

Validation of the long versions of the CART-Q 1

1 Running Head: LONG VERSIONS OF THE CART-Q

2

3

4

5

6

7

8

9 Initial evidence for the criterion-related and structural validity of the long versions of the

10 direct and meta-perspectives of the

11 Coach-Athlete Relationship Questionnaire

12

Daniel J. A. Rhind – Brunel University

and

Sophia Jowett – Loughborough University

13

14

15

16

17

18

19

20 Paper submitted for publication in *The European Journal of Sport Science*

21 Date of submission: November 4th, 2008

22 Date of final submission: January 6th, 2010

23 Correspondence concerning this article should be addressed to Daniel J. A. Rhind, School

24 of Sport and Education, Brunel University, Uxbridge, UB8 3PH

25 Tel.: +44 (0) 1895 266860

26 Email: Daniel.Rhind@Brunel.ac.uk

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26

Abstract

The present study aimed to develop and initially validate a longer version of the Coach-Athlete Relationship Questionnaire (CART-Q), both its direct perspective (Jowett & Ntoumanis, 2004) and meta-perspective (Jowett, in press, 2007b). In Study 1, Instruments (e.g., questionnaires, scales and inventories) that have been used to assess relationship quality in the broader psychological literature were examined and items potentially relevant to the coach-athlete relationship were identified. The content validity of the identified items was then assessed using expert panels. A final questionnaire was subsequently prepared and administered to 693 participants (310 coaches and 383 athletes). Confirmatory Factor Analysis was employed to assess the multidimensional nature of the questionnaire based on the 3 Cs (i.e. closeness, commitment and complementarity) model of the coach-athlete relationship. The findings indicated that the direct and meta-perspective items of the long versions of the CART-Q approached an adequate data fit. Moreover, evidence for the internal consistency and criterion validity of the new instruments was also obtained. In Study 2 the newly developed measure was administered to an independent sample of 251 (145 athletes and 106 coaches). Further statistical support was gained for the factorial validity and reliability of the longer version of the CART-Q.

Keywords: coach-athlete relationship quality, validation, performance, satisfaction

1 Initial evidence for the criterion-related and structural validity of the long versions of the
2 direct and meta-perspectives of the
3 Coach-Athlete Relationship Questionnaire

4 The last decade has witnessed a significant increase in the amount of research being
5 conducted regarding the coach-athlete relationship (Jowett & Wylleman, 2006). Research
6 in this domain has been fuelled by the suggestion that positive outcomes in sport are
7 associated with quality relationships between coaches and athletes (Petitpas, 2002).
8 Furthermore, elite award-winning coaches have been found to place a tremendous
9 emphasis on having quality coach-athlete relationships for both sporting success and the
10 athlete's personal development (Gould, Collins, Lauer & Chung, 2007). As a result, there
11 is a need to investigate the nature and role played by this relationship and to establish how
12 it should best be conceptualized, measured, and ultimately optimized.

13 The coach-athlete relationship has been defined as "...the situation in which
14 coaches' and athletes' emotions, thoughts and behaviors are mutually and causally inter-
15 connected" (Jowett & Ntoumanis, 2004, p. 245). This definition was developed based on
16 research conducted in the area of close relationships and benefits from emphasizing the bi-
17 directional nature of such relationships as well as incorporating the affective (emotions),
18 cognitive (thoughts) and behavioral aspects (Cf., Kelley et al., 1983).

19 Jowett (2005, 2007a) proposed the 3+1C (i.e., closeness, commitment,
20 complementarity and co-orientation) conceptualization of the coach-athlete relationship.
21 The '3Cs' of this model represents the constructs of closeness (cf., Rubin, 1970),
22 commitment (cf., Rusbult, Martz, & Agnew, 1998) and complementarity (cf., Kiesler,
23 1997). Closeness refers to the affective meanings that the coach and athlete assign to their
24 relationship (e.g., liking, trust, and respect). Commitment relates to the members'
25 intentions to maintain the relationship at present and in the future. Complementarity
26 concerns the members' co-operative and corresponding behaviors of affiliation and hence

1 an athlete's friendly and responsive behavior during training attracts friendly and
2 responsive behavior from their coach. The '+1Cs' of Jowett's (2005, 2007a) model is
3 labeled as co-orientation which highlights the degree to which the athlete's and the coach's
4 perceptions are interconnected and therefore reflect their common ground. Co-orientation is
5 comprised of the direct perspective (how one person feels, thinks and behaves towards the
6 other; e.g., 'I like my coach/athlete') and the meta perspective (how the athlete/coach
7 believes their coach/athlete feels, thinks and behaves; e.g., 'My coach/athlete likes me'). A
8 series of qualitative studies have been conducted to explore the nature of the coach-athlete
9 relationship by assessing the existence and content of the 3 + 1Cs (e.g., Jowett, 2003;
10 Jowett & Cockerill, 2003; Jowett & Meek, 2000). For example, the study by Jowett and
11 Meek (2000) involved four coach-athlete dyads who were also married. In-depth interviews
12 were conducted based on the interpersonal constructs of closeness, complementarity and
13 co-orientation. A content analysis of the data revealed that the close relationship facilitated
14 co-oriented views in terms of relevant tasks and goals which in turn contributed to co-
15 operative acts on the training ground. Jowett and Cockerill (2003) interviewed 12 athletes
16 who had all won an Olympic medal between 1968 and 1988. Themes relating to closeness
17 (e.g., trust and respect), co-orientation (e.g., common goals) and complementarity (in terms
18 of roles and tasks) were found to underline relationship quality as experienced by some of
19 the most successful athletes in the world.

20 Based upon the data gained through the qualitative research studies, the 11-item
21 direct perspective of the Coach-Athlete Relationship Questionnaire (CART-Q direct;
22 Jowett & Ntoumanis, 2004) was developed. Jowett and Ntoumanis (2004) conducted two
23 validation studies; the first study employed Principal Components Analysis (PCA) to
24 uncover the underlying structure of the instrument, whilst the second study employed
25 Confirmatory Factor Analysis (CFA) to confirm its underlying factor structure. The latter
26 study demonstrated that both the three first order factor model (i.e., Closeness,

1 Commitment, and Complementarity; 3 Cs) and a higher order model which was
2 hypothesized to represent the overall quality of the coach-athlete relationship and contained
3 the 3 Cs, have the same satisfactory model fit indices (Comparative Fit Index (CFI) = 0.96,
4 Non-Normed Fit Index (NNFI) = .94, Standardized Root Mean Square Residual (SRMR) =
5 .05 and Root Mean Square Error of Approximation (RMSEA) = .09). Overall, Jowett and
6 Ntoumanis (2004) provided initial evidence for the content, factorial and criterion-related
7 validity as well as the internal consistency of the 11-item direct perspective of the CART-
8 Q.

9 A meta perspective version of the 11-item CART-Q direct has also been developed
10 in order to facilitate the assessment of the construct of co-orientation (see Jowett, 2005,
11 2007a). Thus, for each of the direct items, a meta item was created which allowed
12 statements to be phrased in a way that considers how a coach or athlete believes the other
13 member feels or thinks. The 11-item meta-perspective CART-Q has demonstrated
14 corresponding factor structure with that of the direct CART-Q. Jowett (2007b) has found
15 that the latent structure (e.g., a model which theorizes the relationships which exist between
16 the variables and factors within the data) comprised of three first order factors (meta
17 closeness, meta commitment and meta complementarity) had an excellent fit to the data
18 (CFI = 1.00, SRMR = .04 and RMSEA = .00). A second model which also contained a
19 higher order factor which represented a general meta relationship factor also had acceptable
20 fit indices (CFI = 0.95, SRMR = .04 and RMSEA = .07). Subsequent empirical research
21 has lent further support to the validity of the CART-Q direct and meta versions (see e.g.,
22 Jowett & Clark-Carter, 2006).

23 The CART-Qs have proved to be useful instruments for researchers interested in
24 assessing the nature, content or quality of the coach-athlete relationship. In particular, the
25 relatively short length of the questionnaires ensure that they can be administered
26 expediently and as part of a battery of questionnaires within a research study (e.g., Jowett

1 & Chaundy, 2004; Jowett & Clark-Carter, 2006). However, it is possible that researchers
2 and practitioners require detail not necessarily captured in the current short versions of the
3 CART-Q. Thus, the option to select from either a short or a long version based on the
4 requirements dictated by a researcher's and practitioner's specific work, suggested the need
5 for the development and validation of longer versions of the CART-Q to fill the identified
6 gap in relation to the available measures regarding the coach-athlete relationship
7 (Wylleman, 2000).

8 Gill, Dzewaldowski, and Deeder (1988) argued for the construction of multi-
9 dimensional instruments within sport psychology which are based on theory, item and
10 reliability analysis, factor analysis, tests of convergent and divergent validity, validation in
11 relation to external criteria and application in research and practice. In the sport psychology
12 domain, the concepts of interest are generally hypothetical and therefore evidence of their
13 construct validity needs to be demonstrated. Hence, Duda (2001) called for all sport-
14 specific instruments to be evaluated within a construct validity framework.

15 Whenever one is developing a measure of a psychological construct, two crucial
16 concepts to consider are validity and reliability. The American Psychological Association
17 (1999) has argued for a unified validity which is comprised of face/content validity,
18 criterion-related validity, and construct validity. Content validity relates to the "...match
19 between items or tasks in the measure and the content domain to which generalization is
20 sought" (Hoyt, Warbasse & Chu, 2006, p. 774). Moreover, Hoyt and colleagues (2006)
21 have explained that criterion-related validity includes "...correlations with future
22 performance (predictive validity) and correlations with theoretically-related constructs
23 assessed at the same point in time" (concurrent validity) (p. 776). Finally, construct validity
24 relates to "...an ongoing theory-guided enquiry into systematic determinants of test scores
25 (often called the test's factor structure or internal structure" (Hoyt et al., 2006, p. 778). In a
26 seminal chapter, Messick (1989) argued for multiple standards for the assessment of

1 construct validity such as relevant content (which is based on sound theory and rationale),
2 internally consistent items, external correlations with related measures, generalisability
3 across different samples and time, as well as being explicit in terms of social consequences
4 (e.g., racial bias). Construct validity is also indicated by convergent validity (e.g., whether
5 a measure is associated to other measures to which it should theoretically be linked with)
6 and discriminant validity (e.g., whether a measure is not associated with other measures to
7 which it should, in theory, not be linked with).

8 Reliability, or internal consistency, concerns how well items which are developed to
9 measure a single construct correlate with each other. It therefore assesses whether the items
10 are measuring the same construct (American Psychological Association, 1999). Thus, any
11 newly developed or extended psychological instrument needs to show evidence of both
12 validity and reliability for it to be deemed a sound scientific measure.

13 The focus of the present research is to develop longer versions of the direct and
14 meta CART-Qs. The need for this expansion is based on a number of important theoretical,
15 applied, and research-related factors. In theoretical terms, expanding the measures of
16 closeness, commitment, and complementarity will broaden the scope of the relevant issues
17 that are assessed and addressed within each subscale. On an applied level, a longer
18 instrument is more likely to provide a more comprehensive and detailed assessment of this
19 dyadic relationship. This information could be used for the development of interventions
20 and norm data can also be developed which would further help to identify areas of strength
21 or weakness within the coach-athlete relationship (e.g., high or low levels of commitment).
22 This should help narrow the gap which has been identified between existing theoretical
23 knowledge and its usefulness for coaches and athletes (Coppel, 1995). It will also meet the
24 need for more research that has more practical use for coaches and athletes
25 (Poczwardowski, Sherman, & Henschen, 1998) whilst addressing the need for the
26 delineation of valid instrumentation in this domain as identified by Wylleman (2000). In

1 items within these measures were then pooled to create three sets of relevant items
2 (closeness = 290 items, commitment = 291 items, and complementarity = 278 items). The
3 identification of scales was completed by the first author who has expertise in conducting
4 such searches and experience of undertaking relationship research.

5 Each of the 859 items was then carefully considered by the authors to ensure that it
6 was relevant and representative of one of the clearly defined constructs (i.e., one of the 3
7 Cs). This helped to reduce the risk of introducing error which would in turn negatively
8 impact the strength of inter-item correlations and hence go against the objectives of scale
9 development (Quintana & Minami, 2006). All efforts were made to ensure that all items
10 were clear, concise, distinct, comprehensible, and reflected the construct of interest
11 (Anastasi, 1988).

12 Each item was either included (with modifications made where appropriate) or
13 excluded from further analysis. Items were excluded for a number of reasons. For instance,
14 some items duplicated other included items. Other items addressed issues which were
15 irrelevant to the coach-athlete relationship (e.g., related to sex) or contained words which
16 were viewed as having the potential to cause comprehension problems (e.g., “My partner is
17 antagonistic”). A total of 28 items for Closeness, 29 items for Commitment, and 38 items
18 for Complementarity were retained following this process. All of the original 11 items in
19 the CART-Q were retained.

20 Three separate documents were created following the procedures outlined by
21 DeVellis (2003). Each contained items that assessed either closeness, commitment or
22 complementarity. Four different versions of each of these three documents were developed
23 to represent (a) athlete direct perspective, (b) athlete meta-perspective, (c) coach direct
24 perspective, and (d) coach meta-perspective. In the direct versions the items focused on
25 how the respondent felt, thought or behaved towards the other member of the dyad (e.g., “I
26 like my coach/athlete”). The meta versions contained the same basic items but with them

1 being reworded such that they assessed how a respondent believed the other member of
2 their dyad felt, thought or behaved (e.g., “My coach/athlete likes me”). Therefore a total of
3 12 documents were created.

4 Phase 2: Content validity

5 The aim of the second phase was to assess the content validity of the items
6 identified in Phase 1. Panels of experts assessed the pool of items the authors had identified
7 as potentially relevant in Phase 1. A total of 12 expert panels were employed (one for each
8 of the 12 questionnaires developed in Phase 1) which were comprised of 44 experts.
9 Experts consisted of 20 sport psychology consultants and/or academics, 12 sport
10 psychology PhD students, 6 coaches and 6 athletes. Each expert was given a pack that
11 contained instructions and the set of items that either dealt with the direct or meta-
12 perspective of closeness, commitment or complementarity. This ensured that all items were
13 reviewed and scrutinized by several members of a panel. Each expert panel contained at
14 least one subject matter expert (e.g., sport psychology academic and/or consultant), a sport
15 psychology Ph.D. student, and either a coach or an athlete (depending upon the specific
16 version of the questionnaire being assessed). Thus each judge reviewed either the coach
17 direct, coach meta, athlete direct or athlete meta version of the items designed to measure
18 closeness, commitment or complementarity.

19 Experts independently read through the set of items and indicated whether they
20 thought each of them were “representative’ (i.e. does it represent the construct of interest”,
21 “Relevant” (i.e., does it reflect the definition of Closeness/Commitment/Complementarity
22 provided), “Clear” (i.e., is it easily understood), and “Specific” (i.e., is it focused and not
23 too general or ambiguous). Participants indicated their opinions by circling “Yes”, “No” or
24 “Unsure” for whether each item was representative, relevant, clear or specific. A
25 “Comments” section was also included under each item to enable the participant to explain

1 their responses and to suggest any alterations. Finally, panel members were asked about the
2 appropriateness of the pitch, flow, instructions used, and presentation of the questionnaire.

3 The feedback from the expert panels was then reviewed. An item was retained if it
4 was viewed as relevant, representative, clear and specific by at least 9 out of the 12 panel
5 members (3/4) and if no significant issues had been highlighted by any respondent. This
6 procedure was adopted as it has been employed in previous related research by Jowett and
7 Ntoumanis (2004) in the development of the short version of the CART-Q. This resulted in
8 three item pools being generated containing 21 items (closeness), 20 items (commitment)
9 and 23 items (complementarity). Evidence for the content validity of all of these 64 items
10 was found.

11 Phase 3: Construct and criterion validity

12 The aim of this phase of the study was to assess the criterion-related and structural
13 validity of the items which had been developed in Phases 1 and 2.

14 *Method*

15 *Participants.* A sample of 693 respondents took part in this study (55% = males and
16 45% = females). Of these 44% were coaches (M age = 44.24, SD = 11.51) and 56% were
17 athletes (M age = 24.86, SD = 7.58). Participants were recruited from a wide range of both
18 individual (e.g., athletics, cycling, swimming) and team sports (e.g., football, netball,
19 cricket), as well as a range of competitive levels including recreational (2.7%), University
20 (10.2%), club (31.6%), regional (22.5%), national (17.3%), and international (15.7%).
21 Participants had been involved in their primary sport for a mean of 10.17 years (SD = 8.07).
22 The average length of their relationship with their current coach or athlete was 3.32 years
23 (SD = 3.42), with the mean number of hours being spent with this person in training each
24 week being 4.91 hours (SD = 4.88).

25 *Instrumentation.* Two long versions of the *Coach-Athlete Relationship*
26 *Questionnaires* (CART-Qs) were developed, based on the results of Phases 1 and 2. One

1 version was designed for the athlete and another for the coach. Both versions contained 128
2 relationship statements (64 direct items and 64 meta items). These contained 42 items
3 designed to measure closeness (21 direct and 21 meta), 40 for commitment (20 direct and
4 20 meta), and 46 to measure complementarity (23 direct and 23 meta).

5 Moreover, three items from the “Overall Performance” sub-scale of the *Elite*
6 *Athlete Self Description Questionnaire* (Marsh, Hey, Johnson, & Perry, 1997) were
7 employed in both a direct and meta form. Support for the factorial validity and internal
8 consistency of this measure has been shown in previous research (Marsh et al., 1997;
9 Marsh & Perry, 2005). Three items from the “Satisfaction with Performance” sub-scale of
10 the *Athlete Satisfaction Questionnaire*, which has been found to show good psychometric
11 properties (Riemer & Chelladurai, 1998) were also included. All items began with the
12 prefix “During training...” such that participants focused on their sporting relationship
13 with their coach or athlete. Respondents indicated the extent to which they agreed with
14 each statement on a 7 point scale ranging from 1 = *Strongly Disagree* through to 7 =
15 *Strongly Agree*.

16 *Procedures.* In order to achieve the relatively large and heterogeneous sample
17 required for this study, a wide range of different strategies were employed to recruit
18 participants. This approach is in line with Duncan, Strycken, Duncan, and Chaumonton
19 (2002) who argued that using a range of recruitment methods is advantageous because it
20 increases the success of the overall project. Firstly, National organizations, such as
21 National Governing Bodies (NGBs) from a wide range of sports were contacted via e-mail
22 and/or telephone to invite them to participate in the present study through providing access
23 to coaches and athletes. Secondly, clubs, groups and societies were approached via their
24 head coach/manager. Finally, participants were recruited on an individual level through
25 attending sporting events, courses and training sessions.

1 Fit Indices scores was less than 0.01 and between χ^2 scores was less than 0.05 which
2 indicates that there are no differences in the latent structures of these sub-groups (Cheung
3 & Rensvold, 2002). The data could therefore be combined to create a single data set.

4 *Structural Validity.* Many researchers have advocated that a number of goodness-
5 of-fit indices are employed in order to evaluate model fit (Marsh, 2007; Hu & Bentler
6 1998). Therefore the present study utilized four different statistics: the Comparative Fit
7 Index (CFI), the Bentler-Bonnet Non-Normed Fit Index (NNFI), the Standardized Root
8 Mean-Square Residual (SRMR) and the Root Mean-Square Error of Approximation
9 (RMSEA). For a model to be seen as having an acceptable fit, it should have a CFI and an
10 NNFI of at least 0.90 (Marsh, 2007; Kline, 2005) and a SRMR of less than 0.10 (Kline,
11 2005). Browne and Cudeck (1993) suggest that an RMSEA between 0 and 0.05 indicates a
12 close fit, less than 0.08 represents a reasonable fit and greater than 0.08 suggests a poor
13 fitting model. The sample of 693 ensured that, in all of the CFA analyses, the
14 participant/item ratio was greater than 10:1 (as recommended by Everitt, 1975) and that
15 Bentler's (1995) guideline of having a free parameter-item ratio also greater than 10:1 was
16 also met. In general terms, a sample size of over 500 is said to be very good for the
17 purposes of CFA (Comrey & Lee, 1992). This relatively large sample should therefore help
18 minimize the risks of patterns of co-variation being unstable and the sample not
19 representing the target population (DeVellis, 2003).

20 The two-stage approach advocated by Anderson and Gerbing (1988) was used. In
21 the first stage of the analysis, the item pools for closeness (21 items), commitment (20
22 items) and complementarity (23 items) were analyzed independently using CFA. The
23 modification process was theory-driven and fundamentally based on the 3+1C
24 conceptualization (Jowett, 2005, 2007a). Thus items were only retained if they loaded onto
25 the factor which they had been developed to measure. The modifications which were
26 grounded in theory were supported by the modification indices provided by EQS 6.1 for

1 Windows (Bentler & Wu, 2005), namely Lagrange Multiplier and Wald test. Items which
2 did not load on to the factor to which they were conceptually associated were identified and
3 deleted one by one and a CFA was conducted on the resultant items until satisfactory fit
4 indices were achieved for both the direct and meta versions of the long CART-Q. This
5 process resulted in three final scales designed to measure closeness (10 items), commitment
6 (11 items) and complementarity (15 items).

7 The second stage of the analysis involved assessing whether the 3+1C
8 conceptualization satisfactorily fit the data. Two different models were tested. Model 1
9 (M1) hypothesized a general higher order factor of relationship quality which accounts for
10 the correlations between the three first order factors of closeness, commitment and
11 complementarity. In Model 2 (M2), a three first order factor model was tested comprising
12 of closeness, commitment and complementarity. These two models were selected as they
13 were found to have the best fit indices in the validation of the original CART-Qs (Jowett,
14 2007b; Jowett & Ntoumanis, 2004).

15 The robust maximum likelihood estimation procedure was employed due to a
16 relatively high normalized estimate of Mardia's coefficient (multivariate kurtosis = 90.87)
17 as recommended by Bentler (1995). This approach adjusts the standard errors and the Chi
18 Square statistic under conditions of non-normality in order to protect against the risk of a
19 type 1 error. Theory-driven modifications, supported by the Lagrange Multiplier and Wald
20 tests, were made. Such refinements are a common requirement in the development of
21 instruments (MacCallum, Roznowski, & Necowski, 1992). The model fit was re-evaluated
22 after each item had been removed. Hoffman (1995) supports this process as it has the
23 benefit of maintaining the general structure of the hypothesized factor model with the best
24 indicators. This process resulted in a final version of the questionnaires which contains 29
25 items (direct and meta): 7 for closeness, 10 for commitment and 12 for complementarity.

1 (The items of the long versions of the direct and meta-perspective of the CART-Q are
2 available from the authors).

3 For the direct items, the fit indices achieved the recommended cut-off points (see
4 Table 2). Model 1, which hypothesized a higher order factor did not yield as good indices
5 as Model 2. For Model 2, which purports three first order factors, the SRMR of .07 is
6 below the recommended .10 cut-off point. Furthermore, the RMSEA of .07 indicates a
7 reasonable model fit. Also, both the RCFI and the NNFI achieved adequate fit indices of .9.
8 These statistics were supplemented by the Akaike Information Criteria (AIC) which
9 assesses if fewer estimated parameters could be used to achieve a satisfactory model fit.
10 Although no specific cut-off values are provided for use with this statistic, the model with
11 the lowest AIC value is suggested to provide the more parsimonious fit to the data.
12 Therefore, as the AIC is lower for M2 than for M1, further evidence is provided for the
13 conclusion that M2 achieves a better fit to the data than M1. Thus, the M2 model with three
14 first order factors which are taken to represent closeness, commitment and
15 complementarity has been shown to approximate an adequate fit to the data. The factor
16 loadings and error variances for closeness ranged from .56 - .91 (.31 - .64), for commitment
17 ranged from .74 - .94 (.34 - .70), and for complementarity ranged from .75 - .88 (.47 - .70).
18 All loadings were statistically significant at the 0.05 level. The inter-factor correlations
19 were as follows: .51 for closeness and commitment, .49 for closeness and complementarity,
20 and .19 for commitment and complementarity.

21 *insert Table 2 near here*

22 Similar findings were found for the meta items with the three first order factor
23 model (M2) again fitting the data more accurately than the higher order factor model (M1)
24 and also having a lower AIC value (see Table 2). The factor loadings and error variances
25 for meta-closeness ranged from .76 - .91 (.42 - .65), for meta-commitment ranged from .71
26 - .90 (.41 - .70), and for meta-complementarity ranged from .73 - .91 (.38 - .70). All

1 loadings were statistically significant at the 0.05 level. The inter-factor correlations were as
2 follows: .53 for meta-closeness and meta-commitment, .51 for meta-closeness and meta-
3 complementarity, and .22 for meta-commitment and meta-complementarity.

4 *Reliability.* The sub-scales of the long versions of the CART-Q were all found to
5 have satisfactory internal consistency as they exceeded the cut off point of .70 (Nunnally &
6 Bernstein, 1994). Specifically, Direct Closeness $\alpha = .92$, Direct Commitment $\alpha = .94$,
7 Direct Complementarity $\alpha = .94$, Meta Closeness $\alpha = .91$, Meta Commitment $\alpha = .92$ and
8 Meta Complementarity $\alpha = .94$.

9 *Criterion Validity.* Criterion validity is "...a measure of how well a variable, or set
10 of variables, predict an outcome" (Pennington, 2003, p. 37). In this study, concurrent
11 validity was tested using the criterion variables of satisfaction and subjective performance.
12 There is theoretical and empirical evidence to link coach leadership (see Riemer, 2007) and
13 coach-athlete relationships (e.g., Jowett & Ntoumanis, 2004) with satisfaction and
14 performance. The two sub-scales used as criterion variables were found to be internally
15 consistent: satisfaction $\alpha = .81$ and performance $\alpha = .91$. Results from the bivariate
16 correlations (see Table 1) indicated that the six sub-scales of the long CART-Qs were all
17 significantly correlated with both satisfaction and performance which provides some
18 evidence for the criterion-related validity (concurrent) of the new instruments.

19 Two hierarchical multiple regression analyses were also conducted. This enabled an
20 assessment of whether the long versions of the CART-Q were able to predict a significantly
21 higher amount of variance in the criterion variables of satisfaction and performance than
22 the short CART-Q. Firstly, satisfaction was predicted from both the direct and meta
23 perspectives of the short and longer versions of the CART-Q. Specifically, the direct 3Cs
24 from the short CART-Q were entered into the first step and the meta perspectives of the
25 3Cs on the short CART-Q were entered into the second step. The direct and meta
26 perspectives of the 3Cs as measured by the long CART-Q were entered into the third and

1 *Participants.* A sample of 251 respondents took part in this study (49% = males and
2 51% = females). Of these 42% were coaches (M age = 37.71, SD = 10.05) and 58% were
3 athletes (M age = 19.82, SD = 3.08). Participants were recruited from a wide range of both
4 individual (e.g., athletics, golf and swimming) and team sports (e.g., football, netball and
5 rowing), as well as a range of competitive levels: recreational (2.0%), University (23.8%),
6 club (25.4%), regional (23.8%), national (16.4%), and international (8.6%). Participants
7 had been involved in their primary sport for a mean of 7.78 years (SD = 4.46). The average
8 length of their relationship with their current coach or athlete was 2.57 years (SD = 2.37),
9 with the mean number of hours being spent with this person in training each week being
10 4.57 hours (SD = 3.65).

11 *Materials.* The administered questionnaire contained the 29 item direct perspective
12 version of the long CART-Q (which was developed in Study 1). All items began with the
13 prefix ‘During training...’ to emphasize that the questionnaire is focused on the
14 respondent’s sporting relationship with their coach/athlete. The long CART-Q is comprised
15 of 7 items which measure closeness (e.g., I care about my coach/athlete), 10 items that
16 measure commitment (e.g., I am committed to maintaining a close partnership with my
17 coach/athlete) and 12 items which measure Complementarity (e.g., I am organized). The
18 third section contained the meta perspective of the long CART-Q. This has very similar
19 items to the direct perspective version with the only difference being that they were re-
20 worded to ask the respondent to think about how their coach/athlete feels, thinks and
21 behaves. The meta perspective of the long CART-Q therefore measures meta closeness
22 (e.g., my coach/athlete cares about me), meta commitment (e.g., my coach/athlete is
23 committed to maintaining a close partnership with me) and meta Complementarity (e.g.,
24 My coach/athlete is organized). Respondents indicated their agreement with the items on a
25 7 point scale from 1 ‘strongly disagree’ to 7 ‘strongly agree’.

26 *Procedure.* The same recruitment methods as those used in Study 1 were employed.

1 ***Insert Table 3 near here***

2 Discriminant validity was also tested through comparing the fit of the correlated 3
3 first order factor model with alternative competing approaches in which all possible pairs
4 of factors are hypothesized to load on to a single factor. The results of these analyses are
5 shown in Table 3. In M5 the two factors were comprised of closeness and another factor in
6 which the commitment and complementarity items were hypothesized to load on to the
7 same factor. In M6 the two factors were comprised of commitment and another factor in
8 which the closeness and complementarity items represented a single factor. In M7 the two
9 factors were comprised of complementarity and another factor in which the commitment
10 and closeness items were hypothesized to load on to the same factor.

11 As in the above analyses, due to the non-normality of the data, the Satorra-Bentler
12 scale chi-square statistics were compared. In each case M1 was found to be superior. When
13 comparing M1 and M5 $\chi^2_{diff} = 26.70$ ($p < .01$). When comparing M1 with M6 $\chi^2_{diff} = 47.47$
14 ($p < .01$) and when comparing M1 with M7 $\chi^2_{diff} = 52.91$ ($p < .01$). Thus, in all cases there
15 was a significant loss of fit when moving from the 3 correlated first order factor model to
16 any of the alternative models, which lends further support to the structural validity of the
17 new measure.

18 Further analyses using Cronbach's alpha provided support for the reliability of the
19 long CART-Qs sub-scales; direct closeness $\alpha = .85$, direct commitment $\alpha = .88$, direct
20 Complementarity $\alpha = .88$, meta closeness $\alpha = .87$, meta commitment $\alpha = .88$ and meta
21 Complementarity $\alpha = .89$.

22 General Discussion

23 The current research focused on gaining initial evidence for the criterion validity
24 and the structural validity of the scale's responses on an expanded measure of the quality of
25 the coach-athlete relationship (CART-Q; Jowett, in press, 2007b; Jowett & Ntoumanis,
26 2004). This means that the CART-Q is now available in both a short and long version.

1 Phases 1 and 2 of Study 1 involved the generation of items and the assessment of their
2 content validity by expert panels. This ensured that the items contained within the longer
3 CART-Q are viewed as being relevant and representative of the construct of interest.

4 The structural validity of the longer versions of the CART-Q was assessed in Phase
5 3. The 3 first order 3 C model (i.e., closeness, commitment and complementarity),
6 adequately fit the data and provided a better fit than the higher order model. This supports
7 the findings of Jowett's (in press; 2007b) research which validated the meta version of the
8 CART-Q. Study 2 lends further support to the structural validity and reliability of the
9 newly developed measure using an independent sample. The 3 correlated first order factor
10 model taken to represent closeness, commitment and complementarity was found to fit the
11 data significantly better than a number of alternative models.

12 Associations between the expanded measure and performance and satisfaction
13 supported previous research findings (e.g., Jowett & Cockerill, 2003; Jowett & Ntoumanis,
14 2004) and also provide evidence for the criterion-related validity of the longer CART-Qs.
15 Therefore, initial evidence for the three important forms of validity recommended by the
16 American Psychological Association (1999), content, structural and criterion-related, has
17 been found. All of the sub-scales of the longer versions of the CART-Qs were also found to
18 be internally consistent. Research is needed to assess the stability of the measure over time.

19 Evidence supporting the expansion of the CART-Q was provided by the
20 hierarchical multiple regression analyses. They indicated that the longer instruments can
21 account for 7.1% of the variance in satisfaction and 9.4% of the variance in perceived
22 performance over and above that explained by the short CART-Qs. This research has an
23 important contribution to make in theoretical, applied, and research terms. By expanding
24 the questionnaire, its scope to include relevant interpersonal aspects has been broadened.
25 For example, the closeness sub-scale now includes items regarding whether a coach and
26 athlete value and care about one another. The commitment sub-scale has been expanded to

1 include, for example, items regarding whether the coach/athlete can imagine ending the
2 relationship in the next year, how much their sporting success is influenced by the
3 relationship member, and how much has been invested in the relationship. As for
4 complementarity, items regarding being receptive and paying attention have been added
5 along with questions about being organized and clear about what is expected of each
6 relationship member during training sessions.

7 This new measure could provide information upon which coach education programs
8 can be developed and to ensure that coaches, athletes, sport psychologists, and researchers
9 have a greater knowledge-base upon which to develop their understanding of the nature and
10 role of the coach-athlete relationship. This knowledge should, in turn, help all of these
11 interested parties to take measures to optimize the effectiveness of coach-athlete
12 relationships and hence the performance and satisfaction of the coach and athlete.

13 With reference to applied sport psychology, the expanded CART-Q represents a
14 tool which will enable sport psychology consultants to obtain a more detailed assessment of
15 the quality of a coach-athlete relationship. The results of such an assessment could provide
16 them with information upon which they can formulate decisions regarding potential areas
17 of strength or weakness in a relationship. Such an assessment could assist toward taking
18 appropriate steps to ensure that the relationship continues at an optimal level into the
19 future. This helps to narrow the gap highlighted by Coppel (1995) in terms of scientific
20 knowledge and its usefulness in applied terms. It also helps to address the need identified
21 by Wylleman (2000) to develop, validate, and delineate measures regarding the coach-
22 athlete relationship.

23 In research terms, the present study helps to diversify theory and research from
24 other social scientific domains into the field of sport psychology, as recommended by
25 Poczwadowski, Barott, and Jowett (2006). The expanded CART-Q provides researchers
26 with a comprehensive assessment of the quality of a coach-athlete relationship and will

1 represent a useful resource for researchers intending to investigate the quality of a coach-
2 athlete relationship but for whom the original CART-Q (see e.g., Jowett, 2007b; Jowett &
3 Ntoumanis, 2004) is too brief. Furthermore, the three sub-scales can be used independently
4 and researchers can select a sub-scale/s based on their specific interests.

5 A number of lines of investigation open up. Firstly, further validation of the longer
6 versions of the CART-Q is merited. The factorial structure of the long versions of the
7 CART-Q need to be assessed with different samples (e.g., team versus individual sports,
8 recreational versus elite performers). There is also great scope for the expanded measure,
9 whether the three sub-scales are used independently or together, to investigate the nature
10 and role of the coach-athlete relationship. Such research could assess the associations of the
11 coach-athlete relationship with individual factors (i.e., the gender and age of the coach and
12 athlete, motivation, passion), relationship factors (e.g., atypical relationships, same-sex and
13 different sex dyads, relationship styles), and environmental factors (e.g., team versus
14 individual sports, different types of sport, and different levels of performance). The long
15 versions of the CART-Q could be used in longitudinal and intervention research.

16 Research and interest in the coach-athlete relationship is likely to continue to
17 increase into the future. With many sport-related positive outcomes being related to quality
18 relationships (Petitpas, 2002), and with award-winning coaches placing a tremendous
19 emphasis on the role played by quality relationships in terms of both success and personal
20 development (Gould et al., 2007), it is highly probable that the demand for information,
21 conceptualizations and measurements regarding the coach-athlete relationship will also
22 increase. The expanded CART-Q can help to meet this demand through facilitating
23 education, research and applied sport psychologists in the drive towards optimizing sport
24 performance and participant satisfaction.

25
26

References

- 1 American Psychological Association (1999). *Standards in Educational and*
2 *Psychological Testing (4th Ed.)*. Washington, DC: American Psychological
3 Association.
- 4 Anastasi, A. (1988). *Psychological testing* (6th Ed.). New York: Macmillan.
- 5 Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A
6 review and recommended two-step approach. *Psychological Bulletin*, 3, 411–423.
- 7 Bentler, P.M. (1995). *EQS structural equations program manual*. Encino, CA:
8 Multivariate Software.
- 9 Bentler, P. M. & Wu, E. J. C. (2005). *EQS 6.1 for Windows*. Encino, CA: Multivariate
10 Software (Context Link).
- 11 Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit.
12 *Sociological Methods and Research*, 21, 230-258.
- 13 Byrne, B. M., & Stewart, S. M. (2006). The MACS approach to testing for multi-group
14 invariance of a second order structure: A walk through the process. *Structural*
15 *Equation Modelling*, 13, 287-321.
- 16 Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indices for testing
17 measurement invariance. *Structural Equation Modelling*, 9, 233-255.
- 18 Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis*. Hillsdale, NJ:
19 Erlbaum.
- 20 Coppel, D.B. (1995). Relationship issues in sport: A marital therapy model. In S.M.
21 Murphy (Ed.), *Sport psychology interventions* (pp. 193-204). Champaign, IL:
22 Human Kinetics.
- 23 DeVellis, R. F. (2003). *Scale development: Theory and applications (2nd Ed.)*. CA: Sage.
- 24 Duda, J. L. (2001). Achievement Goal Research in Sport: Pushing the boundaries and
25 clarifying some misunderstandings. In G. C. Langer (Ed.) *Advances in motivation in*
26 *sport and exercise* (pp. 129-182). Champagne, IL: Human Kinetics.

- 1 Duncan, S.C., Strycker, L.A., Duncan, T.E., & Chaumenton, N.R. (2002). Telephone
2 recruitment of a random stratified youth sample for a physical activity study.
3 *Journal of Sport & Exercise Psychology, 24*, 347-358.
- 4 Everitt, G. S. (1975). Multivariate Analysis: The need for data and other problems.
5 *British Journal of Psychiatry, 126*, 237-240.
- 6 Gill, D. L., Dzewaldowski, D. A., & Deeder, T. E. (1988). The relationship of
7 competitiveness and achievement orientation to participation in sport and non-sport
8 activities. *Journal of Sport and Exercise Psychology, 10*, 139-150
- 9 Gould, D., Collins, K. B., Louer, L. A., & Chung, Y. C. (2007). Coaching life skills
10 through football: A study of award-winning high-school coaches. *Journal of*
11 *Applied Sport Psychology, 19*, 16-37.
- 12 Hoffmann, R. (1995). Establishing factor validity using variable reduction in
13 confirmatory factor analysis. *Educational and Psychological Measurement, 55*,
14 572-582.
- 15 Hoyt, W. T., Warbasse, R. E., & Chu, E. Y. (2006). Construct validation in counseling
16 psychology research. *The Counseling Psychologist, 34*, 769-792.
- 17 Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity
18 to under-parameterised model mis-specification. *Psychological Methods, 3*, 424-
19 453.
- 20 Jowett, S. (2003). When the honeymoon is over: A case study of a coach - athlete
21 relationship in crisis. *The Sport Psychologist, 17*, 444-460.
- 22 Jowett, S. (2005). On repairing and enhancing the coach-athlete relationship. In S. Jowett
23 & M. Jones (Ed.) *Psychology of sport coaching*. Leicester: British Psychological
24 Society.

- 1 Jowett, S. (2007a). Closeness, commitment, complementarity and co-orientation in the
2 coach-athlete relationship: An interdependence analysis. In S. Jowett & D. Lavallee
3 (Eds.) *Social psychology in sport* (pp. 15-28). Champagne, IL: Human Kinetics.
- 4 Jowett, S. (2007b). Factor Structure and Criterion Validity of the Meta-Perspective
5 Version of the Coach-Athlete Relationship Questionnaire (CART-Q). *Manuscript*
6 *under review*.
- 7 Jowett, S. (in press). Validating coach-athlete relationship measures with the nomological
8 network. *Measurement in Physical Education and Exercise Science*.
- 9 Jowett, S., & Chaundy, V. (2004). An investigation into the impact of coach leadership
10 and coach-athlete relationship on group cohesion. *Group Dynamics: Theory,*
11 *Research and Practice, 8*, 302–311.
- 12 Jowett, S., & Cockerill, I. M. (2003). Olympic Medalists' perspective of the athlete -
13 coach relationship. *Psychology of Sport and Exercise, 4*, 313-331.
- 14 Jowett, S., & Clark-Carter, D. (2006). Perceptions of empathic accuracy and assumed
15 similarity in the coach-athlete relationship. *British Journal of Social Psychology,*
16 *45*, 617-637.
- 17 Jowett, S., & Meek, G. (2000). Coach – athlete relationships in married couples: An
18 exploratory content analysis. *The Sport Psychologist, 14*, 157-175.
- 19 Jowett, S., & Ntoumanis, N. (2004). The Coach - Athlete Relationship Questionnaire
20 (CART – Q): Development and initial validation. *Scandinavian Journal of*
21 *Medicine Science and Sports, 14*, 245-257.
- 22 Jowett, S., & Wylleman, P. (2006). Interpersonal relationships in sport and exercise:
23 Crossing the chasm. *Psychology of Sport and Exercise, 7*, 119-123.
- 24 Kelley, H. H., Berscheid, E., Christensen, A., Harvey, H. H., Huston, T. L., Levinger, G.,
25 et al. (Eds.) (1983). *Close relationships*. New York: Freeman.

- 1 Kiesler, D.J. (1997). *Contemporary interpersonal theory research and personality,*
2 *psychopathology, and psychotherapy.* New York: Wiley.
- 3 Kline, R. B. (2005). *Principles and practice of structural equation modeling,* London:
4 Guilford Press.
- 5 MacCallum, R. C., Roznowski, M., & Necowitz, L. B. (1992). Model modifications in
6 covariance structure analysis: The problem of capitalization on chance.
7 *Psychological Bulletin, 111,* 490-504.
- 8 Marsh, H. W. (2007). Application of confirmatory factor analysis and structural equation
9 modeling in sport/exercise psychology. In G. Tenenbaum & R. C. Eklund (Eds.),
10 *Handbook of sport psychology (3rd Ed.).* New York: Wiley.
- 11 Marsh, H. W., Hey, J., Johnson, S., & Perry, C. (1997). Elite Athlete Self-Description
12 Questionnaire: Hierarchical confirmatory factor analysis of responses by two
13 distinct groups of elite athletes. *International Journal of Sport Psychology, 28,* 237-
14 258.
- 15 Marsh, H. W., & Perry, C. (2005). Self-concept contributes to winning gold medals: Causal
16 ordering of self-concept and elite swimming performance. *Journal of Sport and*
17 *Exercise Psychology, 27,* 71-91.
- 18 Martens, M. P. (2005). The use of structural equation modeling in counseling psychology
19 research. *The Counseling Psychologist, 33,* 269-298.
- 20 Messick, S. (1989). Validity. In R. L. Linn (Ed.), *Educational measurement (3rd Ed.,* pp.
21 13-103). New York: American Council on Education.
- 22 Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory (3rd Ed.).* New York:
23 McGraw-Hill.
- 24 Pennington, D. C. (2003). *Essential personality.* London: Arnold.

- 1 Petitpas, A. (2002). Counseling interventions in applied sport psychology. In L. Van
2 Raalte & B. W. Brewer (Eds.), *Exploring sport and exercise psychology* (pp. 253-
3 268). Washington, DC: American Psychological Association.
- 4 Poczwardowski, A., Barott, J. E., & Jowett, S. (2006). Diversifying approaches to
5 research on athlete-coach relationships. *Psychology of Sport and Exercise*, 7, 125-
6 142.
- 7 Poczwardowski, A., Sherman, C., & Henschen, K. (1998). A sport psychology service
8 delivery heuristic: Building on theory and practice. *The Sport Psychologist*, 12,
9 192-208.
- 10 Quintana, S. M., & Minami, T. (2006). Guidelines for meta-analyses of counseling
11 psychology research. *The Counseling Psychologist*, 34, 839-876.
- 12 Riemer, H. A. (2007). Multidimensional model of coach leadership. In S. Jowett & D.
13 Lavallee (Eds.) *Social psychology in sport* (pp. 57-74). Champagne, IL: Human
14 Kinetics.
- 15 Riemer, H. A. & Chelladurai, P. (1998). Development of the Athlete Satisfaction
16 Questionnaire (ASQ). *The Journal of Sport and Exercise Psychology*, 20, 127-156.
- 17 Rubin, Z. (1970). Measurement of romantic love. *Journal of Personality and Social*
18 *Psychology*, 16, 265-273.
- 19 Rusbult, C.E., Martz, J. M., & Agnew, C. R. (1998). The Investment Model Scale:
20 Measuring commitment level, satisfaction level, quality of alternatives, and
21 investment size. *Personal Relationships*, 5, 357-391.
- 22 Wylleman, P. (2000). Interpersonal relationships in sport: Uncharted territory in sport
23 psychology research. *International Journal of Sport Psychology*, 31, 555-572.
- 24

1 Table 1

2 *Means and Standard Deviations of the extended 3Cs and correlations with performance*3 *and satisfaction*

Variables/Subscales	<i>Mean</i>	<i>SD</i>	Direct Satisfaction	Direct Performance
Direct Closeness	5.97	0.93	.46*	.35*
Direct Commitment	5.13	1.45	.54*	.74*
Direct Complementarity	6.11	0.90	.25*	.23*
Meta Closeness	5.69	0.97	.46*	.34*
Meta Commitment	4.99	1.43	.48*	.70*
Meta Complementarity	6.01	0.94	.24*	.22*

4 * $p < .05$

5

6

7

8

9

10

11

12

13

14

15

16

17

1 Table 2

2 *Fit indices for the higher order and first order models for the direct and meta items*

Model	RCFI	NNFI	SRMR	RMSEA	90% sig. CI	AIC
M1 (direct)	.87	.86	0.22	0.10	.095-.103	932.36
M2 (direct)	.90	.90	.07	0.07*	.066-.074	759.95
M1 (meta)	.84	.82	.23	0.11	.106-.114	867.26
M2 (meta)	.90	.90	.08	0.07*	.066-.074	736.41

3 *Note.* RCFI = Robust Comparative Fit Index, NNFI – Non-Normed Fit Index, SRMR –
 4 Standardized Root Mean-Square Residual, RMSEA = Root Mean-Square Error of
 5 Approximation, 90% CI = 90% Confidence Interval of RMSEA and AIC = Akaike
 6 Information Criterion, * = not significant

7

1 Table 3

2 *Fit indices for alternative models for the direct and meta items*

Model	RCFI	NNFI	SRMR	RMSEA
M1 (direct)	.95	.97	0.07	0.07*
M1 (meta)	.94	.96	.07	0.07*
M2 (direct)	.85	.84	.23	0.12
M2 (meta)	.82	.82	.25	0.13
M3 (direct)	.70	.77	.28	0.20
M3 (meta)	.77	.76	.24	0.18
M4 (direct)	.81	.81	.16	0.19
M4 (meta)	.83	.82	.21	0.24
M5 (direct)	.88	.87	.11	0.10
M5 (meta)	.87	.85	.13	0.11
M6 (direct)	.85	.85	.16	0.15
M6 (meta)	.86	.87	.12	0.14
M7 (direct)	.83	.83	.13	0.13
M7 (meta)	.84	.83	.14	0.12

3 *Note.* RCFI = Robust Comparative Fit Index, NNFI – Non-Normed Fit Index, SRMR –
4 Standardized Root Mean-Square Residual, RMSEA = Root Mean-Square Error of
5 Approximation, * = not significant

6

7

8

9