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7 **A multi-study examination of the complementarity dimension of the coach-athlete**
8 **relationship**

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10 Luke Felton^a, Sophia Jowett^b, Chris Begg^b, and Xinmiao Zhong^b

11 ^aDepartment of Life Sciences, University of Roehampton, London, SW15 4JD, United
12 Kingdom. Luke.Felton@roehampton.ac.uk

13 ^bSchool of Sport, Exercise and Health Sciences, Loughborough University, Loughborough,
14 LE11 3TU, United Kingdom.

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17 Corresponding author: Luke Felton

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Abstract

This multi-study aimed to examine the complementarity dimension of the coach-athlete relationship in relation to individual and group outcomes, specifically well-being and cohesion. Self-report data was collected from athletes in the UK ($n = 304$). In Study 1 ($n = 106$), mediation analysis demonstrated significant indirect effects between direct and meta complementarity and vitality via basic psychological needs satisfaction. In addition, a significant direct effect between direct complementarity and vitality was also seen, independent of the indirect effect. In Study 2 ($n = 198$), mediation analysis demonstrated significant indirect effects between direct and meta complementarity and task and social cohesion via the basic psychological needs. A significant direct effect between meta complementarity and task cohesion was also identified, independent of the indirect effects. No direct or indirect effects were observed for reciprocal complementarity. Findings highlight the importance of complementarity, and satisfaction of the basic psychological needs, within the coach-athlete relationship for enhancing athletes' feelings of well-being and cohesion.

Keywords: well-being, cohesion, coaches, athletes, relationships

1 behaviours, feelings and thoughts respectively. While *closeness* refers to the affective bond
 2 that is formed between the coach and athlete and is reflected in feelings of trust, respect, and
 3 appreciation, *commitment* refers to their thoughts and intentions to maintain a close
 4 relationship over time, *complementarity* reflects athletes' and coaches' interpersonal
 5 behaviours that are either *corresponding* or *reciprocal* in nature. Corresponding behaviours
 6 encompass *friendliness, responsiveness, readiness and easiness* and are manifested by both a
 7 coach and an athlete in an interaction. Reciprocal behaviours capture the behaviours that a
 8 coach and an athlete are expected to manifest in their respective roles. Subsequently, a
 9 coach's role is to *lead*, instruct and orchestrate (Lyle, 2002) whereas an athlete's role is to
 10 *follow*, listen and learn, take initiative (Driska, Kamphoff, & Armentrout, 2012; Giacobbi,
 11 Roper, Whitney, & Butryn, 2002). According to Kiesler's (1996) work, corresponding
 12 complementarity reflects *affiliation* (friendliness versus hostility and warm versus cold
 13 interactions) and reciprocal complementarity reflects *control* (dominance versus submission
 14 and directive versus deference-type interactions). Reciprocal behaviours are complementary
 15 if they are opposite; for example, coach leads and athlete follows ("mismatch"). While
 16 corresponding behaviours are complementary if they are similar and so both the coach and
 17 the athlete are friendly to one another ("match"). Complementarity, in traditional
 18 interpersonal theory (see e.g., Kiesler, 1996), predicts the likely outcomes of these
 19 interactions and relationships. For example, greater complementarity has been found to
 20 reduce negative affect (e.g., anger, anxiety) and increase relationship satisfaction and
 21 commitment (Sadler, Ethier, & Woody, 2011; Cundiff et al., 2015).

22 The quality of the coach-athlete relationship as defined by complementarity,
 23 commitment and closeness (3Cs) has been highlighted as an important factor for athletes'
 24 experiences including but not limited to their perceptions of satisfaction (Jowett & Nezlek,
 25 2011), physical self-concept (Jowett, 2008), collective efficacy (e.g., Hampson & Jowett,

1 2014; Jowett, Shanmugam, & Caccoulis, 2012), team cohesion (Jowett & Chaundy, 2004),
2 burnout (Isoard-Gauthier, Trouilloud, Gustafsson, & Guillet-Descas, 2016) and well-being
3 (e.g., Davis & Jowett, 2014; Felton & Jowett, 2013). Overall, findings have demonstrated a
4 positive association between high quality coach-athlete relationships and important outcomes.
5 These findings therefore highlight the importance of developing quality coach-athlete
6 relationships that has the 3Cs as its foundation.

7 In the present study, the focus is on the complementarity dimension of the 3Cs model.
8 While the 3 Cs are thought to be separate yet related dimensions of a model that aims to
9 capture the quality of the coach-athlete relationship (Jowett, 2009; Jowett & Ntoumanis,
10 2004), rarely are these dimensions examined separately especially in quantitative research
11 (e.g., Jowett, 2008; Rhind & Jowett, 2011). A more in-depth examination of each of the 3Cs
12 may supply additional knowledge as this pertains to their unique functions. Subsequently,
13 based on the assertion that complementarity provides “an indicator of the general
14 interactional harmony in any relationship” (Tracey, 2002, p. 267) and in turn a key factor for
15 satisfying and lasting relationships (e.g., Philippe & Seiler, 2006; Jowett & Cockerill, 2003;
16 Markey & Markey 2007), we hypothesised that perceptions of athletes’ complementarity with
17 the coach associate with higher levels of feeling energetic and spirited as well as more
18 cohesive and united within the team and with team-mates. Moreover, we sought to explore
19 whether these associations can be explained through the satisfaction of athletes’ basic needs.
20 Complementarity as a relationship quality dimension creates a social situation within which
21 athletes and coaches interact (Jowett, 2007) and so we hypothesised that when there is great
22 complementarity, athletes are more likely to feel more fulfilled in terms of their competence
23 in their sport performance as well as autonomy and connectedness relative to their coaches,
24 leading in turn to higher levels of vitality and team cohesion.

1 Basic psychological needs theory (BPNT; Deci & Ryan, 2000), proposes that humans
2 have three innate psychological needs that are essential for continued motivation and well-
3 being (Ryan & Deci, 2002). These needs include; *autonomy*, the need to feel in control of
4 one's actions (deCharms, 1968), *competence*, the need for effective interaction within a
5 particular context to produce desired outcomes (White, 1959), and *relatedness*, the need feel
6 connected to and understood by others (Baumeister & Leary, 1995). Whilst not being
7 researched extensively, previous research has demonstrated the positive associations that
8 exist between coach-athlete relationship quality and the psychological needs (Choi, Cho, &
9 Huh, 2013; Felton & Jowett, 2013, Jowett et al., 2017; Riley & Smith, 2011). Within this
10 research different approaches to examining the coach-athlete relationship and basic
11 psychological needs were taken, with some employing composite variables and others
12 examining the individual dimensions. In their study of Korean collegiate athletes, Choi et al.,
13 examined the associations between each of the 3Cs and each basic need, demonstrating
14 positive associations for commitment and closeness with autonomy and competence, and
15 complementarity with competence and relatedness. In contrast, Felton and Jowett used a
16 composite variable for coach-athlete relationship quality and demonstrated a positive
17 association with competence and relatedness. Finally, Jowett et al., in their multi-cultural
18 study demonstrated positive associations between composite variables of both coach-athlete
19 relationship quality and basic needs.

20 In addition to the associations that exist between coach-athlete relationship quality
21 and basic needs, the association between the basic needs and individual and group outcomes
22 is of relevance to the current study. While previous research has consistently shown that
23 athletes experience greater well-being when they perceive their psychological needs are
24 satisfied (e.g., Adie, Duda, & Ntoumanis, 2008; Balaguer et al., 2012; Felton & Jowett,
25 2013), satisfaction of the basic needs has also been shown to be a potential mediating

1 mechanism in the association between coaching variables (e.g., coaches interpersonal style,
2 coach-athlete relationship quality) and well-being outcomes (see Balaguer et al., 2012; Felton
3 & Jowett; Jowett et al., 2017). Consequently, satisfaction of the basic needs may act as a
4 mechanism through which the coach, through their behaviour towards the athlete, can
5 influence the athletes psychological functioning. Whilst the basic needs have been
6 continually linked with individual factors such as well-being, the association with group level
7 processes is less understood. In one of the only studies to investigate the associations between
8 cohesion and the basic needs, Blanchard, Amiot, Perreault, Vallerand, and Provencher (2009)
9 reported positive associations between team cohesion and each of the basic psychological
10 needs, with the strongest association being to relatedness. These findings warrant further
11 investigation in order to generate better understanding of how group outcomes can be
12 influenced by the basic needs. From a practical point of view, such information could
13 potentially help athletes and coaches appreciate the role of their interpersonal behaviours
14 (complementarity) in fostering a sense of togetherness within their teams.

15 The present study aimed to examine the specific associations between the
16 complementarity dimension of the 3Cs model and two important outcomes related to
17 performance, namely team cohesion, and well-being, namely vitality. To date, there is only
18 one study that has examined separately the dimension of complementarity (corresponding
19 and reciprocal subdimensions) in an attempt to expand this notion and assess its invariance
20 within the context of the coach-athlete relationship (Yang & Jowett, 2013). As mentioned
21 earlier, corresponding complementarity is displayed when the coach and athlete interact in
22 “matching” ways demonstrating responsiveness and friendliness for example. Reciprocal
23 complementarity is evident when the coach and athlete interact in “mismatching” ways
24 demonstrating dominance (e.g., lead, direct) on the part of the coach and submissiveness
25 (e.g., listen, execute) on the part the athlete. Consistent with previous research in domains

1 other than sport coaching (Sadler, Ethier, & Woody, 2011; Cundiff et al., 2015), Yang and
2 Jowett found a positive association between athletes' submissive interpersonal behaviours
3 and their satisfaction with the coach-athlete relationship, as well as a positive association
4 between coaches' dominant interpersonal behaviours and their satisfaction with the
5 relationship. This two-study paper extended Yang and Jowett's research in two ways. First, it
6 aimed to further understand the functions of corresponding and reciprocal complementarity
7 relative to athletes' vitality and team unity. Second, it aimed to explore the mechanisms by
8 which corresponding and reciprocal complementarity associates with such important
9 outcomes as personal vitality and team unity guided by basic psychological needs theory.

10 **Study 1**

11 Guided by theory and research, the aim of Study 1 was to examine the association
12 between athletes' perspectives of corresponding complementarity and their experience of
13 well-being, measured through subjective vitality. In addition, the indirect role of basic
14 psychological needs satisfaction was investigated. It was predicted that corresponding
15 complementarity would be positively associated with vitality (Hypothesis 1), corresponding
16 complementarity would be positively associated with basic need satisfaction (Hypothesis 2),
17 basic need satisfaction would be positively associated with vitality (Hypothesis 3), and finally
18 that basic need satisfaction would mediate the association between corresponding
19 complementarity and vitality (Hypothesis 4). The study hypotheses are illustrated in Figure 1.

20 **Method**

21 *Participants*

22 One hundred and six athletes, including 39 males and 67 females, participated in the
23 study. The mean age of the participants was 19.91 (SD=1.54). Seventy-one participants

1 participated in team sports, and 35 participated in individual sports. The participants
2 participated in more than 20 types of sports, with the majority performed in hockey (n=18),
3 football (n=14), rugby (n=12), and water polo (n=12). Thirty-one percent of the participants
4 participated/competed at university level and the rest at club (26%), regional (23%), national
5 (9%), international (10%) and other levels of performance (1%). Twenty-eight participants
6 (26%) had been training with their present coach for two years or more, and the rest 78
7 participants (74%) had less than two years' training with their present coach. Forty-four
8 participants (42%) had been involved in the sport for 10 years or more, and 62 participants
9 (58%) had less than 10 years' involvement. The participants' coaches consisted of 73 males
10 and 32 females.

11 *Measures*

12 The *Complementarity* dimension of the *Coach-Athlete Relationship Questionnaire*
13 (CART-Q; Jowett, 2009; Jowett & Ntoumanis, 2004) was used to measure athletes'
14 interpersonal behaviours. Both athletes' direct perspective of corresponding complementarity
15 (i.e., When I am coached by my coach, I am at ease; When I am coached by my coach, I am
16 ready to do my best; When I am coached by my coach, I adopt a friendly stance; When I am
17 coached by my coach, I am responsive to his/her efforts) and athletes' meta-perspective of
18 corresponding complementarity (i.e., My coach is at ease when he/she coaches me; My coach
19 is ready to do his/her best when he/she coaches me; My coach adopts a friendly stance when
20 he/she coaches me; My coach is responsive to my efforts when he/she coaches me) were
21 assessed; a total of 8 items. All items were rated on a 7-point scale from "strongly disagree"
22 (1) to "strongly agree" (7).

23 The *Basic Need Satisfaction in Relationships Questionnaire* (BNSRQ; La Guardia,
24 Ryan, Couchman, & Deci, 2000) was used to measure the extent athletes' basic psychological

1 needs were satisfied within the context of the coach-athlete relationship. The nine items in the
2 BNSRQ consisted of three items for autonomy (e.g., When I am with my coach, I feel to be
3 who I am), three items for competence (e.g., When I am with my coach, I feel like a
4 competent person), and three items for relatedness (e.g., When I am with my coach, I feel
5 cared about). All items were rated on a 7-point scale from “not at all true” (1) to “very true”
6 (7).

7 Finally, the *Subjective Vitality Scale* (SVS; Ryan and Frederick, 1997) was used to
8 measure athletes’ mental and physical vitality (e.g., I feel alive and vital; I feel energised).
9 All six items were rated on a 7-point scale from “not at all true” (1) to “very true” (7).

10 *Procedure*

11 The University Ethical Advisory Committee granted ethical approval before data
12 collection was undertaken. Prospective participants were contacted either directly or
13 indirectly via their coaches or club organisers and invited to participate in the study. Athletes
14 were informed of the overall aims of the study and the requirements as well as criteria for
15 participation. Participants who were subsequently agreed to participate, were supplied a
16 questionnaire pack. Each pack contained an invitation participation letter, consent form and
17 the questionnaire; they were either completed in the presence of the test administrator or in
18 the athletes’ own time before being returned to the test administrator in the next training
19 session. The athletes returned the completed questionnaire in an envelope supplied.

20 *Data analysis*

21 The data was screened for normality using SPSS 24 prior to further analysis being
22 performed, with skewness and kurtosis values for all variables falling within the accepted
23 range. Descriptive statistics and bivariate correlations were then performed. Mediation

1 analysis was conducted using the PROCESS command in SPSS in accordance with the
2 procedures outlined by Hayes (2018) in order to examine the direct and indirect effects. Two
3 mediation analyses were conducted in which the models varied in terms of the independent
4 variable (i.e., direct or meta complementarity) and the covariate (i.e., direct or meta
5 complementarity). The relevant covariate (e.g., direct or meta complementarity), was
6 included in the models due to the significant association that exists between the two
7 independent variables. Within each model the mediating variable (i.e., basic need
8 satisfaction) and dependent variable (i.e., vitality) remained the same. Analysis was
9 conducted using PROCESS Model 4 with the bootstrap resampling set to 5000 and the
10 percentile confidence intervals set to 95%. A significant indirect effect is indicated if the 95%
11 confidence interval (95% CI) does not contain zero (Preacher & Hayes, 2004; 2008).

12 **Results**

13 *Descriptive Statistics*

14 Means, standard deviations, Cronbach's alpha coefficients, and correlations for all the
15 variables are presented in Table 1. Athletes in the current study reported moderate to high
16 levels of complementarity, basic psychological need satisfaction, and vitality. Correlations
17 between all study variables were significant, therefore all variables were included within the
18 mediation analysis.

19 *Mediation analysis – Direct effects*

20 Mediation analysis was conducted using Model 4 of the PROCESS macros in SPSS to
21 test the study hypotheses. The direct and indirect effects can be seen in Figure 2. In terms of
22 the direct effects, direct complementarity was significantly positively associated with vitality

1 and basic need satisfaction, and need satisfaction was positively associated with vitality. Meta
 2 complementarity was not significantly associated with vitality.

3 *Mediation analysis – Indirect effects*

4 The results indicated two indirect effects, as shown in Figure 2. In relation to direct
 5 complementarity, athletes experiencing higher levels of direct complementarity in their
 6 coach-athlete relationship would be likely to perceive greater satisfaction of the basic needs
 7 ($a = .36$), and greater satisfaction of the basic needs would increase experiences of vitality (b
 8 $= .35$). A bootstrap confidence interval of the indirect effect through basic need satisfaction
 9 ($ab = .12$), based on 5000 bootstrap samples, was entirely above zero (.020 to .262). There
 10 was also evidence that direct complementarity was associated with vitality independent of its
 11 effect on the basic psychological needs ($c' = .29$).

12 Similar results were evident for meta complementarity. Athletes experiencing higher
 13 levels of meta complementarity in their relationship with the coach would likely perceive
 14 greater need satisfaction ($a = .52$), and greater need satisfaction would increase vitality (b
 15 $= .35$). A bootstrap confidence interval of the indirect effect through competence satisfaction
 16 ($ab = .18$), based on 5000 bootstrap samples, was entirely above zero (.056 to .342). In this
 17 model there was no evidence that meta complementarity was associated with vitality
 18 independent of its effect on the psychological needs ($c' = -.06, p = .91$).

19 *Discussion*

20 The aim of Study 1 was two-fold: (a) to examine the associations between athletes'
 21 perceptions of corresponding complementarity (direct and meta) and vitality and (b) to
 22 explore whether the satisfaction of basic psychological needs explain the above-mentioned
 23 associations. The results demonstrated that while direct corresponding complementarity (e.g.,

1 When I am coached by my coach, I am responsive to his/her efforts) associated with athletes'
2 perceptions of vitality, meta corresponding complementarity (e.g., My coach is responsive to
3 my efforts when he/she coaches me) did not associate with athletes' vitality, partially
4 supporting hypothesis 1. Nonetheless, both direct and meta-perspective of corresponding
5 behaviours associated with athletes' perceptions of vitality through the satisfaction of basic
6 psychological needs supporting hypotheses 2, 3 and 4. Overall the findings suggest that if an
7 athlete perceives the coach to allow him/her to be responsive, at ease, ready and friendly
8 (direct corresponding complementarity) in their coach-athlete interactions, then this athlete is
9 more likely to experience greater personal vitality, energy and drive. In contrast, a coach's
10 responsiveness, readiness, easiness and friendliness as perceived by the athlete (meta
11 corresponding complementarity) did not seem to directly link with the athlete's experience of
12 vitality. On one hand, it would appear that when athletes perceive the interactions with their
13 coach as friendly, relaxed and responsive for example, are more likely to feel uplifted and
14 strengthened. On the other hand, athletes' vitality won't seem to be affected by how they
15 think their coaches may be rating these interaction (meta corresponding complementarity).
16 So, coaches as far as the athletes are concern may rate positively or negatively these
17 interactions, either way their vitality would not be affected. Subsequently, it is plausible to
18 suggest that direct corresponding complementarity is more important to athletes' vitality
19 (how one thinks directly affects their own feelings) than meta corresponding
20 complementarity (how one believes another person thinks indirectly affects their feelings).
21 This conjecture seemed to be supported by the mediational results where it was found that
22 both direct and meta corresponding complementarity affected athletes' vitality through the
23 satisfaction of their basic needs. The findings are consistent with previous research in the
24 coach-athlete relationship (Choi et al., 2013; Yang & Jowett, 2013) and other types of

1 relationship including romantic and therapeutic relationships (Sadler et al., 2011; Cundiff et
2 al., 2015).

3 **Study 2**

4 Guided by previous theory and research outlined earlier, the aim of study 2 was to
5 examine not only the direct and meta-perspective of corresponding complementarity but also
6 reciprocal complementarity and their associations with task cohesion and social cohesion.
7 There is a dearth of research that examines the links between the coach-athlete relationship
8 and team cohesion. Previous research (e.g., Jowett & Chaundy, 2004) has shown that
9 closeness, commitment and corresponding complementarity are associated with both social
10 and task cohesion. Based on previous findings, this study aimed to extend them by exploring
11 the mechanisms by which coach-athlete relationship quality (via both reciprocal and
12 corresponding complementarity) associates with team cohesion. The indirect or mediating
13 effects of basic psychological need satisfaction were therefore investigated. It was
14 hypothesised that all forms of complementarity would be positively associated with task and
15 social cohesion (Hypothesis 5), all forms of complementarity would be positively associated
16 with basic needs (Hypothesis 6), basic needs would be positively associated with task and
17 social cohesion (Hypothesis 7), and that basic needs would mediate the association between
18 complementarity and cohesion (Hypothesis 8). The study hypotheses are illustrated in Figure
19 3a and 3b.

20 **Method**

21 *Participants*

22 One hundred and ninety-eight athletes, including 105 males (53%) and 93 females,
23 participated in the study. The mean age of the participants was 20.84 (SD=2.96). The

1 participants participated in a range of sports, with the majority participating in football
2 (28%), rugby (20%), and netball (19%). Sixty-two percent (n=124) of the participants
3 generally competed at university level, and the rest at club (13%), regional (19%), national
4 (2%), and international level (4%). One hundred and twenty-five participants (63%) had been
5 training with their present coach for two years or more, and the remaining 73 (37%)
6 participants had less than two years' training with their present coach. One hundred and
7 forty-four participants (73%) had been training with their present team for two years or more,
8 and 54 participants (27%) had less than two years' training with their present team. Finally,
9 the participants' coaches in the current sample were mostly male (70%).

10 *Measures*

11 As in study 1, Jowett and Ntoumanis' (2004) and Jowett's (2009) direct and meta-
12 perspective of the corresponding complementarity dimension of the *Coach-Athlete*
13 *Relationship Questionnaire* (CART-Q), as well as La Guardia et al's., (2000) *Basic Need*
14 *Satisfaction in Relationships Questionnaire* (BNSRQ) were employed.

15 In addition, from the *Athlete Submissive and Coach Controlling Behavior Scale*, only
16 the Athlete Submissive Behaviour Scale (ASB-S; Yang and Jowett, 2013) consisting of 4
17 items, was used to measure athletes' reciprocal complementarity relative to their coach. The 4
18 items were as follows: I enjoy following my coach's instructions and lead; I am willing to
19 accept my coach's advice and opinion; I am happy to let my coach make the final decisions
20 concerning my training and competitions; I tend to agree with the opinions and suggestions
21 offered by my coach. All items were rated on a 7-point scale from "never" (1) to "always"
22 (7).

23 Finally, *Group Environment Questionnaire* (GEQ; Carron, Widmeyer, & Brawley,
24 1985) was used to measure athletes' perceptions of team cohesion, which consists of nine

1 items of *social cohesion* (e.g., Some of my friends are on this team; I do not enjoy being a
2 part of the social activities of this team; Our team members rarely party together; For me this
3 team is one of the most important social groups to which I belong) and nine items of *task*
4 *cohesion* (e.g., I do not like the style of play on this team; Our team is united in trying to
5 reach its goal for performance; I'm not happy with the amount of playing time I get; This
6 team does not give me enough opportunities to improve my personal performance; Our team
7 members have conflicting aspirations for the team's performance). All items were rated on a
8 9-point scale from "strongly disagree" (1) to "strongly agree" (9). Composite variables for
9 task and social cohesion were used in this study in line with previous research examining
10 coaching behaviour and cohesion (e.g., Callow, Smith, Hardy, Arthur, & Hardy, 2009; Jowett
11 & Chaundy, 2004); Smith, Arthur, Hardy, Callow, & Williams, 2013).

12 *Procedure*

13 The University Ethical Advisory Committee granted ethical approval before data
14 collection was undertaken. Prospective participants were contacted either directly or
15 indirectly via their coaches or club organisers and invited to participate in the study. Athletes
16 were informed about the overall aims of the study and the requirements as well as criteria for
17 participation. Participants who were subsequently supplied with a questionnaire pack. Each
18 pack contained an invitation participation letter, consent form and the questionnaire. The
19 packs were either completed in the presence of the test administrator or completed in the
20 athletes' own time before being returned in the next training session. The athletes returned
21 the completed questionnaire in an envelope supplied.

22 *Data analysis*

23 The data was screened for normality using SPSS 24 prior to further analysis being
24 performed, with skewness and kurtosis values for all variables falling within the accepted

1 range. Descriptive statistics and bivariate correlations were then performed. Mediation
2 analysis was conducted using the PROCESS command in SPSS in accordance with the
3 procedures outlined by Hayes (2018) in order to examine the direct and indirect effects. A
4 series of mediation analyses were conducted in which the models varied in terms of the
5 independent variable (i.e., direct, meta, or reciprocal complementarity), the covariates (i.e.,
6 direct, meta, or reciprocal complementarity depending on the independent variable), and the
7 dependent variable (i.e., task or social cohesion). Within each model the mediating variable
8 (i.e., basic need satisfaction) remained the same. Analysis was conducted using PROCESS
9 Model 4 with the bootstrap resampling set to 5000 and the percentile confidence intervals set
10 to 95%.

11 **Results**

12 *Descriptive Statistics*

13 Means, standard deviations, Cronbach's alpha coefficients, and correlations for all the
14 variables are presented in Table 2. Athletes in the current study reported moderate to high
15 levels of all three forms of complementarity, basic psychological need satisfaction, task
16 cohesion and social cohesion. Correlations between all study variables were significant,
17 therefore all variables were included within the mediation analysis.

18 *Mediation analyses – Direct effects*

19 Mediation analysis was conducted using Model 4 of the PROCESS macros in SPSS to
20 test the study hypotheses. The direct and indirect effects can be seen in Figures 4a and 4b. In
21 terms of the direct effects, only corresponding meta-complementarity was significantly
22 positively associated with task cohesion with no significant direct effects being found
23 between the various forms of complementarity and social cohesion. Both direct and meta

1 (corresponding) complementarity were significantly positively associated with basic need
 2 satisfaction, and need satisfaction was positively associated with both task and social
 3 cohesion. Reciprocal complementarity was not significantly associated with basic need
 4 satisfaction.

5 *Mediation analysis – Indirect effects*

6 The results indicated two indirect effects in relation to both task and social cohesion,
 7 as shown in Figures 4a and b. For the task cohesion model (Figure 4a), in relation to direct
 8 complementarity athletes experiencing higher levels of direct complementarity in their coach-
 9 athlete relationship would be likely to perceive greater satisfaction of the basic needs (a
 10 = .51), and greater satisfaction of the basic needs would increase perceptions of task cohesion
 11 ($b = .46$). A bootstrap confidence interval of the indirect effect through basic need satisfaction
 12 ($ab = .23$), based on 5000 bootstrap samples, was entirely above zero (.109 to .361). There
 13 was no evidence that direct complementarity was associated with task cohesion independent
 14 of its effect on basic psychological needs ($c' = -.06$, $p = .71$).

15 Similarly, athletes experiencing higher levels of meta complementarity in their coach-
 16 athlete relationship would be likely to perceive greater basic need satisfaction ($a = .47$), with
 17 greater need satisfaction indicating greater perceptions of task cohesion ($b = .46$). A bootstrap
 18 confidence interval of the indirect effect through basic need satisfaction ($ab = .22$), based on
 19 5000 bootstrap samples, was entirely above zero (.113 to .345). There was also evidence that
 20 meta complementarity was associated with task cohesion independent of its effect on basic
 21 needs ($c' = .32$). There were no significant results in relation to reciprocal complementarity.

22 For the social cohesion model (Figure 4b), associations between direct and meta
 23 complementarity and basic needs satisfaction were the same as in the task cohesion model
 24 (e.g., $a = .51$ for direct and .47 for meta). Similarly, greater basic need satisfaction would

1 likely increase perceptions of social cohesion ($b = .46$). Bootstrap confidence intervals of the
 2 indirect effect through basic need satisfaction ($ab = .23$ for direct and $ab = .22$ for meta
 3 complementarity), based on 5000 bootstrap samples, were entirely above zero (direct
 4 complementarity = .114 to .365 and meta complementarity = .112 to .346). There was no
 5 evidence that direct complementarity ($c' = .01, p = .93$) or meta complementarity ($c' = .17, p$
 6 $= .20$) were associated with social cohesion independent of their effect on basic needs. As
 7 with task cohesion, there were no significant results in relation to reciprocal complementarity.

8 *Discussion*

9 The aim of study 2 was to examine the associations between three forms of
 10 complementarity, basic psychological needs satisfaction within the context of the coach-
 11 athlete relationship, and perceptions of task and social cohesion. The results highlighted a
 12 range of direct and indirect effects between the study variables. There was partial support for
 13 hypothesis 5 as there was only one observed significant association between corresponding
 14 meta complementarity and task cohesion. Moreover, while corresponding direct and meta
 15 complementarity were positively associated with basic need satisfaction, reciprocal
 16 complementarity was not. These findings provide partial support for hypothesis 6 and suggest
 17 that if an athlete views that their own behaviour and that of the coach is affiliative (their
 18 interpersonal behaviours are marked by responsiveness, easiness, friendliness and readiness),
 19 then they are more likely to satisfy basic psychological needs (competence, relatedness and
 20 autonomy) within their coach-athlete relationship. These findings are in line with previous
 21 research (e.g., Hampson & Jowett, 2014; Jowett & Chaundy, 2004). Athletes' perceptions of
 22 reciprocal complementarity or interpersonal behaviours that are reflective of their role (listen,
 23 execute, filter information etc) was neither associated with perceptions of unity within the
 24 team nor with perception of basic needs satisfaction. The lack of association between these
 25 two variables may suggest that the role that the athlete plays in relation to the coach doesn't

1 affect one's perceptions of cohesion or belongingness to the larger team. The reasons for that
2 may be that the athlete may assume a different role within the larger team and hold a different
3 status and position (Beauchamp, Bray, Eys, & Carron, 2005). Further research is warranted in
4 order to identify the correlates of reciprocal complementarity and its role within the context
5 of the coach-athlete relationship. Nonetheless, psychological needs satisfaction was
6 positively associated with both task and social cohesion thus supporting hypothesis 7.
7 Therefore, if the athlete perceives that their coach is satisfying their needs for autonomy,
8 competence, and relatedness they are also likely to perceive a greater degree of task and
9 social cohesion with fellow mates and within the team.

10 Finally, results in relation to the indirect effect of basic needs provided partial support
11 for hypothesis 8. Basic needs were found to mediate the association between direct and meta
12 complementarity and both task and social cohesion, however no significant findings were
13 found in relation to reciprocal complementarity. These findings suggest that direct and meta
14 complementarity have a positive indirect impact on perceptions of task and social cohesion
15 due to the association that exists with basic need satisfaction. If an athlete's interpersonal
16 behaviour is affiliative relative to his/her coach and if an athlete's perceives that his/her
17 coach's interpersonal behaviour is affiliative relative to them, then they are likely to satisfy
18 psychological needs within the coach-athlete relationship and in turn experience higher levels
19 of unity and belongingness with others in their teams or squads. It should also be noted that
20 meta complementarity maintained a direct association with task cohesion within the
21 mediation models, suggesting that perceiving the coach as behaving in an affiliative manner
22 (responsive, easy, ready and friendly) has a positive influence on perceptions of task cohesion
23 irrespective of the effect of basic psychological needs satisfaction. The findings of this study
24 are consistent with Study 1 and previous research (Choi et al., 2013; Felton & Jowett, 2013;
25 Yang & Jowett, 2013).

1 *General Discussion*

2 This two-study paper added to the limited evidence around the functions of
3 complementarity of the 3Cs model of the coach-athlete relationship quality; it specifically,
4 focused on both corresponding and reciprocal forms of the complementarity dimension
5 relative to their associations with athletes' vitality and team unity. Results from the two
6 studies demonstrated a range of direct effects. In study 1, it was revealed that athletes' own
7 perceptions of affiliation with the coach (i.e., direct corresponding complementarity: athlete
8 perceiving themselves to be responsive, at ease, ready and friendly when coached by their
9 coach) are associated with athletes' feelings of energy, dynamism, determination and passion.
10 Athletes' own perceptions of affiliation seem to enhance their own well-being supporting
11 research in sport (Choi et al., 2013; Felton & Jowett, 2013; Jowett et al., 2017) and elsewhere
12 (Ryff, 1989; Diener & Seligman, 2002). Indeed, meta-analyses show that the link between
13 happy people and high-quality relationships is extremely robust (Lyubomirsky, King, &
14 Diener, 2005).

15 For example, an athlete's perception of their behaviour (direct complementarity) may
16 be more important for their well-being than their perceptions in relation to how they think
17 their coach behaves towards them (meta complementarity). While direct complementarity is
18 athletes' own perceptions of their responsiveness, readiness, friendliness and easiness – these
19 perceptions are the result of interactions they have had with their coaches. Hence coaches'
20 behaviours are significant in shaping athletes' perceptions of direct corresponding
21 complementarity leading to their well-being. Subsequently, coaches need to ensure that they
22 are creating an environment that allows athletes to feel open, accessible and available (as
23 opposed to withdrawn, hostile and distant). Subsequently, such interpersonal behaviours
24 experienced and manifested by athletes are more likely to have a positive influence on their
25 wellbeing. This result may be linked to coach-created motivational climates (e.g., Duda &

1 Balaguer, 2007; Smith, Smoll, & Cumming, 2007) and the benefits associated with creating a
2 mastery or task created environment for the athletes to thrive (Brown, Arnold, Reid, &
3 Roberts, 2018); it may also be linked with growth mindset (Dweck, 2008) whereby the
4 environment within the athlete operates values the effort exerted and not one's existing talent
5 or performance, learning is encouraged and failures are viewed as part of one's journey of
6 growth and development.

7 Whereas in study 2, it was found that athletes' perceptions of their coach affiliation
8 (i.e., meta corresponding complementarity: coach is perceived to be responsive, at ease, ready
9 and friendly when they coach their athletes) are associated with athletes' levels of cohesion.
10 Consistent with previous research, albeit limited research examining relationship factors and
11 group processes (e.g., Hampson & Jowett, 2014; Jowett & Chaundy, 2004; Jowett et al.,
12 2012), coaches' affiliation (as perceived by the athletes) seems to enhance athletes'
13 perceptions of team cohesion and potentially performance, since team cohesion has been
14 found to be linked with performance in meta-analyses (Carron, Colman, Wheeler, & Stevens,
15 2002). On a different note, the association recorded between direct corresponding
16 complementarity and task and social cohesion was exclusively via the indirect effect of basic
17 needs satisfaction. This finding suggests that athletes whose behaviours are responsive,
18 friendly and helpful are more likely to experience greater task/social cohesion due to the
19 positive impact of these behaviours have on their need satisfaction. It is worth noting that
20 results suggest that for corresponding complementarity to impact an athlete's social cohesion,
21 coaches would need to ensure that athletes' basic psychological needs are satisfied. Thus, if
22 coaching environments are created with the aim to meet the basic psychological needs of
23 connectedness, autonomy and competence (Deci & Ryan, 2000), then it is possible to reach
24 high levels of team cohesion among team-members but also high levels of good quality
25 relationships between athletes and coaches.

1 The association hypothesised between athletes' reciprocal complementarity and group
2 processes was not supported. Reciprocal complementarity reflects to an extent an athlete's
3 level of being coachable, in other words, willing to learn (by working hard to outperform
4 themselves), actively engaging (by asking question and seeking out feedback), considering
5 alternatives (by being open to suggestions, information) and so on. Coachability may thus be
6 a characteristic of the individual and as such it may be better associated with such individual
7 factors as motivation, confidence and resilience (Favor, 2011) as opposed to group factors
8 (e.g., team cohesion, collective efficacy). Further research is warranted to shed light to the
9 unique functions of the athlete and coach reciprocal complementarity dimension within the
10 context of the coach-athlete relationship.

11 Overall, these results speak on one hand to the important role coaches play in
12 elevating through their affiliation, or meta complementary behaviours, athletes' sense of task
13 cohesion and on the other hand their athletes' affiliation, or direct complementary behaviours,
14 in enhancing their own well-being. This set of results provide initial evidence of the
15 differential functions of the different forms of complementarity. At the same time, it
16 highlights that complementarity is reflective of quality coach-athlete relationships (Jowett,
17 2007) that is subsequently instrumental to feelings of their happiness and belongingness (cf.
18 Baumeister & Leary, 1995).

19 This study also focused on exploring the mechanisms by which corresponding and
20 reciprocal complementarity associate with personal vitality and team unity. Results from the
21 two studies demonstrated a range of indirect effects between the variables. In study 1,
22 findings suggest that well-being, as measured by subjective vitality (Study 1), and team
23 cohesion (task and social, Study 2) are indirectly influenced by the different forms of
24 complementarity through satisfaction of the basic psychological needs within the context of
25 the coach-athlete relationship. In relation to cohesion, direct and meta corresponding

1 complementarity was indirectly, through basic needs satisfaction, associated with task and
2 social cohesion (see Blanchard et al., 2009). This finding is consistent with previous research
3 highlighting that basic psychological needs is an important mechanism between interpersonal
4 relationships and outcomes (see Jowett et al., 2017). Collectively, the findings uncover the
5 potential functions of the different forms of complementarity as this relates to both the
6 satisfaction of athletes' basic needs and group processes. Not only this study shows the
7 associations that exist between basic needs and both task and social cohesion, but it also
8 emphasises the importance of the psychological needs for increasing athletes' perceptions of
9 both forms of cohesion.

10 *Practical Applications*

11 This research underlines the practical significance of complementarity and basic
12 psychological needs satisfaction within coach-athlete relationships. Within the coach-athlete
13 relationship, interpersonal behaviours that display responsiveness (openness), readiness
14 (willingness), easiness (acceptance) and friendliness (compassion, warmth) are key for both
15 individual-related factors (e.g., vitality, satisfaction, positive affect) and group-related
16 processes (e.g., team cohesion, collective efficacy). Importantly, such interpersonal
17 complementary and collaborative behaviours can shape a positive social environment that is
18 both healthy and psychologically safe (Jowett & Wachsmuth, 2020) and provide a sound
19 platform for building high-performing teams (Edmondson, 1999; Edmondson & Lei, 2014).
20 Future research could explore several avenues related to complementary transactions, both
21 corresponding and reciprocal, and its associations to efficacy (self, other, coaching,
22 collective), stress, conflict, resilience, goal attainment, sport performance and skill
23 improvement to name a few. The satisfaction of basic psychological needs has been a popular
24 mediator within coach-athlete relationship research (Felton & Jowett, 2013, 2017; Jowett et
25 al., 2017). Within the context of coaching, the current findings suggest that coaches and

1 athletes would benefit from engaging in complementary-type interactions as they would seem
2 to satisfy the basic psychological needs and enhance vitality and unity. Moreover, coaches
3 could provide the athlete with choices and opportunities for involvement in the training to
4 develop autonomy, deliver positive and instructional feedback to enhance competence, and
5 develop a sense of relatedness through taking an interest in the athlete's life outside of sport.
6 This may be particularly relevant for enhancing perceptions of social cohesion as the findings
7 demonstrated no direct associations between complementarity dimensions and social
8 cohesion when the basic needs were included as mediators in the model. Psychological safety
9 may be another potential mediator of the association between the dimensions of the coach-
10 athlete relationship quality including complementarity and outcome variables (see
11 Edmondson & Lei, 2014). For example, complementary may give rise to psychological safety
12 leading to, for example, less interpersonal conflict, more intrapersonal resilience and
13 performance improvement.

14 *Limitations and future directions*

15 Whilst this study provides further evidence for how the coach-athlete relationship, and
16 complementarity in particular, can affect athlete well-being and group processes, there are
17 limitations to acknowledge. Both studies were cross-sectional and therefore the direction of
18 causality between the variables studied is impossible to determine. Previous research has also
19 demonstrated the circular relationship that can exist between cohesion and performance (e.g.,
20 Carron et al., 2002), and therefore a circular relationship between cohesion and the
21 independent and mediator variables in the current study could potentially exist. Future
22 research adopting a longitudinal and/or experimental design in order to examine changes in
23 the coach-athlete relationship, basic needs satisfaction, and well-being/cohesion over time is
24 required to confirm the hypothesised associations and check for potential circularity of
25 relationships. Within study 1, we examined athlete well-being through the assessment of

1 subjective vitality exclusively. Future research may consider examining different aspects of
2 well-being, whilst also considering ill-being to provide a comparison, as previous research
3 has shown the coach-athlete relationship and basic needs to relate to different well/ill-being
4 factors (e.g., Blanchard et al., 2009; Felton & Jowett, 2013). Similarly, future research could
5 examine the basic psychological needs separately in order to understand the associations that
6 exist between the coach-athlete relationship and each individual need. Whilst Ryan and Deci
7 (2017) state that all three needs are important for psychological functioning, and that no
8 hierarchy exists between the needs, understanding the degree to which each need is satisfied
9 could provide insights for potential interventions aimed at enhancing need satisfaction.
10 Finally, the current study focused on the athlete's perceptions of complementarity however
11 the coach-athlete relationship is dyadic in nature and therefore the coaches' perceptions of
12 complementarity should be considered. Capturing the perceptions of coach-athlete dyads
13 would provide a comprehensive picture of the many different ways complementarity (e.g.,
14 creating profiles in terms of reciprocal complementarity: dominant/coach and
15 submissive/athlete or corresponding complementarity: capturing difference scores between
16 coaches and athletes direct and meta) impacts important outcomes. This study is one of the
17 first to examine how reciprocal complementarity is related to important processes in sport
18 and therefore more research is needed in order to develop a clearer understanding of exactly
19 what role it plays alongside corresponding complementarity.

20 To conclude, the current findings suggest that athlete's perceptions of corresponding
21 complementarity are related to well-being and cohesion, with evidence for both direct effects
22 and indirect effects through the satisfaction of basic psychological needs. Therefore, coach-
23 athlete relationships characterised by friendly and responsive interpersonal behaviours, are
24 likely to satisfy athletes' basic needs, and in turn contribute to their levels of energy and
25 unity.

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Table 1. Means, standard deviations, reliability coefficients, and bivariate correlations for all study variables

Variables	1	2	3	4
1. Direct corresponding complementarity	-			
2. Meta-corresponding complementarity	.67	-		
3. Basic psychological needs	.49	.60	-	
4. Vitality	.53	.54	.69	-
Mean	5.75	5.51	4.80	5.21
SD	.84	.84	1.00	1.01
α	.79	.79	.86	.90

Note: All correlations significant at $p < .01$

Table 2. Means, standard deviations, reliability coefficients, and bivariate correlations for all study variables

Variables	1	2	3	4	5	6
1. Direct corresponding complementarity	-					
2. Meta-corresponding complementarity	.73	-				
3. Reciprocal complementarity	.62	.66	-			
4. Basic psychological needs	.65	.67	.50	-		
5. Task cohesion	.41	.49	.37	.54	-	
6. Social cohesion	.42	.46	.37	.54	.68	-
Mean	5.88	5.89	5.88	5.47	6.93	7.26
SD	.62	.76	.67	.91	1.07	1.01
α	.70	.79	.73	.89	.83	.79

Note: All correlations significant at $p < .01$.

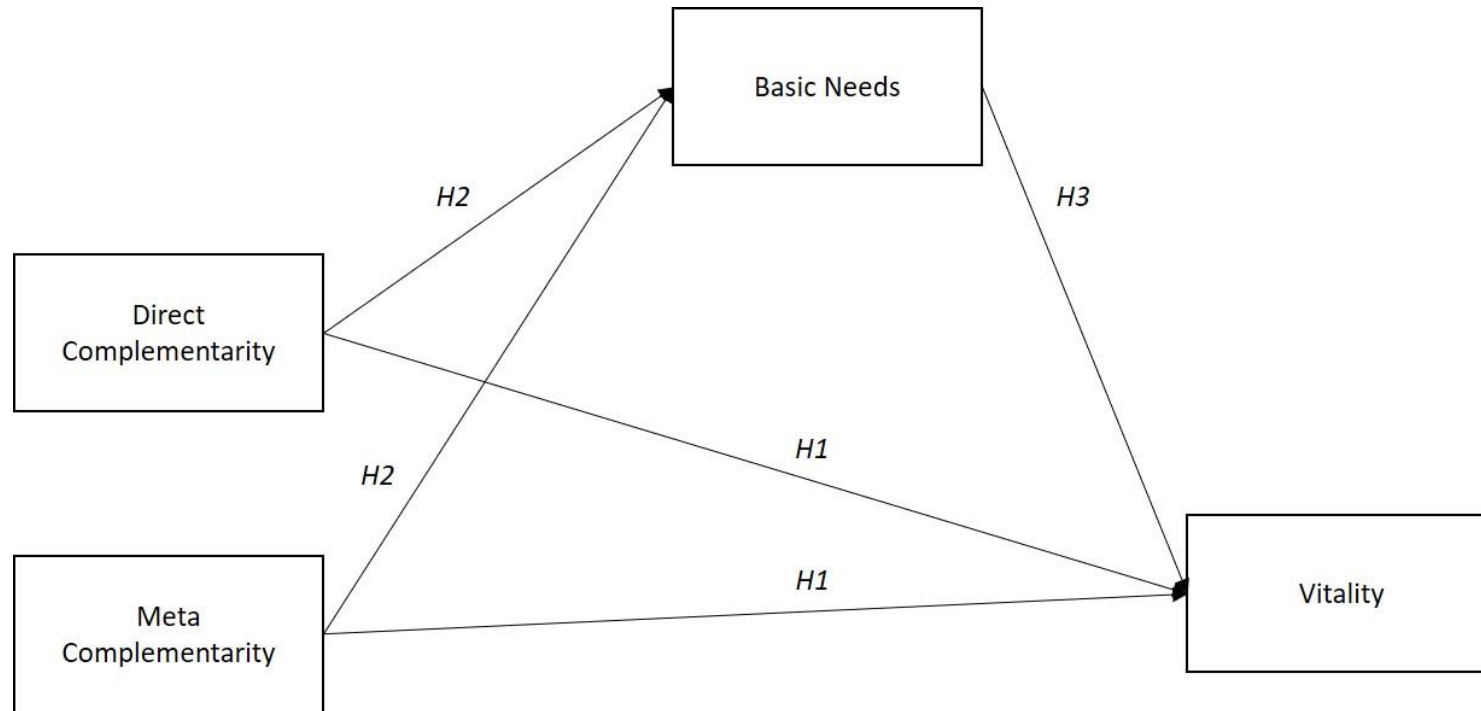


Figure 1. Hypothesised model for Study 1 depicting the various study hypotheses. The indirect effect (Hypothesis 4) is the product of the H2 and H3 path coefficients. All pathways were hypothesised to be positive. Note: H1 = Hypothesis 1, H2 = Hypothesis 2, H3 = Hypothesis 3.

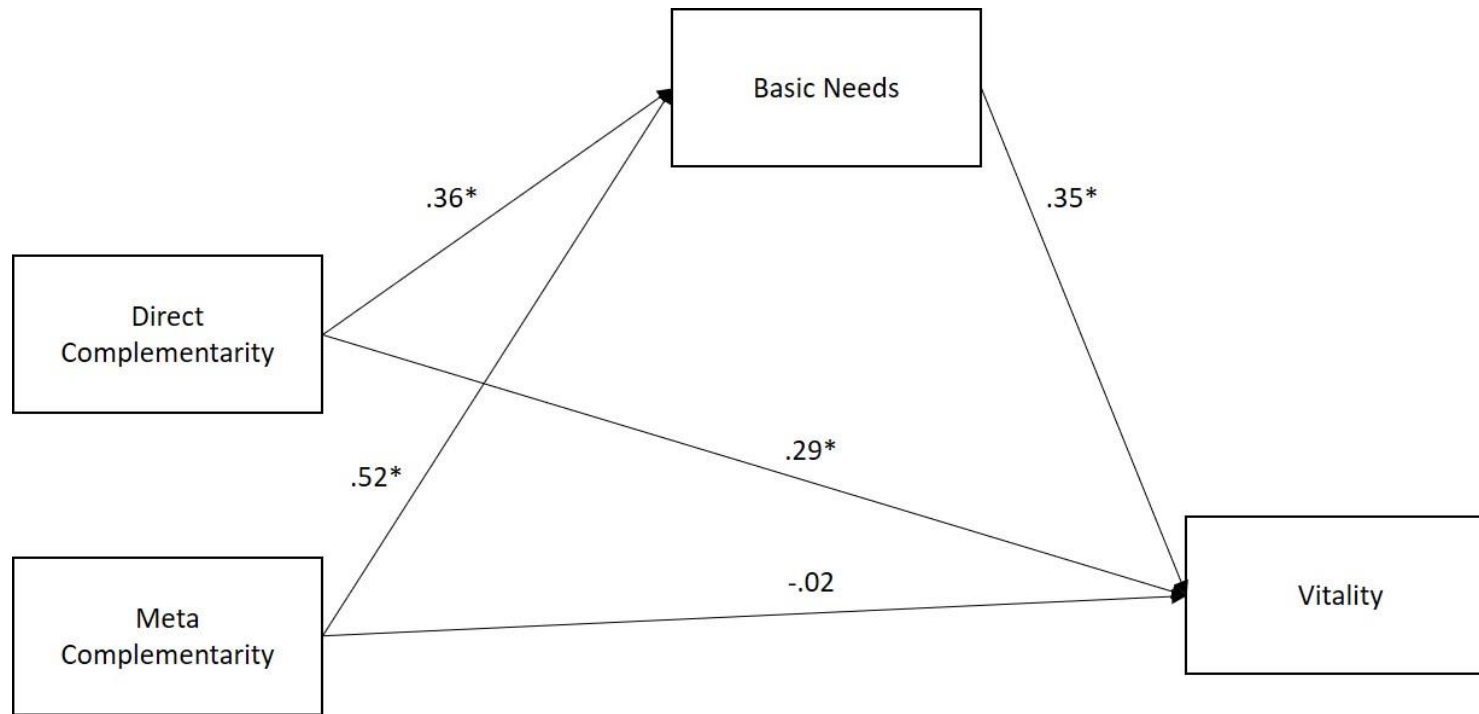


Figure 2. Mediation output for the relationships between direct-corresponding and meta-corresponding complementarity and vitality via the mediating variable of basic psychological need satisfaction. Associations between the independent and dependent variables indicate the direct effects.

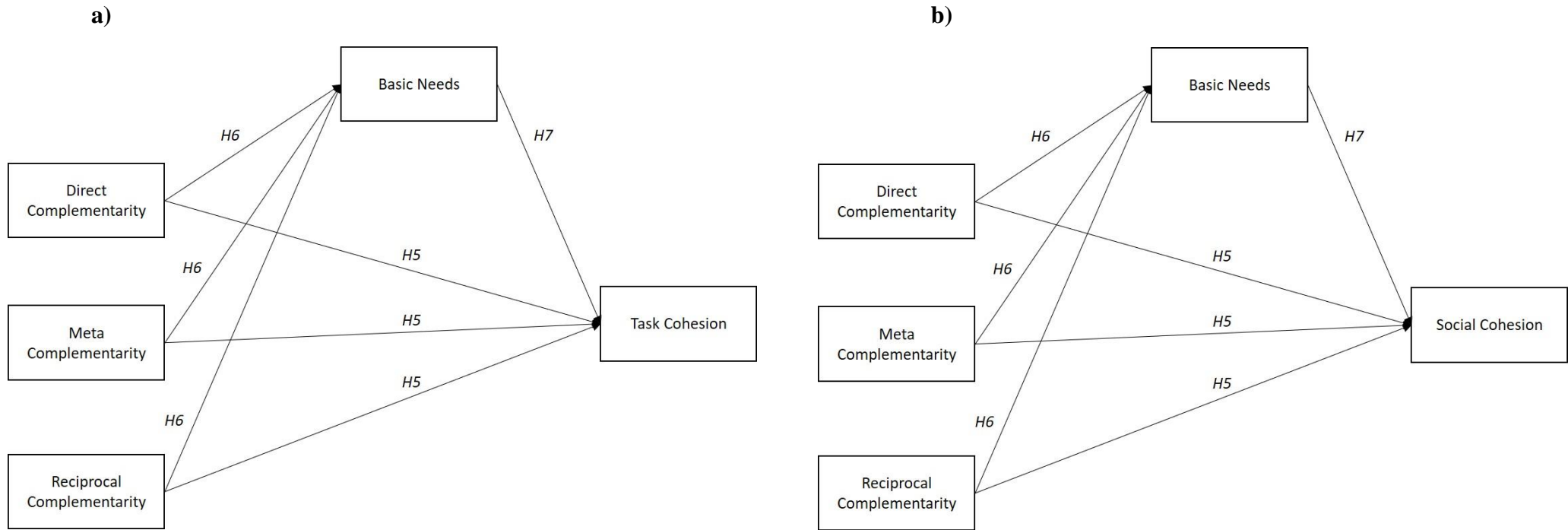


Figure 3. Hypothesised models for Study 2 depicting the various study hypotheses in relation to a) task cohesion and b) social cohesion. The indirect effect (Hypothesis 8) is the product of the H6 and H7 path coefficients. All pathways were hypothesised to be positive. Note: H5 = Hypothesis 5, H6 = Hypothesis 6, H7 = Hypothesis 7.

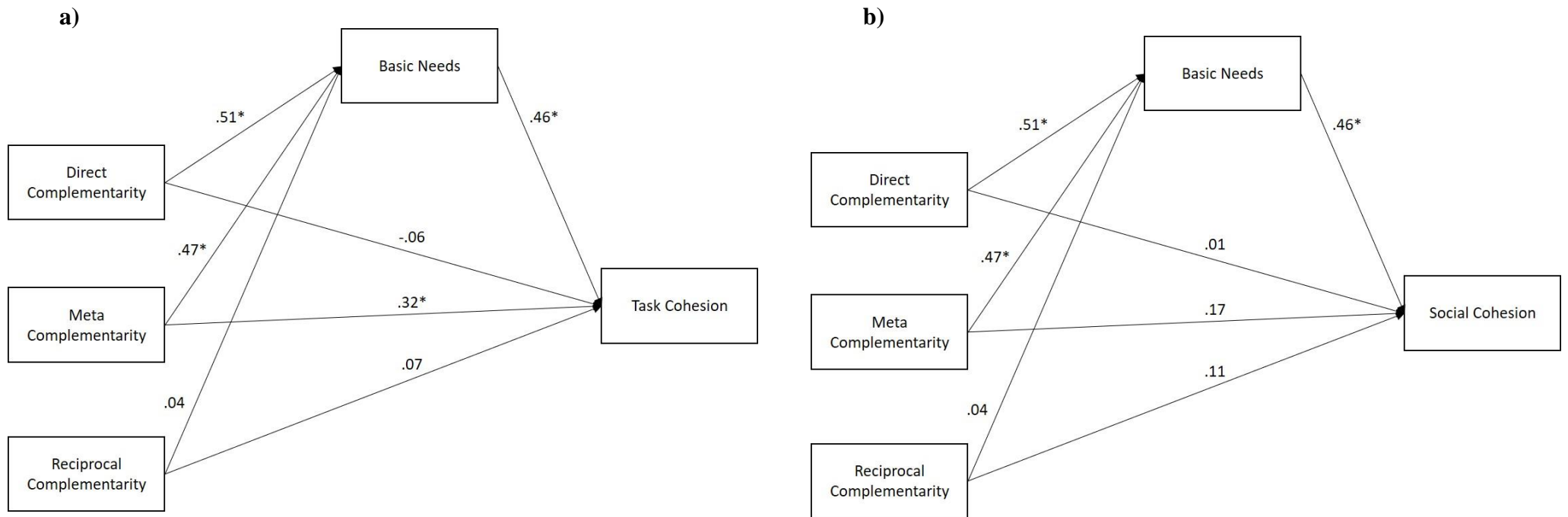


Figure 4. Mediation outputs for the relationships between a) Direct-corresponding, meta-corresponding, and reciprocal complementarity and task cohesion and b) Direct-corresponding, meta-corresponding, and reciprocal complementarity and social cohesion, via the mediating variable of basic psychological need satisfaction. Associations between the independent and dependent variables indicate the direct effects.