to obtain a more holistic (i.e., ideographic) picture of motivational regulatory styles and how they may operate in conjunction with each other rather than abiding by an "either/or" perspective. This view is in keeping with Deci and Ryan (1991) who suggested that all forms of motivation are likely to be present within an individual but to different degrees. Thus, in keeping with a multidimensional view of motivation, one can be both self-determined (autonomous) and nondetermined or more controlled depending on the situation or demands of the sport or physical activity.

Interestingly, despite examining motivational styles using very similar assessment instruments (i.e., grounded in SDT), the numbers of profiles have been equivocal across the different studies. Cece et al. (2018) found four profiles among adolescent athletes differing in the degree of autonomy and control (and this profile composition repeated at three timepoints over a single sporting season), whereas Bechter et al. (2018) found three profiles using Australian high school students engaged in PE. Wang et al. (2016) found five profiles in a sample of Singaporean youth, and Ullrich-French et al. (2016) found four profiles in a sample of adolescent high school students. Martinent and Decret (2015) found both a well-fitting two and three profile solution with repeated measures taken over the course of one academic year in a sample of young French table tennis players recruited from intensive national training settings. Gustafsson et al. (2018) found five profiles among Spanish elite athletes, Lindwall et al. (2017) found six profiles with nonelite athlete adults, and Tóth-Király found four profiles in a Hungarian sample of mostly amateur participants of all ages. Cowden et al. (2021) found three profiles among competitive tennis players, and Saward et al. (2024) found five profiles among English sub-elite university footballers. Taken as a whole, these and related studies indicate that LPA is a useful person-centered approach to obtain unique motivational profiles. However, subtle differences in the composition of the samples, different numbers of observed indicators, and in some cases use of different instruments to assess sport motivation all have contributed to different numbers of profiles.

1.2 | Relations of Motivational Styles to External Markers

In addition to understanding the role of motivation as a contributor to athletic engagement, motivational styles in physical activities have also been used to predict a variety of outcomes. In keeping with SDT, the more autonomous and volitional types of motivation are associated with more adaptive outcomes including academic performance, adaptive perfectionism, adaptive coping, effort during injury rehabilitation, and well-being (e.g., Amiot et al. 2004; Bailey and Phillips 2016; Boiché et al. 2008; Burnam et al. 2014; Chan and Hagger 2012; Levy et al. 2008; Reis et al. 2000; Ryan et al. 2009, and for a meta-analysis, see Vasconcellos et al. 2020). Conversely, the more controlled and less autonomous types of motivation are associated with negative outcomes such as burnout, depression, distress, substance use, and even doping intentions (e.g., Ariani 2017; Cresswell and Eklund 2005; Curran et al. 2011; Gustafsson et al. 2018; Mudrak et al. 2018; Rockafellow and Saules 2006; Wang et al. 2017; Williams et al. 2006).

These related findings suggest that it is only natural to think that the more autonomous and self-determined motivational styles would be associated with a positive self-concept. In the case of sport motivation, this would mean that individuals participating in some type of physical activity of their own volition and driven by intrinsic values (for pleasure and sheer enjoyment as opposed to some separate reward contingency) would have more favorable self-evaluations when they achieve their desired performance outcomes. This has been the case with studies linking academic motivation and self-constructs (e.g., see Howard et al. 2021 for a meta-analysis). However, only a handful of studies have extended this premise to include studies of sport motivation and self-constructs. Standage and Gillison (2007), for instance, found that autonomous physical education motivation was positively related to general self-esteem in a sample of British secondary school students. Although these authors did not examine profiles in the strictest sense using a person-oriented approach, their structural equation model posited paths from autonomous motivation to self-esteem and eventually health-related quality of life.

Biddle and Wang (2003) used cluster-based techniques to examine relations between motivational profiles and physical self-worth, global self-esteem, and physical activity in a sample of adolescent English girls. The authors reported that a five-cluster solution fits the data best, with the cluster labeled *high motivation and physical self* reporting the highest physical self-perceptions (i.e., the best sport competence, physical condition, strength, and body attractiveness). Other studies, using either cluster-based or mixture modeling techniques, accentuate similar findings with more self-determined and autonomous motivations being associated with better self-concepts and

physical self-evaluations (e.g., Thøgersen-Ntoumani and Ntoumanis 2006; Valero-Valenzuela et al. 2021).

In keeping with the theoretical premise supporting SDT (Deci and Ryan 1995), one reasonable prediction from these related studies might suggest that intrinsically motivated individuals fare better (i.e., they are more likely to act on their own will) and as a result are likely to give themselves a more positive self-evaluation. This is because they see intrinsic worth in their effort, which stems from their own volition and willingness to engage for sheer pleasure and enjoyment. In the context of sport competition and participation, this overall sense of self-worth translates to a benevolent appraisal of their athletic competence and makes them feel accomplished from their efforts. In some form of cognitive feedback loop, this is what gives rise to feelings of self-worth and a positive self-evaluation. Extrinsically motivated and more controlled individuals (as well as amotivated types), on the other hand, suffer some type of handicap with regard to their self-esteem. This is because they engage in an activity to stave off guilt or appease people who pressure them to engage in ways that are not of their own volition.

1.3 | Focus of the Current Study

In the current study, we offer several refinements to previous work addressing sport motivational styles. First, we examine typologies of sports motivation in a sample of Czech university students taking courses as part of a physical education and sport program. As such, their curriculum requires extensive participation in a wide range of physical activities. In contrast to other studies that focused exclusively on one type of athlete (sub-elite vs. elite) or one type of sport (e.g., football or tennis only), the current study included both elite and recreational (intramural) athletes with experience in a broad spectrum of sports. This wide variability in type of sport (individual vs. team), level of competition (elite vs. recreational), and even gender provides a means to test the generalizability of sport motivational profiles using multiple group comparison procedures (Morin, Meyer et al. 2016).

We also model relations between motivational regulatory styles and global self-esteem, physical self-worth, and social physique anxiety. The inclusion of these designated "outcomes" provides a means to structurally validate membership in the different profiles. The specific measures offer a means to link both global (i.e., esteem and self-worth) and specific forms (i.e., social physique anxiety) of self-evaluation with motivational regulatory styles. Results of this study can therefore broaden the current body of evidence by demonstrating whether qualitatively different motivational styles in sport are differentially associated with self-evaluations.

Based on the previous empirical evidence, it was hypothesized that a model with three to six mutually exclusive profiles would adequately fit the sample of university students. Profiles will differ qualitatively in their levels of intrinsic, extrinsic, and amotivation and in their overall shape across the multiple indicators. In the absence of any theoretical guidance or empirical evidence that can inform our expectations related to the consistency of profiles across groups, we hypothesized that latent profile indicator means would be invariant across gender (males vs. females) (It is worth noting that several studies have provided evidence of gender invariance (e.g., Ullrich-French et al. 2016), but none have investigated profile similarity in terms of the type of competition or sport.), competition level (highly competitive vs. recreational), and type of sport (individual vs. team). Further, and consistent with SDT, we anticipated that profiles characterized by high levels of autonomous (self-determined) types of motivation would be associated with lower social physique anxiety, higher global self-esteem, and physical self-worth. In contrast, it was expected that profiles with higher levels of extrinsic motivation (i.e., greater perceived control from external sources) and separately those indicated by higher levels of amotivation would be characterized by relatively high levels of social physique anxiety and low levels of both global self-esteem and physical self-worth.

2 | Method

2.1 | Participants and Procedures

The sample consisted of 456 undergraduate students (290/63% males) with a mean age of 21.6 years (SD = 2.1). Participants were recruited from the Charles University in Prague, Czech Republic, Faculty of Physical Education and Sport. All participants were students attending a master's degree program preparing physical education teachers and professional sport coaches. As a result, the sample was continually engaged in physical activities as a part of their educational curriculum (4–7 h per week). Outside of the school, participants engaged in a variety of sports activities and their experience with the most current sport activity ranged from 1 to 21 years (M = 10.2, SD = 4.7). Most of the sample (56%) trained at least four times per week with 51% participating in a variety of individual sports (e.g., running, swimming, skiing, and tennis) and 49% participating in team-based sports (e.g., football, ice-hockey, basketball, and floorbal). Participants self-classified according to their competition level as either highly competitive (32%) or recreational (68%) athletes. The group of highly competitive athletes constitutes those competing at the highest national (e.g., national championship and the highest national league), or international level (e.g., Olympic Games, world championship, and Champion's League).

Participants were recruited using convenience sampling methods taking place during sport psychology seminars at the Department of Psychology, Charles University in Prague. During the consenting procedure (IRB# 142/22 Ethiccs Committee, FTVS UK), all participants were informed about the purpose of the study and of their ethical rights as research participants. Participation in the anonymous study was completely voluntary and participants were free to terminate their participation in the study at any time with no resulting penalty. By returning the questionnaire to the first author, participants consented with the processing of their data for research purposes.

2.2 | Measures

2.2.1 | Latent Profile Indicators

Latent profile indicators representing the different motivation styles were drawn from the Czech version of the sport motivation scale (Komarc at al. 2020). The original SMS (Pelletier et al. 1995) contains 28 items assessing intrinsic motivation (e.g., "For the pleasure of discovering new performance strategies"), identified regulation (e.g., "Because it is one of the best ways to maintain good relationships with my friends"), introjected regulation (e.g., "Because it is absolutely necessary to do sports if one wants to be in shape"), external regulation (e.g., "Because people around me think it is important to be in shape"), and amotivation (e.g., "I used to have good reasons for doing sport, but now I am asking myself if I should continue doing it") using a 7-point Likert-type response scale ("does not correspond at all" to "corresponds exactly"). In the current study, we used 22 of 28 items that have demonstrated sufficient construct validity in a sample of Czech university students (Komarc et al. 2020) (It is worth noting that the original version of the SMS does not assess integrated regulation and the subscale assessing external regulation does not correspond entirely with the conceptual definition of external regulation in terms of links between action and rewards and contingencies [see e.g., Pelletier et al. 2013]). Estimates of generic reliability based on a common factor model (McDonald 1999) for the current sample ranged from $\omega = 0.66$ for introjected regulation to $\omega = 0.91$ for intrinsic motivation ($\omega_{avg} = 0.78$ for the full sample).

2.2.2 | Latent Profile Distal Outcomes

Social physique anxiety. We used 8 of the 12 social physique anxiety scale (SPAS: Hart et al. 1989) items to assess a person's anxiety associated with how other people evaluate their body or physical appearance (e.g., "When it comes to displaying my physique/figure to others, I am a shy person" and "I am comfortable with how fit my body appears to others"). We excluded four items from the original 12 in order to avoid methodological artifacts (e.g., negatively worded vs. positive items) previously reported (Motl and Conroy 2000). Items were rated on a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree) with higher scores indicating greater social physique anxiety. The SPAS has been shown to have adequate construct validity, internal consistency, and test–retest reliability (Hart et al. 1989), including demonstrating good psychometric properties with Czech university students (Harbichová and Komarc 2012). In the present study, McDonald's ω for SPAS scores was 0.97, indicating a unidimensional scale.

Global self-esteem. We used the 10-item Rosenberg self-esteem scale (RSES: Rosenberg 1965) to measure participants' global self-esteem (GSE). The RSES consists of five negatively (e.g., "At times I think I am no good at all") and 5 positively (e.g., "On the whole, I am satisfied with myself") worded items. The RSES uses a 4-point Likert scale response format ranging from 1 (strongly agree) to 4 (strongly disagree). Scores on the negatively framed items were reversed and thus higher scores for all 10 items indicate higher levels of global self-esteem. The scale has demonstrated good psychometric properties and was translated and validated for the Czech population (Blatný and Osecká 1994). The reliability of the RSES in the current sample was $\omega = 0.91$.

Physical self-worth. Self-evaluations in the physical domain were assessed by a 6-item subscale from the physical self-perception profile (PSPP: Fox and Corbin 1989) measuring overall physical self-worth (PSW). This includes elements of the physical domain such as pride, self-respect, satisfaction, and confidence in the physical self. The questionnaire items are administered in a forced-choice structured alternative format in order to eliminate social desirability response bias. For each item, there are two alternative stems (e.g., some people are very competitive vs. others are not quite so competitive), each with two possible options ("sort of true" and "really true"). Physical self-worth subscale scores can range from 6 to 24, where higher scores represent higher PSW. There is now considerable evidence reinforcing that PSPP is a psychometrically sound assessment for physical self-perception, especially among university students and has been shown to be culturally valid in terms of its factor structure (Page et al. 1993). The Czech version of the PSPP has demonstrated adequate validity and reliability (Tomešová and Štochl 2006). The estimate of generic reliability for the current sample was $\omega = 0.91$.

2.2.3 | Analysis

The analyses were conducted in a sequential order to address the study's research questions. First, a confirmatory factor analysis (CFA) was performed on all items to verify the latent constructs, both for profile indicators and outcomes. The CFA used the weighted least squares mean and variance adjusted (WLSMV) estimator, which is suitable for modeling ordered categorical responses and does not assume normally distributed variables (Beauducel and Herzberg 2006). McDonald's ω was calculated for reliability estimation based on a congeneric model, as it does not assume equal factor loadings like Cronbach's α. Standardized latent scores from the CFA were saved for subsequent analyses to partially control for measurement error, providing a more accurate indicator of motivational profiles (Morin, Boudrias, et al. 2016). Model fit was assessed using conventional criteria (Hu and Bentler 1999): comparative fit index (CFI > 0.95), Tucker–Lewis index (TLI > 0.90), root mean square error of approximation (RMSEA < 0.08), standardized root mean residual (SRMR < 0.06), and χ^2/degrees of fredom ratio (χ^2/df < 5.0).

Next, a series of latent profile analyses (LPA) with one to seven profiles was estimated using five motivational indicators: intrinsic motivation, identified regulation, introjected regulation, external regulation, and amotivation. The optimal number of profiles was determined using statistical benchmarks, including the Bayesian and Akaike information criteria (smaller values indicating better fit), entropy (0–1; higher values indicating better classification), and the Lo–Mendell–Rubin adjusted likelihood ratio test (A-LRT) and bootstrapped likelihood ratio test (BLRT) to compare neighboring models (Nylund

et al. 2007; Celeux and Soromenho 1996). Solutions were checked to ensure that the log-likelihood function was replicated and that no local maxima were identified. In addition to statistical criteria, substantive interpretability, theoretical alignment, and model parsimony were also considered when selecting the final profile structure.

Multiple-group analysis was used to test the profile structure's similarity across gender, competitive level (recreational vs. highly competitive), and type of sport (individual vs. team). This analysis assessed configural (number of profiles), structural (indicator levels), and distributional similarity (profile proportions). Likelihood ratio difference tests between nested models evaluated model fit, with nonsignificant $\Delta\chi^2$ values supporting configural, structural, and distributional invariance.

Lastly, differences in distal outcomes (GSE, PSW, and SPA) across the identified motivational profiles were examined using the "DU3STEP" method in Mplus (L. Muthén & B. Muthén, 1998–2012). This approach prevents auxiliary variables from influencing profile membership by treating them as predictors rather than indicators. Mplus provided overall between-group difference tests (Wald's test) and pairwise comparisons of mean values of auxiliary variables across profiles.

3 | Results

3.1 | Descriptive Statistics and Preliminary Analysis

Table 1 contains descriptive statistics along with reliability estimates and zero-order correlations between all of the study measures based on the CFA. Based on the benchmark criteria, the model fit for the 8-factor CFA using all of the study measures (5 types of motivational regulation and 3 distal outcomes) was good, $\chi^2(961) = 1643.2$, $p < 0.001$, RMSEA = 0.04, TLI = 0.96, CFI = 0.95, and SRMR = 0.05. The model-based internal reliability estimates ranged from $\omega = 0.66$ for identified regulation to $\omega = 0.97$ for SPA. A detailed description of the CFA model specification and results (e.g., factor loading estimates) can be found in Supporting Information S1.

Sample participants reported the highest mean levels for intrinsic motivation, followed by introjected regulation, identified regulation, external regulation, and then amotivation. For the distal outcomes, on average, participants reported the highest scores for GSE, followed by PSW, and SPA. Bivariate correlations indicated that among the latent profile indicators, intrinsic motivation was most strongly associated with identified regulation and less so with introjected, external, and amotivation. Introjected and external regulations were moderately associated and amotivation was only moderately associated with external regulation. Among the distal outcomes, PSW was moderately associated with both GSE and SPA. The largest association between the five latent profile indicators and the three distal outcomes was between amotivation and GSE, whereas the smallest associations involved the five profile indicators and SPA.

3.2 | Latent Profile Analysis

Table 2 contains the model fit indices for the different LPA solutions. With each successive profile, the log-likelihood (LL), Akaike information criterion (AIC), and Bayesian information criterion (BIC) all improved by getting smaller, being lowest in the 7-profile solution. A significant bootstrapped likelihood ratio test (BLRT) also indicated that each successive model adding a profile provided a better fit than a model with one less profile. On the other hand, according to the adjusted likelihood ratio test (aLRT), 3- and more profile models did not improve model fit significantly when compared to models with one less profile. The shrinkage in AIC and BIC (e.g., visualized using an elbow plot) indicated that the 3- to 4-profile solutions should be considered as plausible model alternatives. Carefully contrasting these two models revealed that relative to the 3-profile solution, the 4-profile solution produced four distinct profiles that were clearly enumerated based on differences in motivational styles and the fourth emergent profile was substantially populated (> 5%). The 4-profile model was further supported by consistently high average posterior class membership probabilities and slightly better entropy (i.e., classification accuracy 0.76 compared to 0.73) than the 3-profile model. Consequently, the 4-profile solution was selected for further interpretation.

TABLE 1 | Descriptive statistics, reliability estimates, and correlations for motivational and self-evaluation measures.

Variable	*M*	SD	ω	1	2	3	4	5	6	7
1. Intrinsic motivation	5.32	0.96	0.91							
2. Identified regulation	4.76	1.11	0.66	0.62**						
3. Introjected regulation	4.93	1.40	0.75	0.46**	0.34**					
4. External regulation	3.29	1.23	0.78	0.26**	0.37**	0.32**				
5. Amotivation	2.10	1.11	0.80	−0.29**	−0.14*	−0.05	0.39**			
6. Social physique anxiety (SPA)	1.96	0.90	0.97	−0.08	0.08	0.04	0.02	0.20**		
7. Global self-esteem (GSE)	3.17	0.48	0.91	0.18**	0.07	0.02	−0.05	−0.40**	−0.53**	
8. Physical self-worth (PSW)	2.76	0.51	0.91	0.27**	0.13*	0.12*	0.18**	−0.27**	−0.69**	0.65**

Abbreviations: *M*, mean; SD, standard deviation; ω, McDonald's omega.
*$p < 0.01$; **$p < 0.05$.

Figure 1 shows that there were some characteristic features of each profile both in their levels (reflecting indicator means) and shape (reflecting the distinct features of each profile across the five motivational indicators). The largest profile (Profile 1) consisted of $n = 235$ (51.5%) participants, who reported the highest levels of intrinsic motivation compared to the other profiles (Since indicator scores are standardized, the use of "high" or "low" is relative to the average level observed across the entire sample). Members of this profile also reported above average levels of identification and internalization, average levels of external regulation, and the lowest levels of amotivation. Profile 1 was thus labeled as "*moderately autonomous*". Members of Profile 2 ($n = 100$, 21.9%) had slightly above average levels of intrinsic motivation, identification, and internalization but higher than the average levels of external regulation and amotivation. As a result, this profile was labeled the "*moderately controlled and amotivated*." Members of Profile 3 ($n = 87$, 19.1%) were characterized by below average scores on all types of motivational regulation and were labeled as "*low motivation*". Finally, members of the smallest Profile 4 ($n = 34$, 7.5%) were characterized by the lowest levels of intrinsic motivation, relatively low levels of identification, slightly below average levels of internalization, slightly above average levels of external regulation, and the highest levels of amotivation. This profile was labeled as "*highly amotivated*".

3.3 | Profile Similarity

We next engaged (in an exploratory fashion) tests of measurement invariance based on gender, competition level, and type of sport—the model fit indices are summarized in Table 3 and all supporting files (Mplus output files, with model specifications and all parameter estimates) are included in Supporting Information S2 accessible via the following link: https://www.dropbox.com/scl/fi/dyvqxh40ndkzud8a1pi81/Supplemental-Material-S2.zip?rlkey=euw4gtxwnqzz7gs88o9cgn09k&dl=0. The baseline configural model (i.e., equal number of profiles) indicated that the 4-profile LPA model is an acceptable model specification for all of the subgroups with small to medium differences in estimated parameters (i.e., latent profile indicator means and latent class prevalence—not shown here). The $\Delta\chi^2$ test between the

TABLE 2 | Fit statistics for the latent profiles with a varying number of profiles.

Model	LL	AIC	BIC	# of fp	Entropy	ALRT	BLRT
1 Profile	−3231.3	6482.5	6523.7	10	1		
2 Profile	−3129.9	6291.9	6357.8	16	0.73	0.001	< 0.001
3 Profile	−3086.6	6217.2	6307.9	22	0.73	0.276	< 0.001
4 Profile	−3055.7	6167.5	6282.9	28	0.76	0.232	< 0.001
5 Profile	−3026.2	6120.3	6260.5	34	0.73	0.054	< 0.001
6 Profile	−3007.4	6094.8	6259.7	40	0.77	0.093	< 0.001
7 Profile	−2985.0	6062.0	6251.6	46	0.79	0.147	< 0.001

Abbreviations: # of fp, number of estimated free parameters; AIC, Akaike information criterion; ALRT, *p*-value for Lo–Mendell–Rubin adjusted likelihood ratio test; BIC, Bayesian information criterion; BLRT, *p*-value for bootstrapped likelihood ratio test; LL, log-likelihood.

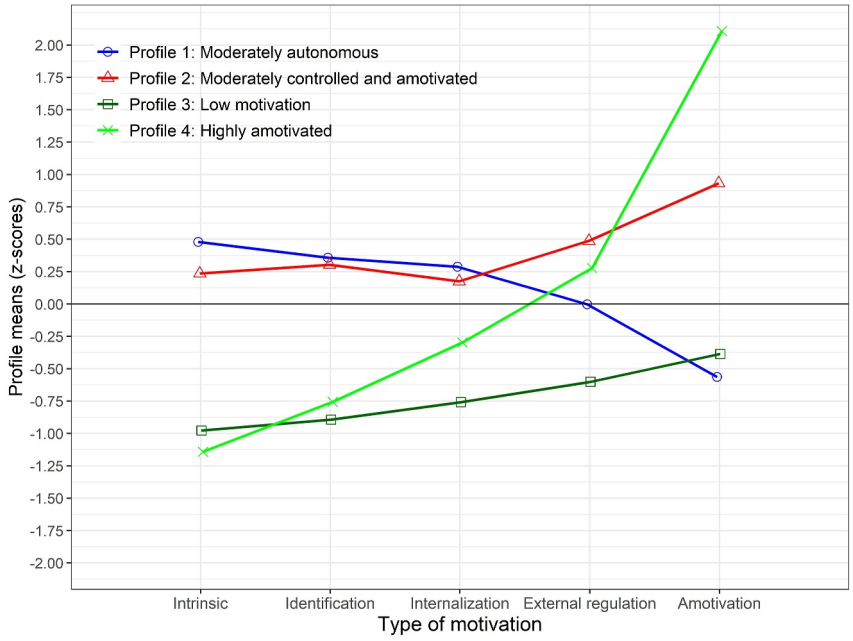

FIGURE 1 | Characteristics of the latent profiles based on sport motivation regulations.

TABLE 3 | Fit statistics for the multigroup LPA invariance models.

Model	LL	AIC	BIC	# of fp	Entropy	$\Delta\chi^2$	df	*p*
Gender (male vs. female)								
Configural invariance (number of profiles equal)	−3324.0	6752.0	6966.3	52	0.83			
Metric invariance (all latent profile indicators equal)	−3350.2	6764.4	6896.3	32	0.84	52.4	20	< 0.001
Partial metric invariance	−3338.9	6743.8	6879.9	33	0.84	29.8	19	0.051
Full invariance (latent class proportions equal)	−3346.2	6752.4	6876.1	30	0.84	29.8	3	0.002
Type of sport (individual vs. team)								
Configural invariance (number of profiles equal)	−3341.3	6786.5	7000.8	52	0.83			
Metric invariance (all latent profile indicators equal)	−3364.7	6793.5	6925.3	32	0.84	46.9	20	0.001
Partial metric invariance	−3352.8	6781.6	6938.2	38	0.84	23.0	14	0.060
Full invariance (latent class proportions equal)	−3355.1	6780.1	6924.4	35	0.84	4.6	3	0.205
Level of competition (recreational vs. highly competitive)								
Configural invariance (number of profiles equal)	−3323.7	6751.4	6965.8	52	0.83			
Metric invariance (all latent profile indicators equal)	−3339.9	6743.8	6875.7	32	0.84	32.4	20	0.040
Partial metric invariance	−3336.7	6739.3	6875.3	33	0.84	25.9	19	0.132
Full invariance (latent class proportions equal)	−3340.0	6740.0	6863.7	30	0.84	6.7	3	0.082

Abbreviations: AIC, Akaike information criterion; BIC, Bayesian information criterion; df, degrees of freedom; LL, log-likelihood; # of fp, number of estimated free parameters; $\Delta\chi^2$, −2 times difference in LL between adjacent models.

configural and full metric invariance model was significant for all three grouping variables (gender: $\Delta\chi^2[20] = 52.4$, $p < 0.001$, type of sport: $\Delta\chi^2[20] = 46.9$, $p < 0.001$, and competition level: $\Delta\chi^2[20] = 32.4$, $p = 0.040$). Following the specification of equivalent models, we specified models with partial metric invariance, progressively freeing LPA indicator means, which displayed the largest differences in the configural model. For gender, it was necessary to estimate only one group-specific latent mean for intrinsic motivation within the amotivated profile ($M_{\text{males}} = -0.39$ vs. $M_{\text{females}} = -1.72$) in order to reach a well-fitting partial invariance model, $\Delta\chi^2(19) = 29.8$, $p = 0.051$. Only one group-specific LPA indicator mean was also estimated for the competition level, $\Delta\chi^2(19) = 25.9$, $p = 0.132$, where the moderately controlled and amotivated profiles differed in their levels of amotivation ($M_{\text{recreational}} = 1.22$ vs. $M_{\text{competitive}} = -0.16$). The partial invariance model for type of sport showed an acceptable fit, $\Delta\chi^2(14) = 23.0$, $p = 0.060$, after removing equality constraints on six latent indicators means, three for the low motivation profile (identification: $M_{\text{individual}} = -1.01$ vs. $M_{\text{team}} = -0.64$, internalization: $M_{\text{individual}} = -0.57$ vs. $M_{\text{team}} = -0.94$, and external regulation: $M_{\text{individual}} = -0.44$ vs. $M_{\text{team}} = -0.76$) and one for moderately autonomous (external regulation: $M_{\text{individual}} = -0.14$ vs. $M_{\text{team}} = 0.20$), moderately controlled and amotivated (internalization: $M_{\text{individual}} = -0.05$ vs. $M_{\text{team}} = 0.39$), and highly amotivated profile (identification: $M_{\text{individual}} = -0.47$ vs. $M_{\text{team}} = -0.97$), respectively. Additional equality constraints placed on latent profile proportions (i.e., distributional or full invariance) revealed that imposing distributional similarity constraints is plausible for type of sport, $\Delta\chi^2(3) = 4.6$, $p = 0.205$, and competition level, $\Delta\chi^2(3) = 6.7$, $p = 0.082$, but not for gender, $\Delta\chi^2(3) = 14.6$, $p < 0.001$. The largest differences in class sizes (proportions) for gender analysis were observed in moderately autonomous (38.2% males vs. 50.9% females) and the highly amotivated profiles (19.5% males vs. 5.8% females).

3.4 | Profile Differences in Distal Outcomes

Figure 2 shows the latent profile differences in social physique anxiety (SPA), global self-esteem (GSE), and physical self-worth (PSW). Omnibus difference tests were statistically significant for all three distal outcomes, SPA: $\chi^2(3) = 41.6$, $p < 0.001$, GSE: $\chi^2(3) = 23.6$, $p < 0.001$, and PSW: $\chi^2(3) = 21.7$, $p < 0.001$. (To guard against the inflation of the Type I error rates (i.e., erroneous rejections of the null) with multiple comparisons, we used the Holm–Bonferroni adjustment (Holm 1979). This controls the familywise error rate in a more conservative manner than the usual Bonferroni procedure [e.g., Sauder & DeMars 2019]). More specifically, the *moderately autonomous* Profile 1 demonstrated significantly higher GSE and PSW, as well as significantly lower SPA compared to all the remaining profiles (all $p_{\text{uncorrected}} < 0.05$). Most of these differences (7 out of 9) remained statistically significant even after applying the Holm–Bonferroni correction for multiple comparisons, with two only slightly exceeding the corrected alpha threshold of 0.05 (all $p_{\text{corrected}} < 0.056$). Furthermore, the *highly amotivated* Profile 4 displayed significantly lower SPA than the *moderately controlled and amotivated* Profile 2 ($p_{\text{uncorrected}} = 0.001$, $p_{\text{corrected}} = 0.004$) as well as the low motivation Profile 3 ($p_{\text{uncorrected}} = 0.031$, $p_{\text{corrected}} = 0.062$). Profiles 2, 3 and 4 did not differ significantly from each other in levels of GSE and PSW (all $p_{\text{un/corrected}} > 0.05$).

4 | Discussion

In this study, we used LPA to examine unique typologies of motivation for sports and physical exercise in a sample of university students engaged in physical education studies. The goal here was to determine whether there are clearly defined and meaningful subgroups that could be characterized by unique motivational regulatory styles. This is the heart of SDT and what makes it so unique as a theoretical framework to account for

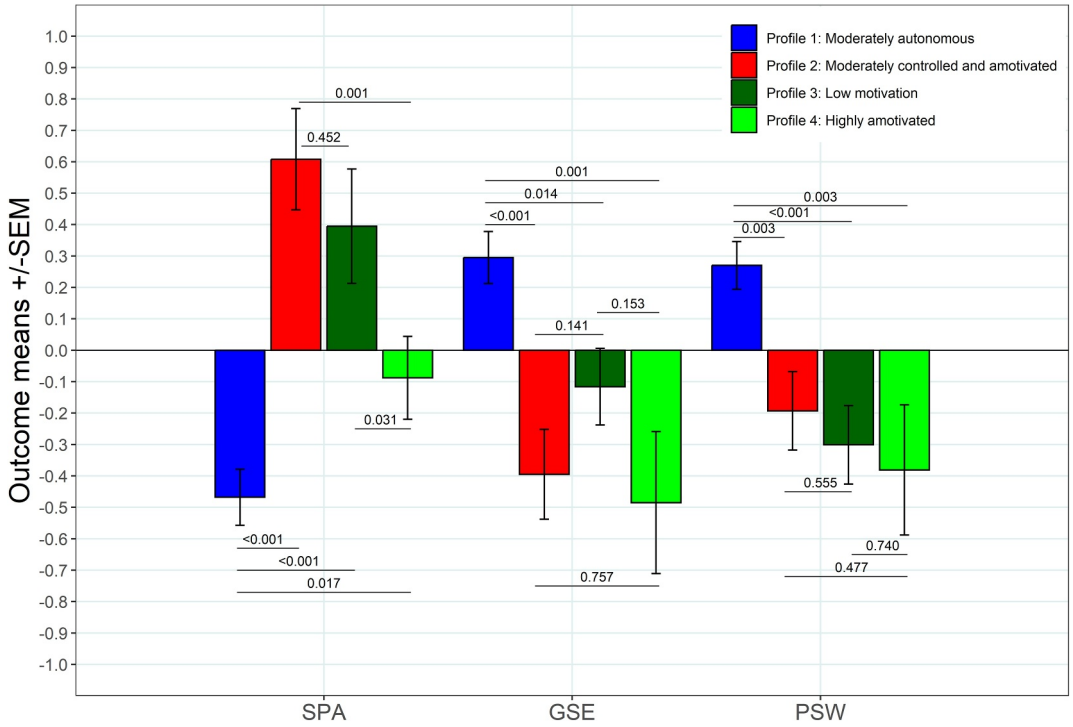

FIGURE 2 | Outcome means and pairwise comparisons between the four profiles of sports motivations. GSE, global self-esteem; PSW, physical self-worth; SPA, social physique anxiety. Uncorrected *p*-values for pairwise comparisons are presented in the figure.

individual differences in human activity. According to SDT, differences in the application of motivational regulatory styles is what distinguishes people in their effort, persistence, and energy when it comes to sport and physical activity. These differences arise from an interaction between the basic psychological needs of a person (i.e., autonomy, competence, and relatedness) and the social world they inhabit. In general, people are not all or none when it comes to motivation, and in truth, most people mix and match motivational styles in an effort to achieve their goals. In certain situations, a person can be intrinsically motivated feeling fully self-determined (autonomous) and competent. At other times, and depending on the context, a person can be motivated solely by extrinsic rewards, punishments, or to avoid guilt or shame. The way people achieve their goals, especially in sports, exercise, and physical activity, is by creating a delicate balance between different motivational styles and using this effort (or lack thereof in the case of amotivation) to evaluate how readily they can achieve their performance goals.

We explored the nature of motivation in a sample of Czech university students enrolled in physical education courses. The sample included a distinct combination of athletes from various sport disciplines and competitive levels, spanning from recreational (intramural) participants to more competitive sub-elite athletes. Based on the existing literature, we expected anywhere from three to six profiles that would differ in their configuration of motivational regulatory practices. We chose the 4-profile solution given it enumerated four distinct and uniquely shaped profiles. Over half of the students belonged to a profile labeled *moderately autonomous*, distinguished by the highest scores on the intrinsic and more autonomous types of motivation, average scores on external regulation, and relatively low scores on amotivation. The next largest profile (*moderately controlled and amotivated*) mapped very closely to the *moderately autonomous* profile for intrinsic motivation but differed in their higher levels of external regulation and much higher levels of amotivation. The two remaining profiles, characterized as *low motivation* and *highly amotivated*, had very unique motivational profile that could be distinguished not only from each other, but also from the more autonomous profiles. In the case of the low motivation profile (almost one-fifth of the sample), they had a very distinct profile being below average on all forms of motivation across the board. In essence, they were neither intrinsically or extrinsically motivated but were not highly amotivated as well. The *highly amotivated* profile, on the other hand, showed a sharp contrast to the other profiles. They too were below average on all forms of motivational regulations but had above average scores on external regulation and the absolute highest scores on amotivation. Taken as a whole, this suggests that members of this profile were subject to external pressures and controlled if not being at times amotivated in their physical sport endeavors.

The mixture of motivational regulatory styles was not too dissimilar from other studies that have used similar instruments purported to assess SDT-based motivational regulation in sports (e.g., Behavioral Regulation in Exercise Questionnaire [Mullan et al. 1997], and the Sports Motivation Scale-II [Pelletier et al. 2013]). In particular, several studies using LPA reported a profile characterized as moderately autonomous (Gustaffson et al. 2018; Lindwall et al. 2017; Tóth-Király et al. 2020). Moreover, all three of these studies produced very similar profiles resembling the highly amotivated profile obtained in the current study. In all of these studies, the profile is characterized by individuals with very high amotivation coupled with very low

levels of autonomous forms of motivation and external regulation being around average.

There is additional support in the literature for the low motivation profile obtained in the current study, which resembles profiles with below average levels on all motivational regulations (e.g., Gustaffson et al. 2018; Lindwall et al. 2017). On the other hand, we are aware of only one other study (Cece et al. 2018) that identified a profile similar to the moderately controlled and amotivated profile in the current study. This might indicate the existence of sample-specific profiles; however, it also showcases the possible unique ways that motivation interacts when all forms are considered simultaneously and using a person-centered approach like LPA. Despite minor discrepancies between previously reported studies and the current results (e.g., more profiles were extracted in some studies, and profile indicator mean estimates varied in different studies), the overall similarities in profile shape across different studies suggest an accumulation of evidence supporting naturally occurring subgroups based on motivational regulatory styles within the context of sports and physical education.

Multiple group models showed that the basic composition of profiles (configural similarity) was quite similar for gender, competition level (recreational vs. elite), and individual versus teams sports. The multigroup analysis also indicated that it is reasonable to assume the relationships between items and the underlying factor structure are largely similar across gender, competition level, and type of sport (individual vs. team), supporting partial metric invariance. There was also evidence that the same number of individuals could be assigned to the different profiles for type of sport and competition levels, indicating a certain consistency in motivational styles for the different grouping variables. The multigroup model for gender, however, suggested some imbalance in the number of males versus females assigned to the different motivational regulatory styles with more males assigned to the highly amotivated profile (Profile 4) and more females assigned to the moderately controlled and amotivated profile (Profile 2). From a broader methodological perspective, it should be emphasized that a certain form of measurement invariance (e.g., partial metric invariance) constitutes an important prerequisite for valid between-group comparisons in profile prevalence. This study therefore adds to the current body of literature by being the first to provide multigroup similarity tests for sport motivation profiles in the level of competition and sport type.

We also validated profile membership using three relevant measures of self-appraisal including whether people get anxious about their physique (SPA), positively or negatively value themselves against some standard (GSE), and view their physical self-worth (PSW). Each of these measures provides insights into people's views of themselves in various contexts that may, to some degree, be tied to their motivational levels. As expected and based on SDT, members of the more autonomous and self-determined profile (Profile 1) viewed themselves in a better limelight compared to the remaining profiles. They had higher self-esteem and thus valued themselves more, had greater pride and self-respect fostering their physical self-worth, and were not anxious about their physical stature when viewed by others. This prediction is consistent with SDT, which holds that greater self-determination and greater volitional control produce an aura of "competence" that pervades one's actions. Members of the *moderately autonomous* profile believe their own volitional actions result in favorable outcomes, and thus they will take responsibility and "own" their performance. This, in turn, reflects back on their self-esteem, and in the case of sporting activities, boosts their pride and confidence in their physical accomplishments. At the same time, these same individuals have little apprehension about what others think of their body in terms of its form, structure, muscle tone, and their proportions and are comfortable with the effect that fitness has on their physique (i.e., their build, strength, physical competence, and body image).

Interestingly, the highly amotivated profile, which contains individuals who lack an internal drive and are not driven by reward structures, had less concern about their physical stature compared to members of the moderately controlled and amotivated and the low motivation profiles. The latter finding may indicate that these individuals have a lack of concern about their body image or appearances (i.e., body fat, muscle tone, and proportions), given they see no connection between how hard they work to keep in shape and external rewards. The latter would include recognition for having a good build or adulation for their physical accomplishments (working out in the gym is not tied to any reward structure like verbal confirmation from friends that one appears "fit and in shape").

5 | Study Limitations

There are a number of limitations associated with this study. The derivation of profiles and their composition is based on cross-sectional data, which prevents making causal statements about relations between profile membership and the designated outcomes in question. Future studies may want to examine profile membership prospectively, as a means of assessing whether people's motivational styles remain consistent over time and also whether motivational styles have temporal associations with the measure of psychosocial functioning like those measured in the current study. Only Czech university students were involved in the study, with a limited age range, which may limit generalization to other age cohorts in different settings. Along these lines, the data are entirely self-report, which presents the potential for reporting bias. People do tend to present themselves in a more positive frame, and this can influence how they answer questions about their motivational status. Subgroup comparisons were restricted to type of sport, competition level, and gender, all sources of potential variability in profile composition. However, a host of other factors may contribute to profile membership. Contextual factors that may play a role in sports motivation include culture, family background, peer influences, role models, and school interests. Personality traits including conscientiousness, neuroticism, and self-regulation can also influence sports motivation. Future studies are warranted that examine the myriad of different intra- and interpersonal influences that not only provide a substrate for motivation but also may contribute to how a person feels about themselves in terms of their overall worth, self-esteem, and their body image.

6 | Implications

Knowing the configuration of an athlete's motivational regulatory style can be instrumental in developing an appropriate training program that leads to improved performance. It will do no good, for instance, to use strategies that reflect an external regulatory style for an athlete who relies heavily on intrinsic motivational strategies. Likewise, for an athlete that responds better to external exhortations, attempting to drive home the utility of intrinsic motivation will fall on deaf ears. In the current study, a large percentage of the students were mostly intrinsically motivated and could be distinguished from each other primarily in terms of their levels of amotivation, very low for some students and relatively high for others. This point of demarcation represents an opportunity for developing personalized training strategies that target increasing intrinsic motivation while at the same time finding ways to minimize amotivation. The latter represents a challenge as amotivation encompasses a lack of connection between psychological needs satisfaction and performance. In other words, amotivated individuals do not see the need to fulfill autonomy, competence, or relatedness or connect their own impetus to participate in sports with perceived benefits, regardless of whether they are intrinsically (i.e., for pleasure or enjoyment) or extrinsically (for a reward or to reduce distress) motivated at times. Future studies may thus want to delve more deeply into the subtle differences between profiles that are apparently quite similar in most respects and differ in only one type of motivation. There may be certain "conditions" or situations in which they feel amotivated or at certain times in their training they cannot muster sufficient motivation. These turning points become teachable moments where coaches can grapple with the reasons for diminished enthusiasm that may be tied to burnout or decrements in performance.

Conflicts of Interest

The authors declare no conflicts of interest.

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Supporting Information

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