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ABSTRACT
The purpose of this study was to examine the relationship between perceptions of autonomy support, structure and involvement provided by the head coach and motivational processes at mid- and late-season in competitive rugby players. Participants (M_{age} = 20.17 years, *SD* = 1.61 years, *Range* = 18 to 27 years) completed assessments of perceived coaching style and psychological need fulfillment at the mid-season point ($n_{mid\text{-}season}$ = 102; 47.05% female) and motivation to continue playing rugby and perceived effort spent playing rugby at the late-season assessment ($N_{late\text{-}season}$ = 82; 53.64% female). Structural equation modeling analyses provided support for a conceptual model whereby global perceptions of coach support predicted greater need fulfillment which, in turn, was associated with autonomous sport motivation and greater perceived effort. Overall, the results of this study lend partial support for Vallerand's contentions regarding the importance of motivation processes in sport and imply structure and involvement may be important components of a coach's interactional style that impact athletes' motivation.

Key words: Coaching Style, Intrinsic Motivation, Rugby, Self-Determination Theory

INTRODUCTION

This article is based on Vallerand's [1] Hierarchical Model of Intrinsic and Extrinsic Motivation (HMIEM). Participation in sport holds the potential to contribute positively to the social development and psychological well-being of athletes. Social interactions with a

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number of agents (e.g., parents, athletic trainers) have been identified as important facets of the interpersonal dynamics that can shape motivation towards sport involvement [3]. Coaches represent an integral component of the sporting milieu that interact with athletes regularly and impact their motivation to participate in sport [4, 5]. Despite the importance of understanding the motivational implications of coach-athlete interactions in sport domains, it appears that few attempts have been made to fully test the nature and function of coach-athlete interactions within the framework of Vallerand's HMIEM. Hence, the main aim of this study was to test the role of perceived autonomy support, structure, and involvement experienced from interacting with the head coach on a sequence of motivational processes within the domain of sport encapsulated in the HMIEM.

THE HMIEM: A BRIEF OVERVIEW

Grounded in the principles set forth by Deci and Ryan [6] within the framework of Self-Determination Theory (SDT), Vallerand has developed the HMIEM as a conceptual model for studying the sequence of motivational processes impacting outcomes such as persistence behavior and well-being in various applied domains including sport. The original version of the HMIEM is comprised of five postulates that converge to provide a broad overview of human motivation and adaptive processes operating at three distinct yet interactive levels of analyses. The most abstract level is the global level which is concerned with a person's typical or enduring motivational orientation towards engaging in life's activities [1]. The least abstract level of generality posted within the HMIEM is the situational level [1]. At this level of analysis, the processes that impact motives and resultant consequences represent moment-to-moment variations in the immediate surroundings that people find themselves in at any given time [1]. Between the global and situation levels resides the contextual level. Vallerand [1] notes that the HMIEM's contextual level refers to the motivational processes that operate within particular spheres of life such as education, work, and sport.

The sequence of processes central to adaptive functioning and integration within each level of the HMIEM remain consistent despite variation in the level of generality. In the original development of the HMIEM, Vallerand [1] presented a cogent argument favoring a four-stage sequence of motivational processes that operate at each level of generality comprising the model. In brief, Vallerand [1] proposed the following sequence of motivational processes within the HMIEM: Social Factors → Psychological Need Fulfillment → Motivation → Consequences [7, 8].

MOTIVATION

Consequences such as participatory behavior, well-being, and emotional adjustment are considered to be determined primarily by motivation within the HMIEM [1]. Drawing from SDT [6, 9], the concept of motivation is represented within the HMIEM as a multidimensional construct that varies in the degree to which reasons for enacting a behavior have been internalized and integrated within the person's sense of self [1]. Four specific types of extrinsic motivation have been posited within the HMIEM [1] that represent both controlling (external and introjected regulations) and more autonomous or self-determined (identified and integrated regulations) reasons for engaging in behaviors such as sport. External regulation is the least self-determined form of motivation which is concerned with acting to appease external contingences such as social pressure or reward contingencies [9]. Introjected regulation concerns motivating target behaviors using either intrapsychic pressure to avoid negative emotional states (e.g., guilt, shame) or a desire to maintain contingent self-worth [9]. In contrast to these controlling regulations, identified regulation

is an autonomous form of extrinsic motivation that regulates behaviors from a sense of perceived choice and importance ascribed to behavioral outcomes even if the activity itself is not self-rewarding [9]. Finally, athletes who emit behaviors volitionally whereby activities are fully in harmony with other life goals viewed as important to the person's sense of self are motivated by integrated regulation [1].

In addition to these distinct extrinsic motives, Vallerand [1] contends that amotivation and intrinsic regulation anchor the distal endpoints of the motivational continuum central to the HMIEM. Amotivation is a state akin to learned helplessness whereby athletes see no relevant outcomes associated with the target behavior and therefore do not intend to act or at best engage passively without conviction [1]. In contrast, intrinsic regulation represents the epitome of self-determined motivation within the framework of the HMIEM [1]. Intrinsic regulation concerns "doing an activity for its own sake" [10, p. 2] whereby factors including fun, stimulation, and interest in the activity itself motivate behavior. Vallerand [1] contends distinguishing controlled from autonomous motives is important for understanding both the determinants and consequences ascribed to motivation varying in self-determination. In brief, Vallerand [1] argues that the consequences stemming from motives become increasingly positive as individuals participate for more self-determined than controlling reasons.

PSYCHOLOGICAL NEED FULFILLMENT

An integral component of the sequential process conceptualized to impact motivation within the HMIEM concerns the role afforded to perceptions of competence, autonomy, and relatedness as psychological needs linking social factors with individual motives. Competence refers to mastering tasks that challenge the person in optimal ways such that one feels a sense of effectance regarding the behavior [9]. Autonomy is concerned with feeling ownership over one's actions rather than as a pawn to external agenda such that behaviors are self-initiated with volition from an internal perceived locus of causality [9]. Finally, relatedness is defined by establishing and maintaining secure attachments with others in one's social milieu or more globally such that a person feels enmeshed rather than isolated within and across life's domains [9].

The concept of basic psychological needs is central to both SDT [9] and the HMIEM [1]. According to Deci and Ryan [9], the psychological needs for competence, autonomy and relatedness denote innate rather than acquired human tendencies that promote adaptation and enhance well-being when fulfilled authentically. Within the framework of the HMIEM, Vallerand [1] contends that these basic psychological needs represent the lynch pin connecting perceptions of the social environment with human motivation. Stated differently, it is posited within the HMIEM that social factors such as the degree of success/failure experienced with a given task or interpersonal perceptions of social interaction will influence motivation via the satisfaction of competence, autonomy, and relatedness needs [11].

SOCIAL FACTORS

The final component of the HMIEM proposed by Vallerand [1] as being integral to a full understanding of the sequential chain of processes that shape human motivation is social factors. Within the framework of the HMIEM, motivation is considered to result from two distinct sources, namely top-down effects from motivation at the next higher level in the model hierarchy and the fulfillment of basic psychological needs that rely in part on ambient conditions within the social environment experienced within and across the contexts of life [1]. Social factors such as verbal persuasion, feedback, sanctions, and rewards

hypothetically influence motivation to the extent that they impact the fulfillment of key psychological needs for competence, autonomy, and relatedness.

Interpersonal style represents one key social factor that has received considerable research focus within both the SDT and HMIEM literatures [9, 11]. Deci and Ryan [9] advanced the notion of interpersonal style formally to characterize the manner in which people interact with each other during social exchanges. Much of the research examining the notion of interpersonal styles has centered on the distinction between perceived autonomy supportive versus controlling styles from target social agents such as coaches [12], teachers [13], or physicians [14]. According to Deci and Ryan [9], people who perceive their interactions with others as autonomy supportive will flourish in terms of development, motivation, and well-being whereas those who perceive their interactions to be controlling in nature will experience observable decrements in motivation and well-being. Support for this distinction has been forthcoming in a number of life contexts including sport [12], exercise [15], and physical education [16].

HMIEM AND SPORT RESEARCH: EVIDENCE FOR THE INTEGRATED SEQUENCE OF MOTIVATIONAL PROCESSES

Vallerand [11] notes that the integrated, four-stage sequence of motivational processes central to the HMIEM has received support in applications to sport at the contextual level of the model's hierarchy. One of the earliest studies reported in this area demonstrated that swimmers who dropped out of sport over time displayed less autonomy support and higher controlling interpersonal styles from the coach in comparison to those who persisted with swimming [12]. Structural equation modeling analyses supported the notion that greater perceived autonomy support predicted more self-determined motives that, in turn, were associated with more frequent behavior across time. Another study reported by Sarrazin et al. [17] provided evidence for a modified integrated sequence that implied young, female handball players who perceived their coaches to be more task-focused than ego-orientated in their interactions reported endorsing more self-determined sport motivation and exhibited greater persistence behavior within sport over time.

Complementing these investigations is a study of master's level swimmers that tested the four-stage integrative motivational sequence outlined within the HMIEM at both the contextual and situational levels [18]. Recursive path analysis using iterative multiple regression models to estimate the structural pathways posited within the HMIEM partially supported the four-stage sequence of integrated motivational processes accounting for up to 38 per cent of the variance in select constructs. Close inspection of the path model presented by Kowal and Fortier [18] offers considerable support at both the contextual and situational levels for the HMIEM's proposed motivation sequence comprising psychological need satisfaction → motivation → consequences where flow was the solitary outcome of interest. Less convincing support was evident for the social factors → psychological need satisfaction link proposed within the HMIEM [1]. Careful inspection of the standardized pathways reported by Kowal and Fortier [18] indicated that no more than one third of the hypothesized six pathways linking social factors with perceptions of competence, autonomy, and relatedness were supported within this study.

THE PRESENT STUDY: JUSTIFICATION AND AIMS

The aim of this study was to test the four-stage, integrated sequence of motivational processes in the domain of sport postulated by Vallerand [1, 11] within the HMIEM. Examination of the literature that has tested different postulates embedded within the

HMIEM provided the impetus justifying this study. First, examination of the available evidence suggests there is considerable scope for testing the integrated sequence of motivational processes central to the contextual level of the HMIEM in relation to various outcomes relevant to sport. Previous research has focused predominantly on issues of persistence versus dropout behaviors [12, 17], behavioral intentions [17], and the psychological state of flow [18]. Vallerand [11] contends that examining different outcomes in relation to the integrated sequence of motivational processes embedded within the HMIEM will extend the model's application in sport contexts. Towards this end, this study utilized perceived effort spent while playing rugby as the consequence of interest for both pragmatic and conceptual reasons. First, this construct has been largely overlooked as a motivational consequence in applications of the HMIEM to sport compared with action intentions or persistence behavior [11]. This is rather surprising given the tacit appeal of understanding the motivational basis of perceived effort expended by athletes within sport to the coaching staff. Second, previous research supports the differentiation of perceived effort from motives specific to the HMIEM [19] with subsequent investigations linking the motives for exercise [20] and physical education [21] with the perception of greater effort expended within that physical activity context.

A second line of reasoning justifying this study concerned the limited array of social factors examined in previous studies applying the HMIEM to sport. Careful inspection of previous research indicates that the focal social factors examined have been either: a) the degree of autonomy support experienced from the coaching staff [12]; or b) dimensions of motivational climate drawn from Nicholls' [22] Achievement Goal Theory [17, 18]. These studies offer mixed evidence for the proposed link between social factors and psychological needs outlined by Vallerand [1]. For example, the data reported by Pelletier et al. [12] offers clear support for the role of an autonomy supportive interpersonal style on behalf of the coach in terms of predicting more self-determined forms of sport motivation, but omitted the assessment of psychological needs theorized to be foundational to motivation [1, 9]. Conversely, previous studies offer mixed support for the role of perceived motivational climate engendered by the coaching staff in relation to psychological need satisfaction experienced by athletes within sport. Sarrazin et al. [17] indicated that young athletes who experience the coach's interactions as task involving reported higher competence, autonomy, and relatedness within sport contexts. In contrast, Kowal and Fortier [18] reported that athlete's perceived autonomy was not associated with any social factor at either the contextual or situational levels of analysis and the bulk (~75 percent) of hypothesized links between social factors and psychological need satisfaction constructs were not supported in the analyses.

Overall, it appears that the range of social factors representing the coach's interpersonal style is limited in scope with studies yet to consider the potential role of perceived structure and involvement proposed by Deci and Ryan [9] within the broader framework of SDT. Deci and Ryan [9] have long extolled the virtues of supportive environments in relation to promoting the fulfillment of competence, autonomy, and relatedness needs and have proposed various dimensions of interpersonal style that link directly with each psychological need. Autonomy support has received the most research attention in applications of SDT (and the HMIEM) to the study of issues of interpersonal style in sport. According to Deci and Ryan [9], the concept of autonomy support is concerned with minimizing pressure to engage in different behaviors such that people feel their actions correspond with their own choices and align with personal goals. Alternatively, structure is focused upon clarifying the outcomes to be derived from task engagement while simultaneously encouraging feelings of

competence by using supportive yet realistic feedback regarding task progress [9]. Finally, the dimension of involvement concerns showing emotional support via demonstrating genuine interest in a person's well-being and displaying empathy as individuals struggle with the demands of behavioral change [9]. Limited attempts have been made to include each dimension of interpersonal style in research examining the social factors-psychological need satisfaction relationship in physical activity contexts [23]. This study represents an initial attempt to determine if perceived structure and involvement along with autonomy support matter in terms of the interpersonal style exhibited by the head coach within the domain of sport.

Grounded in the HMIEM [1], the overall purpose of this study was to test a sequence of motivational processes that included athletes' perceptions of the coach's interpersonal style as the primary contributing factor. A secondary purpose was to test the role afforded perceived structure and involvement experienced by athletes in addition to felt autonomy support during interactions with the coaching staff to determine how these social factors align with the HMIEM's motivational sequence at the contextual level [1]. Our hypotheses were based on postulates set forth in the HMIEM [1] and related SDT literature that has either: a) tested the role of structure and involvement in applied domains [23]; or b) presented conceptual arguments concerning the potential role of these components of interpersonal style [7, 9]. First, it was hypothesized that perceived autonomy support, structure, and involvement would be positively interrelated given that they represent adaptive dimensions of supportive interpersonal environments [9, 23]. Second, it was hypothesized that dimensions of interpersonal style attributed to the coach would display a differential pattern of associations with the satisfaction of each psychological need (e.g., $|r_{\text{involvement.relatedness}}| > |r_{\text{involvement.competence}}|$). This hypothesis was based largely on conceptual arguments concerning the role of interpersonal style constructs in relation to the fulfillment of psychological needs within SDT [9] and more directly with reference to the coach-athlete relationship [7]. Finally, it was hypothesized that a conceptual model posting the four-stage integrated sequence of motivational processes using perceived effort as the outcome would be supported within the sport of rugby. This final hypothesis was drawn directly from the postulates set forth by Vallerand [1] within the framework of the HMIEM.

METHODS

PARTICPANTS

The sample at Time 1 one (n = 102) was comprised of 48 female and 54 male varsity rugby players enrolled at a Canadian university. Only 82 of those participants, 44 females and 38 males participated at Time 2 therefore the other 20 participants were subsequently removed prior to commencing with data analysis. Participants ranged in age from 18 to 27 years (M = 20.17 years, SD = 1.60 years). Playing experience within rugby varied from 1 to 13 years (M = 6.40 years, SD = 2.01 years). On average participants reported playing university-level rugby for 2.23 years (SD = 1.14 years). The highest level of play beyond university competition reported in this sample was as follows: a) High school (9.8%), b) Club (50.0%), c) Representative (14.6%), d) Provincial (15.9%), and e) National (9.8%). Self-reported training in pre-season ranged from 0 to 32 hours per week (M = 10.13 hours, SD = 6.55 hours), during season ranged from 1 to 36 hours per week (M = 15.28 hours, SD = 5.52 hours), and in the off-season ranged from 0 to 34 hours per week (M = 7.87 hours, SD = 5.57 hours). Rugby players represented the different roles on the team based on self-reported starting status, which included athletes designated as: a) starters (40 %), b) sometimes start, sometimes don't start (16%), c) non-starters (40%), and d) don't know yet (3%).

INSTRUMENTS

Demographics

Participants were asked during the first wave of assessment to provide demographic information. Each rugby player was asked to provide their age, gender, playing position, number of years playing organized rugby, highest level of rugby played, starting status, and number of hours dedicated to rugby training in pre-season (during season and off-season).

Interpersonal Style (Head Coach)

Participants completed an 18-item instrument designed to assess perceptions of autonomy support, structure, and involvement experienced by each athlete from the head rugby coach. Autonomy support (n = 6 items) was assessed using the short-form of the Health Care Climate Questionnaire [24], which is designed to capture the degree to which people feel as though individuals in authority positions support decision-making and convey confidence in their subordinates ability to execute particular tasks. The original six HCCQ items were modified to make them sport-specific (e.g., "I feel that my physician has provided me with choices and options" was modified to "I feel that my head rugby coach has provided me with choices and options"). Previous studies have adapted the HCCQ items to sport [12] and exercise [15] demonstrating that scores from these items represent a single underlying factor that is associated with more internalized motives.

Additional items were modified from Markland and Tobin [23] to assess perceived structure (n = 6 items) and involvement (n = 6 items) experienced during interactions with the head rugby coach. In line with the conceptual boundaries defining structure and involvement provided by Deci and Ryan [9], the structure items (sample item: "My rugby coach makes it clear to me what to expect from engaging in training") were designed to assess the extent to which athletes felt the head coach provided clear direction towards target goals and unambiguous yet supportive feedback about progress towards goal attainment. The involvement items (sample item: "My coach finds time to talk with me") were intended to capture feelings of empathy and genuine concern on behalf of the coaches for the athletes. All three subscales were measured on a seven point Likert scale ranging from 1 (not at all true) to 7 (very true). Markland and Tobin [23] developed these items originally to assess patient experiences with the interpersonal styles of health-care staff. A subsequent investigation by Edmunds and colleagues reports reliability (Cronbach's α; [25]) estimates ranging from 0.84 to 0.96 for responses to these items in a sample of exercisers from the United Kingdom [26]. This study represented an initial attempt to modify and use the items within the context of competitive sport to assess dimensions of interpersonal style attributed to the coach from the athletes' perspective.

Basic Psychological Need Satisfaction

Participants completed three instruments designed to assess perceived competence (Intrinsic Motivation Inventory-Perceived Competence [IMI-PC] subscale; [27]), autonomy (Basic Need Satisfaction in General-Autonomy [BNSG-A] subscale; [28]), and relatedness (Feelings for Relatedness-Acceptance [FR-A] subscale; [29]). The IMI-PC is comprised of 5 items rated on a 7-point Likert scale anchored at the extremes by 1 (Not at all true) and 7 (Very true). The BNSG-A is a 7-item subscale designed to assess feelings of volition and internal causality [28]. Responses were provided on a 7-point Likert scale anchored at the extremes by 1 (Not at all true) and 7 (Very true). The FR-A subscale used in this study consisted of five modified items that were accompanied by a 7-point Likert repose scale per item anchored by 1 (Does not agree at all) and 7 (Very strongly agree). Minor alterations to the wording of the original items for each subscale were made to ensure the participant

responses were specific to the sport of rugby (i.e., IMI-PC sample item: "I think I did pretty well at rugby, compared to other players"; BNSG-A sample item: "On this rugby team, I feel like I can pretty much be myself"; FR-A sample item = "With other players on my rugby team, I feel supported"). A stem was presented before the IMI-PC, BPNG-A, and FR-A items that situated the participant's responses to all items in the context of their sport experiences (i.e., "The following statements represent different experiences athletes have when they play rugby. Please answer the following questions by considering how you typically feel when you play rugby."). Previous studies have supported the structural validity and reliability of responses from samples of competitive athletes to the IMI-PC [30], BNSG-A [31], and FR-A [32]. An IMI-E, BPNG-A, and FR-A subscale score was created by averaging the relevant items per subscale [33].

Sport Motivation

Participants completed the 24-item Sport Motivation Scale-6 (SMS-6; [34]) to assess motivation in line with the HMIEM [1]. The SMS-6 is comprised of six subscales assessing the quality of sport motivation across the SDT continuum: a) Amotivation (sample item: "I don't know anymore; I have the impression of being incapable of succeeding in rugby"), b) External Regulation (sample item: "For the prestige of being an athlete"), c) Introjected Regulation (sample item: "Because I would feel bad if I was not taking time to do it"), d) Identified Regulation (sample item: "Because it is one of the best ways I have chosen to develop other aspects of my life"), e) Integrated Regulation (sample item: "Because participation in rugby is consistent with my deepest principles") and f) Intrinsic Regulation (sample item: "For the satisfaction I experience while I am perfecting my abilities"). Participants responded to each item on a 7-point Likert-scale anchored at the extremes by 1 (Does not correspond at all) and 7 (Corresponds Exactly). Minor wording modifications were made to the original SMS-6 items to ensure that each item was querying the athletes experiences in rugby to prevent obfuscation if the individual was a dual-sport athlete (e.g., the original SMS-6 item "Because participation in my sport is an integral part of my life" was changed to "Because participation in rugby is an integral part of my life"). The set of SMS-6 items was preceded by a stem that asked athletes to respond to each item in terms of their motives for continuing playing rugby ("Why do you plan to continue playing rugby?"). Mallett et al. [34] provide support for the structural validity and reliability of responses to the SMS-6 items and demonstrated associations between motivation measured with the SMS-6 and a dispositional measure of flow that might be expected based on arguments embedded within SDT [9].

Perceived Effort

Participants completed four items designed to assess perceptions of effort expended in the sport of rugby (Sample item: "I put a lot of effort into rugby"). The items were drawn from the Effort/Importance subscale of the Intrinsic Motivation Inventory (IMI-E; [27]). One item ("It is important to me to do well at this task") was removed from the original IMI-E item pool because the item content represented personal importance as opposed to perceived effort expended in the activity under scrutiny. Participants responded to each item on a 7-point Likert scale anchored at the extremes by 1 (Not at all true) and 7 (Very true). A stem that contextualized each athlete's response in the sport of rugby preceded the presentation of the item set (i.e., "The following statements represent different experiences athletes have when they play rugby. Please answer the following questions by considering how you typically feel when you play rugby."). Previous research has supported the structural validity and reliability of responses to the IMI-E in physical activity contexts [29].

DATA COLLECTION PROCEDURES AND DATA ANALYSES

Participants completed two waves of assessment separated by a period of approximately five weeks across the competitive rugby season. The first assessment was completed at the mid-point of the season with the second assessment completed during the last week of the season. At the first assessment, each athlete provided their demographic information and an assessment of interpersonal style attributed to the coach and feelings of psychological need fulfillment in sport. At the second assessment, each athlete completed instruments measuring sport motivation and perceived effort. Prior to the distribution and completion of questionnaires at each assessment period, participants were given standardized written and verbal instructions to reduce the likelihood of between-subjects or between-time effects on the basis of test administration. All athletes consenting to participate in the study completed the instruments at both time points after a regularly scheduled practice or a team meeting. The protocol for this study was reviewed and cleared by a university-based research ethics board prior to any participant contact during recruitment and data collection.

Data analyses proceeded in iterative stages. First, the data were screened for missing values, normality, and the presence of statistical outliers. Second, estimates of internal consistency reliability (Cronbach's α; [25]) were computed for all multi-item instruments/subscales. Subscale scores for perceived autonomy support, structure, involvement, IMI-PC, BNSG-A, FR-A, each of the six SMS-6 subscales, and the IMI-E were created by averaging the responses for each item per subscale [33]. Third, both descriptive statistics and bivariate (Pearson) correlations were calculated to test patterns of association between HMEIM's constructs within sport. Finally, a conceptual model (see Figure 1) representing the four-stage integrated sequence of motivational processes was specified and tested using structural equation modeling (SEM) that has been advocated for testing models derived from psychological theory [35].

Conventional standards were specified for the SEM analyses which included loading manifest items exclusively on their latent factor, releasing latent factors to correlate, constraining uniqueness values to zero, and fixing either an item loading or a factor variance at unity to define the scale for the analysis (see [36] for a review of these issues). Five global model fit indices – Comparative Fit Index (*CFI*), Incremental Fit Index (*IFI*), Root Mean Square Error of Approximation (*RMSEA*) and the 90% confidence interval surround the RMSEA point estimate, and Standardized Root Mean Square Residual (*SRMSR*) – recommended for use with small samples in which the data likely deviate from normality [37] were used in this study to evaluate overall model fit. While threshold values concerning the degree of model fit in hypothesis-testing approaches using SEM remain controversial [38, 39], it is generally accepted that CFI and IFI values greater than 0.90 and 0.95 reflect acceptable and excellent fit [38] while RMSEA less than 0.05 or in excess of 0.10 [40] and SRMSR values less than or equal to 0.05 denote the boundaries of excellent and unacceptable fit. In addition to these global model fit indices, the distribution of standardized residuals and pattern of structural pathways was also inspected to determine the viability of the proposed conceptual model. AMOS [41] was used to complete all SEM analyses in this investigation.

RESULTS

PRELIMINARY ANALYSES AND SELECTION OF AN ESTIMATOR

Inspection of the data indicated no evidence of missing values for those athletes providing data at both assessment points. No out-of-range responses were noted in the sample data. Minimal deviation from normality was evident in item-level responses for assessments at

mid-season ($M_{skew.}$ = -0.25, $SD_{skew.}$ = 0.61, *Range* = -1.58-1.83; $M_{kurt.}$ = -0.02, $SD_{kurt.}$ = 1.07, *Range* = -1.08-3.39) or late season ($M_{skew.}$ = -0.21; $SD_{skew.}$ = 0.71, *Range* = -1.38-1.29; $M_{kurt.}$ = -0.03, $SD_{kurt.}$ = 0.63, *Range* = -1.07-2.25). Mardia's coefficient (23.09, critical ratio = 5.29) implied evidence of deviation from multivariate normality in the sample data. Joint consideration of the small sample size and deviation from multivariate normality prompted the use of Maximum Likelihood (ML) with bootstrapping (5000 bootstrap samples with replacement from the original sample; [42]). ML is recommended when the data violate normality assumptions in small samples [37]. Bootstrap-generated standard errors have been recommended when the data deviate from normality to improve the stability of parameter estimates within multivariate analyses [42].

SCORE RELIABILITY, DESCRIPTIVE STATISTICS, AND CORRELATIONS

Internal consistency reliability estimates (see Table 1) ranged from 0.52 to 0.91 in this sample. The scores derived from the modified BNSG-A items assessing perceived autonomy demonstrated considerable error variance in the initial analysis (Cronbach's $\alpha = 0.50$). Inter-item correlations displayed a pattern of negative correlations for three BNSG-A items which had been re-coded to account for the negative wording prior to analyses. These three items were removed from further consideration in this study prior to calculating the subscale score for perceived autonomy which is depicted in Table 1.[1] Descriptive statistics (Table 1) indicated that athletes endorsed perceived structure marginally more than autonomy support followed by involvement from their head coach. Perceived relatedness to fellow rugby players was most strongly endorsed followed by autonomy, then competence. Athletes reported more self-determined than controlled motives for sport based on responses to the SMS-6 items and expended high amounts of perceived effort in rugby.

The bivariate correlations between motivational variables assessed in this study are presented in Table 1. A number of interesting patterns are evident in the matrix of correlations. First, the magnitude of the correlations presented in the matrix ranged from weak (i.e., $r_{12} \leq |0.01|$) to strong (i.e., $r_{12} \geq |0.70|$). Second, perceived autonomy support and structure were more strongly and clearly correlated with perceived autonomy than competence or relatedness. This pattern was less marked for involvement, but this dimension of interpersonal style exhibited by the coach was still most strongly associated with perceived autonomy than the other two needs. Third, perceived psychological need satisfaction indices were modestly and positively correlated. Fourth, the magnitude of the correlations between more self-determined sport motives exceeded on average (Mean r = 0.69; Range = 0.65-0.72) those exhibited between more controlling sport motives (Mean r = 0.32; Range = 0.28-0.36). Finally, responses to the SMS-6 items did not produce the expected quasi-simplex pattern of associations in this sample. The magnitude of the bivariate correlation between identified and intrinsic regulations exceeded (albeit marginally) the correlation between identified and integrated regulations.

The assessment of perceived autonomy has proven challenging when applying the HMIEM and SDT frameworks to the study of physical activity [47]. It is worthy of note that lower reliability coefficients indicate greater measurement error contaminating the perceived autonomy scores in this study. Measurement experts have been clear that no specific value ascribed to a score reliability coefficient bestows immutable properties on the data collected in a given sample [49]. Nevertheless, it is also well documented that greater error of measurement in the observed scores within a sample can deflate the overall magnitude of associations (i.e., $|r_{12}|$) with other variables. It is recommended that future studies appraise the merits (and shortcomings) of using modified items to assess HMIEM/SDT constructs while focusing greater attention on lines of research that embrace a construct validation approach [46] to develop sport-specific instruments designed exclusively for use in sport settings.

Table 1. Descriptive Statistics, Reliability Coefficients, and Bivariate Correlations Between Study Variables

Variables	M	SD	α	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Autonomy Support	4.54	1.11	0.86	-												
2. Structure	5.14	1.19	0.91	0.61	-											
3. Involvement	4.16	1.07	0.74	0.76	0.56	-										
4. Competence	5.28	0.90	0.85	0.15	0.11	0.26	-									
5. Autonomy	4.78	0.82	0.52	0.30	0.33	0.32	0.36	-								
6. Relatedness to team	5.47	1.04	0.88	0.11	0.09	0.21	0.35	0.42	-							
7. Amotivation	2.52	1.41	0.83	-0.09	-0.06	-0.12	-0.17	-0.24	-0.18	-						
8. External Regulation	4.36	1.20	0.80	0.06	0.06	0.20	0.30	-0.11	-0.09	0.20	-					
9. Introjected Regulation	4.41	1.10	0.71	0.15	0.26	0.13	0.03	-0.03	0.19	0.18	0.36	-				
10. Identified Regulation	5.12	0.88	0.62	0.24	0.23	0.28	0.16	0.14	0.26	-0.30	0.28	0.47	-			
11. Integrated Regulation	5.14	1.06	0.83	0.18	0.22	0.27	0.37	0.16	0.26	-0.37	0.22	0.31	0.69	-		
12. Intrinsic Regulation	5.38	0.93	0.80	0.12	0.16	0.13	0.14	0.17	0.22	-0.41	0.15	0.36	0.72	0.65	-	
13. Perceived Effort	5.60	1.20	0.90	0.27	0.23	0.27	0.36	0.25	0.33	-0.51	0.03	0.14	0.35	0.32	0.30	-

Note: *M* = Univariate Mean. *SD* = Standard Deviation. α = Estimates of internal consistency reliability [34]. Reliability estimates for perceived autonomy is based on the four positively worded items comprising the subscale. Matrix is based on pairwise comparison and sample size is equivalent across each cell in the matrix. The internal consistency reliability estimate for scores derived from the perceived autonomy subscale is based on the four positively worded items comprising the instrument. Confidence intervals (CI) around the Pearson *r*'s for each pair of interpersonal style variables were calculated as follows: (a) 95% $CI_{autonomy\ support.structure}$ = 0.46, 0.74; (b) 95% $CI_{autonomy\ support.involvement}$ = 0.66, 0.84; (c) 95% $CI_{structure.involvement}$ = 0.39, 0.70 (*n* = 82 across each CI estimated).

SEM TESTING THE HMIEM

A structural model (see Figure 1) based on the HMIEM was specified and tested using SEM. Joint consideration of the sample size, the degree of deviation from multivariate normality in the data, and the complexity of the structural model derived from the HMIEM for examination resulted in a number of steps taken to improve the participant-to-estimated parameter ratio in the SEM. First, a global latent construct was created to represent coaches' interpersonal style. This latent construct was defined by the subscale scores for perceived autonomy support, structure, and involvement that served as manifest indicators (see Table 2). Second, the subscale scores for perceived competence, autonomy, and relatedness served as manifest indicators of a global perceived psychological need satisfaction in sport construct. Previous studies of interpersonal style [23] and psychological need satisfaction [43] in the domain of exercise based on the SDT-framework have also utilized a comparable approach. Third, the subscale scores for identified, integrated, and intrinsic regulations were selected to serve as manifest indicators of a latent autonomous motivation construct. This decision was driven by conceptual arguments and empirical evidence. First, Mageau and Vallerand [7] argued that more self-determined (or autonomous) motives were likely most impactful in determining the consequences of coach-athlete interactions in sport. Second, the pattern of bivariate correlations observed in this study precluded the use of latent relative autonomy construct employed in previous studies [44] given the lack of quasi-simplex associations amongst scores from the SMS-6 subscales. The magnitude and direction of the bivariate correlations (see Table 1) indicated greater shared variance in the SMS-6 subscales chosen

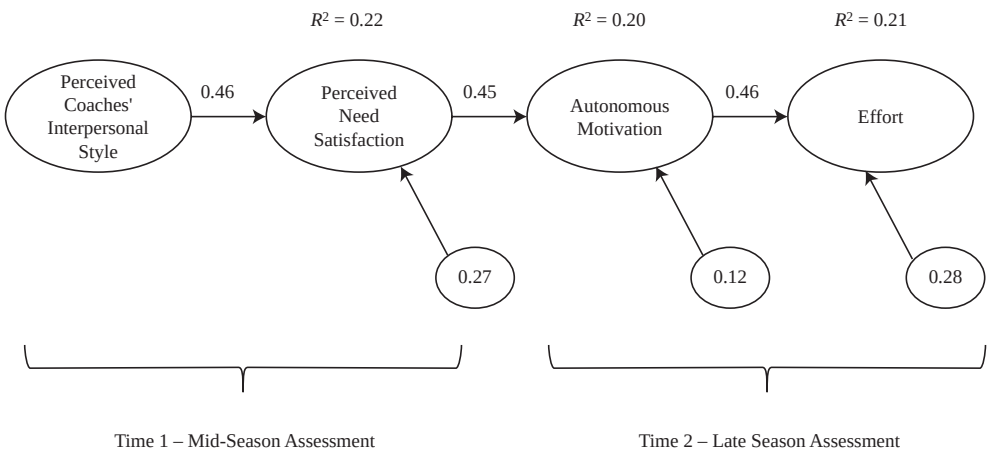

Figure 1. SEM Models Predicting 4-Stage Integrated Sequences of Motivational Processes within Vallerand's [1] HMIEM

Note: Large circles represent latent variables. Small circles represent error variance estimates from the SEM analysis. Unidirectional lines are structural pathways with standardized estimates of predictive relationships between latent exogenous and endogenous variables. Solid lines are statistically significant ($p < 0.05$). Manifest item loadings per latent factor are not shown for clarity (see Table 2 for standardized manifest item loadings per latent factor). Effect size estimates based on Cohen's [45] formula (where $f^2 = R^2/[1 - R^2]$) were as follows in this model: (a) Coaches Interpersonal Style → Psychological Need Satisfaction f^2 = 0.28; (b) Psychological Need Satisfaction → Autonomous Motivation f^2 = 0.25; (c) Autonomous Motivation _ Perceived Effort f^2 = 0.27 in this sample.

as manifest indicators (Mean r_{12} = 0.68) compared with the remaining subscales of this instrument (Mean r_{12} = 0.25)

The structural model tested in Figure 1 using SEM provided a tenable fit to the sample data based on the global indices of model fit (χ^2 = 72.94; *df* = 62; *p* = 0.16; *CFI* = 0.98; *IFI* = 0.98; *RMSEA* = 0.05 [90% CI = 0.00-0.09]; *SRMSR* = 0.10). Joint consideration of the distribution of standardized residuals (93.58% $z \leq |2.00|$, 0 % $z \geq |3.00|$) combined with the pattern of moderate-to-strong standardized factor loadings (see Table 2) provided additional support for the specified model depicted in Figure 1. As a matter of greater interest, inspection of the structural pathways presented in Figure 1 support the specified model given that the direction of the pathways aligns with Vallerand's [1] contentions outlined within the HMIEM. Consistent with Cohen's [45] guidelines, the observed variance accounted for in endogenous latent constructs depicted in Figure 1 exceeds the threshold value indicative of medium effect sizes. Significant indirect effects ($p < 0.05$) were noted for the following pathways inherent within the model tested in Figure 1: a) Perceived Coaches' Interpersonal Style → Autonomous Motivation (β = 0.21, *SE* = 0.11, $95\%_{CI}$ = 0.02 to 0.46); b) Perceived Coaches' Interpersonal Style → Perceived Effort (β = 0.10, *SE* = 0.06, $95\%_{CI}$ = 0.01 to 0.27); and c) Perceived Need Satisfaction → Perceived Effort (β = 0.22, *SE* = 0.10, $95\%_{CI}$ = 0.04 to 0.42).[2]

Table 2. Distributional Properties, Standardized Factor Loadings and Bootstrap Standard Errors of Manifest Indicators Used in the SEM Analyses

Variables	Skew.	Kurt.	FL	SE
Item abbreviations				
Perceived coaches' interpersonal style				
Autonomy Support	-0.10	-0.55	0.88	0.05
Structure	-0.75	0.56	0.67	0.09
Involvement	0.25	-0.07	0.86	0.05
Perceived psychological need satisfaction				
Autonomy	0.21	0.27	0.66	0.14
Competence	-0.16	-0.49	0.55	0.14
Relatedness to other team mates	-0.39	-0.43	0.61	0.14
Autonomous motivation				
SMS6-Identified Regulation	-0.54	0.13	0.87	0.04
SMS6-Integrated Regulation	-0.46	0.27	0.80	0.06
SMS6-Intrinsic Regulation	-0.36	-0.46	0.81	0.05
Perceived Effort				
IMI1 – Put a lot of effort into rugby	-1.35	2.05	0.86	0.07
IMI2 – Didn't try hard at rugby	-1.00	0.36	0.75	0.10
IMI3 – Didn't put much energy in rugby	-1.09	0.19	0.82	0.05
IMI4 – I tried very hard at rugby	-0.96	0.05	0.88	0.06

Note. SMS6 = Sport Motivation Scale-6 [33]. IMI = Intrinsic Motivation Inventory [26]. Skew. = Univariate Skewness Values. Kurt. = Univariate Kurtosis values. *FL* = Factor Loading; *SE* = Bootstrap-based Standard Errors. *FL* and *EV* values are from the SEM of the four-stage integrated model proposed by Vallerand [1] in the HMEIM. All *FL*'s were significant at $p < 0.01$ (two-tailed). IMI items 2 and 3 were reverse coded prior to all analyses. IMI items 1-4 are abbreviations of the item content presented to the rugby players in this study.

All indirect effects were derived from a bootstrapping procedure (k = 5000 samples with replacement) using a bias-corrected (95%) confidence interval around the standardized indirect point estimates and associated standard errors. The unstandardized coefficients are available from the second author upon request.

DISCUSSION

The purpose of this investigation was to evaluate a sequence of motivational processes proposed originally by Vallerand [1] and reinforced with respect to coaching in sport by Mageau and Vallerand's [7] conceptual model of coaching behaviors. Specifically, this investigation examined the role of perceived autonomy support, structure, and involvement provided by the head coach with reference to a four-stage integrated sequence of motivational processes set forth within the HMIEM and aligned with SDT [9]. The results of this study make it apparent that athletes who perceive their coaches to be more supportive of their decisions, provide them with clear feedback concerning goal pursuits, and engage with them in a genuine and empathic manner report greater need fulfillment, more self-determined motives for playing sport, and put forth more perceived effort in sport. Overall, it is reasonable to conclude that the addition of structure and involvement alongside perceived autonomy support represent important dimensions of interpersonal style attributable to the coaching staff worthy of further scrutiny in sport.

CONCEPTUAL IMPLICATIONS FOR THE HMIEM

Observations reported in Table 1 at the bivariate level of analyses provided support for the first hypothesis concerning the associations between dimensions of interpersonal style attributable to the head rugby coach and limited support for the second hypothesis. Deci and Ryan [9] have long extolled the value of perceived autonomy support as an important dimension of interpersonal style experienced when engaged with others that can facilitate internalization within and across contexts such as sport. Less evidence attests to the interplay between perceptions of structure and involvement in various life contexts including sport where evidence concerning the benefits stemming from perceived autonomy support has been plentiful (see [23] for a related discussion). On the basis of these initial findings, it appears that providing clear yet realistic performance targets (structure) and interacting empathically with athletes when they face challenging tasks (involvement) links with the sequence of motivational processes embedded in the HMIEM in a manner consistent with Vallerand's [1] contentions.

Contrary to our expectations and original hypotheses, a differential pattern of associations outlined in the second hypothesis between dimensions of interpersonal style emanating from the head coach and feelings of competence, autonomy, and relatedness in sport felt by athletes was not observed in this sample. A number of possible explanations could account for this finding. First, it is plausible that the measurement of both interpersonal style dimensions attributed to the head coach and satisfaction of key psychological needs in athletes is problematic and warrants more sustained research attention using a construct validation approach [46]. Measurement issues regarding key constructs central to the HMIEM [1] and SDT [9] remain a vexing problem in applied studies using both approaches in physical activity contexts including sport [47]. Markland and Tobin [23] recently created a new set of items designed to assess perceived autonomy support in exercise participants claiming that select HCCQ items tap portions of the content domain theorized to represent perceived structure and involvement. Complementing the arguments forwarded by Markland and Tobin [23], the study of psychological need satisfaction in sport has been proliferated with numerous instruments adapted from other contexts (e.g., work, education) to assess these experiential states. It seems reasonable to suggest that in order to advance research using both the HMEIM and SDT in sport that sustained focus on the development of instruments designed to assess the key constructs of interest would be a worthwhile undertaking.

An alternative explanation for the observations concerning this disconnect between our data and the second hypothesis pertains to the proposed conceptual links between different social factors and each psychological need outlined within the HMIEM [1] and SDT [9]. Mageau and Vallerand [7] noted that joint consideration of all psychological needs central to the HMIEM necessitates consideration of a broader network of interpersonal supports beyond just perceived autonomy support to aptly characterize coach-athlete interactions within sport contexts. Structure and involvement have been proposed as additional dimensions of interpersonal style that exemplify adaptive social interactions between coaches and athletes and the results of the SEM conducted in this study support this argument [7]. Closer inspection of the available literature makes it less clear 'how' and 'when' each dimension of interpersonal style used by the coach will impact the fulfillment of each psychological need central to the HMIEM. For example, Mageau and Vallerand [7] present a schematic overview whereby structure and involvement have unique associations with competence and relatedness whilst autonomy support impacts each psychological need rather than just autonomy itself. Recent studies of exercise participants assessing each dimension of interpersonal style advocated by Mageau and Vallerand [7] collapse these dimensions into a single latent variable in data analyses that prevents more invasive assessment of the inter-relationship between dimensions of interpersonal style and fulfillment of competence, autonomy, and relatedness needs [23]. Taken together with recent studies in exercise [23], it seems reasonable to suggest there is ample scope for further inquiry into the conceptual and empirical linkages between each dimension of perceived interpersonal style exhibited by the coach and the extent to which such interactions fuel psychological need fulfillment amongst athletes competing in sport.

The predictions outlined in our third hypothesis concerning the utility of the integrated sequence of motivational processes central to Vallerand's [1] HMIEM was supported based on the results of the SEM analyses reported in this study. Combined with research in other domains that has tested a comparable four-stage sequence (see [1] and [48] for reviews), it seems that growing support exists for the conceptual links outlined by Vallerand [1] between Social Factors → Psychological Need Fulfillment → Motives → Consequences [11]. While the causal implications embedded within the HMIEM were not tested directly herein, it seems reasonable to imply that consequences of importance to coaches (such as perceived effort put forth by competitive athletes) stem at least in part from more self-determined motives that are underpinned by greater psychological need fulfillment which develops via supportive interpersonal dynamics between athletes and coaches in sport contexts. Such observations do nothing to undermine Deci and Ryan's [9] contention that the quality of motivation is an important consideration in applied domains given that more self-determined motives for sport were positively linked with the amount of perceived effort put forth by athletes at both the bivariate and multivariate levels of analyses in this study.

PRACTICAL IMPLICATIONS FOR COACHES

The present findings, albeit preliminary in nature, with reference to the roles of perceived structure and involvement in competitive sports such as rugby, give rise to a number of practical recommendations for coaches interested in developing a supportive interpersonal style with their athletes. First, it seems reasonable to suggest that coaches consider interacting with each athlete under their tutelage in a manner that supports their sense of personal autonomy rather than trying to coerce their behavior. Standage et al. [48] along with Mageau and Vallerand [7] have outlined a number of strategies that can be utilized by coaches in sport to engage with their athletes using an autonomy-supportive style. Examples

characterizing such an interpersonal style might include: a) providing athletes with opportunities to exercise their own decision-making capabilities, b) avoiding the use of controlling or pressurizing language, c) offering a meaningful rationale for changing a behavior, and d) providing opportunities for athlete-centered input and initiative taken within the confines of sport [7].

A second set of recommendations emanating from this study concerns the degree to which providing structure and acting with a sense of genuine involvement when engaging with athletes may prompt adaptive motivational tendencies and positive consequences such as expending greater perceived effort towards sport-related activities. Providing structure for competitive athletes engaged in sport could be implemented using a number of strategies including: a) offering constructive yet informative feedback, b) clarifying what can realistically be expected from engaging in target behaviors especially if they require personal change, and c) encouraging athletes to focus on self-referenced rather than socially-endorsed standards for performance evaluation (see [48] for a review). Alternatively, facilitating a sense of involvement based on the coaches' interpersonal style could adopt the following techniques: a) acknowledge that each athlete has their own point of view that is worthy of consideration, b) empathize with the challenges each athlete faces when trying to surmount novel or persistent tasks, and c) show genuine interest in each athlete beyond the confines dictated by the domain of sport.

The recommendations concerning engaging with athletes using an autonomy-supportive interpersonal style appear justified on the basis of this study and previous literature (see [7] for a review). Nevertheless, the recommendations set forth concerning both perceived structure and involvement warrant a certain degree of circumspection at this juncture given: a) the limited amount of data attesting to their utility in sport contexts, and b) the lack of clear support for the second hypothesis concerning the anticipated links between these dimensions of interpersonal support with the fulfillment of competence and relatedness needs as suggested by Mageau and Vallerand [7]. Future studies would do well to investigate this issue further to determine the unique role afforded to perceived structure and involvement in sport contexts with reference to dimensions of interpersonal style exhibited by the coaching staff.

STUDY LIMITATIONS

Several limitations should be recognized and future research directions offered to advance our understanding the study of the HMIEM in the domain of sport. First, this investigation relied on self-report data that was collected over a restricted time period that provides little evidence for causal relations. Future studies would do well to embrace more sophisticated experimental designs including measurement of relevant variables (e.g., perceived effort) to provide a greater understanding of the direction of causal flow between coaches' interactional styles and motivational process in sport. Second, this study used purposive sampling techniques that drew athletes from a single university-based athletics program. The extent to which these findings generalize to other sports (e.g., football, soccer, golf) or levels of sport competition (e.g., recreational, professional) where coaching varies considerably from the present sample warrants investigation. Such investigations would do well to consider more sophisticated sampling techniques that confer greater confidence in the external validity of the data. Third, the array of motivational consequences examined in the present investigation was restricted to a single cognitive variable, namely effort. Few studies in the sport domain have linked SDT-based motivational variables with actual performance indicators and this seems like the logical next step to advance research in this area.

CONCLUSION

The purpose of this study was to examine the relationship between specific facets of interpersonal style exhibited from the head coach with motivational processes considered integral to continued involvement in sport. Overall, the results of this study suggest the measurement of perceived coaching style variables may be problematic and worthy of additional empirical scrutiny. Perhaps of greater theoretical interest in the present study is the results observed in the SEM analysis that yielded support for a conceptual model whereby perceptions of coaching style predicted fulfillment of psychological needs which, in turn, was associated with sport motivation and perceived effort in a manner consistent with theory [9] and conceptual arguments [1, 7]. Given the central role afforded coaching in competitive sport programs, the results of this investigation suggest that coaches who provide clear and unambiguous feedback to their athletes in a manner that is perceived as empathic and caring while supporting the athlete's sense of autonomy are likely to yield motivational benefits. The results of this study also do nothing to undermine Deci and Ryan's [9] assertions concerning the mechanisms integral to understand motivational processes and future research using SDT to unravel to complexities of sport motivation appears justified.

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