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# The Adult Oriented Sport Coaching Survey: An instrument designed to assess coaching behaviours tailored to adult athletes.



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| Abstract: | Adult sportspersons (Masters athletes, 35 + yrs) have unique coaching preferences (Callary, Rathwell & Young, 2017). No existing resources provide coaches with feedback on their craft with Masters athletes. Three studies evaluated an adult-oriented coaching survey. Study 1 vetted the face validity of 50 survey items with 12 Masters coaches. Results supported the validity of 48 items. In Study 2, 383 Masters coaches completed the 50 items. Confirmatory factor analysis (CFA) and exploratory structural equation modeling (ESEM) indicated issues with model fit. Post-hoc modifications improved fit, resulting in a 22-item, five-factor model. In Study 3, 467 Masters athletes responded to these 22 items reflecting perceptions of their coaches. CFA (CFI = .951, SRMR = .036, RMSEA = .049) and ESEM (CFI = .977, SRMR = .019, RMSEA = .041) confirmed the model. The resultant Adult-Oriented Sport Coaching Survey provides a reliable and factorially valid instrument for measuring adult-oriented coaching practices. |

## Abstract

Adult sportspersons (Masters athletes, 35 + yrs) have unique coaching preferences (Callary, Rathwell & Young, 2017). No existing resources provide coaches with feedback on their craft with Masters athletes. Three studies evaluated an adult-oriented coaching survey. Study 1 vetted the face validity of 50 survey items with 12 Masters coaches. Results supported the validity of 48 items. In Study 2, 383 Masters coaches completed the 50 items. Confirmatory factor analysis (CFA) and exploratory structural equation modeling (ESEM) indicated issues with model fit. Post-hoc modifications improved fit, resulting in a 22-item, five-factor model. In Study 3, 467 Masters athletes responded to these 22 items reflecting perceptions of their coaches. CFA (CFI = .951, SRMR = .036, RMSEA = .049) and ESEM (CFI = .977, SRMR = .019, RMSEA = .041) confirmed the model. The resultant Adult-Oriented Sport Coaching Survey provides a reliable and factorially valid instrument for measuring adult-oriented coaching practices.


Keywords: Coaching; Andragogy; Masters athletes; Psychometrics

Masters athletes (MAs) represent one of the fastest growing sport cohorts in the Westernized world (Baker, Horton, & Weir, 2010). MAs are typically over 35 years of age, formally registered for sport in some fashion, which may include registration to a sport club with a coach, and acknowledge that they prepare via training for upcoming competitions (Young, 2011). MAs often train with coaches in heterogeneous groups, which may include participants of various ages, abilities, and competitive levels within the same setting (Rathwell, Callary, & Young, 2015). The International Sport Coaching Framework 1.2 (ISCF; ICCE, 2013), which provides guidelines for coach learning globally, notes that coaches' knowledge and approaches should reflect the needs and motives of the people they coach in different sporting contexts. Despite the ISCF's recognition of adults as a significant group that is coached, there are very few resources and a noticeable lack of coach education specific to Masters coaches (Callary, Rathwell & Young, 2018).

Most of what is known about psychosocial approaches to coaching sport derives from models within youth, adolescent, and emerging adult sport literature (e.g., Chelladurai, 2007; Coté, Salmela, Trudel & Baria, 1995). Further, coach education programming is geared towards younger athletes, with Masters coaches commenting that it lacks relevance for their context (Callary et al., 2018). Callary et al. (2018) described how Masters coaches are relatively unaware of the importance of developing specific psychosocial approaches for coaching MAs, but express interest in gaining empirical information about the psychological and social nuances of coaching middle-aged and older adults. This is problematic because no research-based tools exist to assess, understand, and service Masters coach development as it pertains to the psychosocial particularities of the adult sport context. As the number of MAs and Masters coaches increases, it is imperative to (a) understand their distinct needs and (b) to validate commensurate assessment

tools. This is essential because effective, contextually-sensitive coaching practices are associated with enriched sport experiences, motivation, and retention among sport participants (ICCE, 2013).

Although no quantitative assessment tool exists for Masters coaches, a growing body of qualitative research has explored coached adult contexts (e.g., Callary, Rathwell & Young, 2017; Callary et al., 2018; Ferrari, Bloom, Gilbert & Caron, 2016; MacLellan, Callary & Young, 2018; 2019). Ferrari et al. (2016) found that Masters swimmers believed their coaches fostered social, health, and performance benefits. Callary and colleagues explored competitive Masters swim clubs to understand what Masters swimmers wanted, needed, and received from their coaches (Callary, Rathwell & Young, 2015), and how coaches strategically structured the sport environment for MAs (Callary et al., 2017). Generally, Masters swimmers and coaches believed (a) MAs had unique coaching wants and needs compared to younger athletes, and (b) coaches had to alter their strategies when working with them. The findings were upheld by MacLellan et al. (2018; 2019), who noted differences in one canoe/kayak coach's approaches with a group of MAs compared to a group of youth, whereby the coach provided greater opportunities for self-direction and questions with the adults while being more directed with the youth group.

Researchers (Callary et al., 2017; MacLellan et al., 2019; Young & Callary, 2018) contend that our understanding of coaching MAs can be enhanced by examining adult-learning principles, such as the andragogic tenets (Knowles, Holton & Swanson, 2012). Andragogic conceptualizations posit that adults learn best in environments that foster self-directedness, draw in adults' prior experiences as a basis for learning, create opportunities for reflection, and allow for collaborative problem-solving. Callary et al. (2017) described an alignment between andragogy and how Masters coaches (a) enabled MAs' self-direction, (b) explained why MAs

were asked to perform particular skills or activities, (c) accounted for MAs' prior experiences in and out of sport when making decisions, (d) used a problem-oriented approach, (e) made concerted efforts to ready their MAs to learn new skills, and (f) created intrinsically motivating environments. MacLellan et al. (2018; 2019) further corroborated these findings, leading to the advancement of an andragogic model for sport. In all, these qualitative works offer empirical-based evidence legitimizing adult-oriented coaching approaches.

**The need for a tool to assess adult-oriented coaching in sport**

Self-report instruments are features of personal and more formalized coach development strategies wherein coaches receive feedback from different sources, including data-based sources, to deliberate upon and improve their craft (e.g., Hoffmann, Duguay, Guerrero, Loughead & Munroe-Chandler, 2017). Callary and Young (2019) have advocated that the design of professional development programs for Masters coaches should include coach self-report of distinct features of coaching practice to precipitate a central reflection component, and ideally athlete self-report on the same features to enrich the dialogue. To our knowledge, there has been only one quantitative effort related to the development of such a coach-report tool (Rathwell, Young, & Callary ,2017; Young, Rathwell & Callary, 2020). Specifically, a systematic review was conducted on the adult education literature to identify an established instrument (i.e., Instructional Perspectives Inventory; Henschke, 1994), which had been used as a self-report tool to assess instructors/coaches and learners in classroom, corporate and life coaching venues. Unfortunately, this survey performed poorly on psychometric evaluations when administered to Masters coaches, and did not capture the sport-specific context of adult-oriented coaching. Young et al. (2020) concluded that future work needs to generate specifically from sport-

sensitive inventories, and called for the development of a coach-report instrument that captures the nuances, lexicon, and intonation of experiences in the Masters sport coaching context.

## Purpose

The overall purpose of this three-study program was to generate a valid and reliable survey to assess adult-oriented coaching practices used by coaches while working with MAs. In Study 1, the authors generated a catalogue of items derived from qualitative findings in the Masters sport context, that was intended to measure adult-oriented coaching practices. The content of the items was then vetted by a sample of Masters coaches to ensure their applicability to the Masters coaching context. In Study 2, the reliability and factorial validity of the vetted items were tested with data from a large sample of Masters coaches and all problematic items were removed. In Study 3, the factor structure determined in Study 2 was tested with an independent sample of MAs. Together, these three studies sought to address a notable gap in the literature by establishing a survey capable of assessing adult-oriented practices used when coaching MAs.

## Study 1: Creating Items and Establishing Face Validity with Coach Vetting

Study 1 occurred over two phases. In Phase 1, the authors borrowed from qualitative work on Master athletics to generate a catalogue of items intended to measure adult-oriented coaching practices used by Masters coaches. In Phase 2, face validity of the catalogue of items was vetted by a sample of actively involved and invested Masters coaches from different sports.

### Phase 1: Creating Items

Understanding the importance of contextually-sensitive survey items in developing a coach-report instrument, the current authors drew from qualitative research findings on coached Masters sport experiences that were grounded in analyses on adult learning principles. Themes in

the sport-based research (e.g., Callary et al., 2015; Callary et al., 2017; MacLellan et al., 2018; 2019) illustrated content that was explicitly relevant to a Masters coach (e.g., nuances related to motor learning, and readying athletes for competition), thus, was well suited for the design of a survey that Masters coaches could use for self-assessment purposes. As such, an initial pool of items was generated that captured adult-oriented coaching practices used by coaches who work with MAs following DeVellis' (2017) guidelines for scale development in applied social research. The first three authors collaboratively designed and assessed the items concerning adult-oriented coaching practices used with MAs, with each bringing their own expert knowledge to the process. All three have a history of publishing in reputable journals on topics related to coaching Masters sport.

**Conceptual formulations.** According to DeVellis (2017), when beginning survey/scale development, it is essential to clearly define what one wishes to measure. The three senior authors were interested in adult-oriented psychosocial coaching practices used with MAs. Thus, in the spring of 2016, Callary et al.'s (2015) article was used as a guiding formulation for deriving items related to strategies, attributes, and approaches for coaching MAs, because it presented MAs' lived experiences with coaches and detailed what MAs needed, received, and wanted from their coaches.[1] DeVellis (2017) recommends using theory and conceptual formulations when developing a scale. Thus, Knowles et al.'s (2012) andragogy in practice model was used to help frame this study; its six principles posit adults learn best in environments that capitalize on (a) the learner's need to know; (b) the self-concept of the learner; (c) prior experiences of the learner; (d) orienting learning in personally-meaningful ways and in problem solving; (e) diverse motives that adults have for learning; (f) strategies that consider an adult's

[1] Callary et al. (2015) was the only existing descriptive manuscript on this topic published in a peer-reviewed journal at the commencement of the research project in the spring of 2016.

readiness to learn. Because preliminary findings in Masters sport had found grounding in andragogic principles (e.g., MacLellan, Callary, & Young, 2015), the authors determined Knowles et al.'s (2012) andragogic themes could supplement Callary et al.'s (2015) content.

**Item generation.** Devellis (2017) recommends authors create multiple items measuring the same construct to improve internal consistency reliability while keeping the specific measurement of conceptual formulations in mind. The three senior authors created operational definitions for seven distinct themes derived from Callary et al.'s (2015) findings on what MAs preferred from their coaches: (a) accumulated experience and professional development, (b) preferred personal attributes of coaches, (c) coaching behaviours maximizing efficiency, (d) feedback, (e) practice strategies, (f) structural elements of the program, and (g) interactions related to competition. The second author then created one pool of 39 survey items comprising statements to represent the breadth and depth of these seven themes. Using the same process, the third author used Knowles et al.'s (2012) conceptualizations and their representations in sport (e.g., Author citation, 2015; MacLellan et al., 2015) to generate a second pool comprising 29 items across the six andragogic principles (i.e., need to know, self-direction, life experiences, readiness to learn, problem-centered orientation, motivated by internal cues). DeVellis (2017) also recommends that researchers should simultaneously decide on the scale and time frame so that the items and measurement constructs are compatible. The items for this study were designed to be frequency-based and answered on a Likert scale ranging from 1 (never) to 7 (always). To address time frame, we added the instruction, "Based on your current or recent involvement coaching Masters sport, please rate the frequency at which you perform the following statements." See Table A in the supplemental material for the complete list of items and a summary of all decisions by investigators throughout the entire validation process.

After creating the two pools of items, steps were taken to ensure the quality of the generated statements. With the operational definitions of themes and principles in hand, the three senior researchers independently vetted each item and judged whether (a) it was easy to understand, (b) was an important indicator of its respective theme, and (c) if it were used in a survey, would it help us learn about adult-oriented coaching practices used with MAs? All statements were judged on a 3-point Likert scale (1 agree, 2 somewhat agree, 3 disagree). Any item that did not receive a score of 1 (agree) on all three questions posed from each researcher was re-examined. Together, the senior authors rephrased unclear items and eliminated any problematic items. In total, 11 items were removed from the first pool and three items were removed from the second pool, resulting in 28 items derived from Callary et al.'s (2015) qualitative manuscript on Masters coaching approaches and 24 items derived from andragogic principles, respectively. Finally, the item pools were merged and checked for redundancies. Two items were removed for being redundant, resulting in a final 50-item catalogue spanning 13 themes: preferred personal attributes of coaches; coaching behaviours maximizing efficiency; feedback; practice strategies; structural elements of the program; interactions related to competition; need to know, self-direction, life experiences, readiness to learn, problem-centered orientation, motivated by internal cues. For a complete list of the 50 items see Appendix A.

**Phase 2: Establishing Face Validity with Coach Vetting**

Phase 2 tested the content validity of the 50-item catalogue created in Phase 1 by having the content reviewed by experts (DeVellis, 2017). More specifically, we aimed to vet the face validity of our catalogue of survey items with a sample of actively involved and invested Masters coaches from different sports to get an informed perspective on their applicability to this coaching context.

177 **Method.**

178 ***Procedure.*** Upon receiving clearance from a university research ethics board, coaches
179 were recruited for this study via email in the summer of 2016. Coaches were identified from a
180 roster of former participants in our research program (who had consented to be contacted again)
181 or were identified from contact information hosted on Canadian Masters sport websites. Twenty-
182 six email invitations were initially sent to various coaches.

183 ***Participants.*** Twelve Masters coaches (four female, eight male) agreed to participate.
184 They ranged from 27 to 75 years old ($M$ = 58.67, $SD$ = 16.75) and had five to 55 years of
185 experience coaching MAs ($M$ = 16.58, $SD$ = 12.98). They coached, on average, 8.83 months of
186 the year (range = 3-12, $SD$ = 3.25), for 8.13 hours per week (range = 2-20, $SD$ = 4.64). These
187 coaches worked with recreational only to internationally competitive MAs, with MAs of
188 differing skill levels often training together within the same sessions. They represented different
189 sports (two athletics coaches, three lawn bowls coaches, two canoe/kayak coaches, and a coach
190 from race-walking, judo, triathlon, rowing, and alpine ski) and worked with MAs of varying
191 ages. Specifically, the coaches estimated that their MAs ranged from 40-70 years of age ($M_{age}$ =
192 50.17, $SD$ = 9.08).

193 ***Measures.*** Coaches were provided with an electronic copy of the 50 items and were
194 asked to judge the extent to which each item was "relevant for the coaching of Masters/adult
195 athletes" by responding with either 'agree', 'somewhat agree', 'disagree', or 'don't know
196 because the item doesn't make sense or is awkward.' Respondents were also invited to provide
197 feedback after each item. Participants returned their spreadsheet ratings and comments by email.

198 **Results.** Data were collated across all coaches and analyzed as frequencies. Responses
199 are displayed in Figure 1, showing the number of coaches out of 12 responding 'agree',

'somewhat agree', or problematic (i.e., this response category is the merging of 'disagree' with 'don't know or is awkward to me'). In general, items were rated as relevant to coaching Masters/adult athletes; for example, across all items, the average number of coaches rating 'agree' or 'somewhat agree' on items was 11.22 out of 12 (range = 6-12, *SD* = 1.87). Individual items were reviewed by the researchers if more than three coaches answered 'disagree' or 'don't know or is awkward to me'. Accordingly, two items (item 19: Ask your adult athletes to relate their training to concerns they are facing outside of sport, and item 47: Compete at the same venue as your adult athletes) were flagged for review. During review, coaches' feedback was considered. Coaches explained these items were problematic because they "did not use these behaviours", not because they did not make sense or were not relevant. Considering that our items were designed to be frequency-based (i.e., 'never' is a choice on the Likert scale) and there is value in acquiring data indicating behaviours not applied by coaches, we recorded these items as being potentially problematic but chose to keep them in the item pool and further test their validity in future steps. No other items received 'disagree' or 'don't know or is awkward to me' ratings from more than two coaches.

**Discussion.** Study 1 attested to the face validity of 48 of the 50 items in our catalogue, with impressive face validity judged by Masters coaches for items derived from Callary et al. (2015) and for those representing content from andragogic principles in sport. Further content validity is predicated on the establishment of construct validity, or structural/factorial validity. As such, the next step in our survey validation process involved testing the fit and factor structure of our catalogue using data from a large sample of Masters coaches (DeVellis, 2017).

## Study 2: Testing the Factorial Validity of the Coach-Report Tool

Study 2 tested the reliability and factorial validity of the 13 factors catalogue with data from a large sample of Masters coaches.

## Method

**Procedure.** After receiving institutional ethics clearance, Masters coaches were contacted via recruitment emails in the fall of 2016 that had been forwarded to them by directors of Masters sport organizations or through social media platforms governed by Masters sport organizations. Recruitment information directed them to a SurveyMonkey online survey. A total of 512 Masters coaches consented to participate, and 383 completed this study.

**Participants.** Of the 383 Masters coaches, 271 were female, 110 were male, and 2 did not disclose their sex. Coaches ranged from 18 to 89 years old ($M_{age}$ = 49.74 years, $SD$ = 13.56) and primarily worked with Masters golfers (58.2%) and swimmers (22.5%), with the remaining 19.3% working with various other MAs including but not limited to canoe/kayakers, track and field athletes, skiers, and weightlifters/powerlifters. Although the participants reported coaching their MAs across several competitive levels, their athletes' highest competitive participation was at international (28.9%), national (12.1%), provincial (18.6%), regional (21.5%), and recreational (18.9%) levels. Most respondents coached in Canada (76.2%), with the remaining 23.8% coaching in other countries (e.g., United States, United Kingdom, Australia). They ranged between one and 64 years of experience coaching MAs ($M_{years}$ = 18.69, $SD$ = 12.81).

**Measures.** The 50-item catalogue was used to assess Masters coaches' perceptions of the frequency with which they used adult-oriented coaching practices, with one small addition. At this stage the 'planning at the program level' factor only had two items. Thus, a previously deleted item ("Consider how to accommodate athletes in terms of programming, such as practice or competitive schedules") was reclaimed to ensure a minimum of three items per factor to

improve the reliability of the scale (Hair, Black, Babin, & Anderson, 2010). The coaches responded to 51 items (see Appendix A) tapping into 13 factors (number of items per scale in parentheses): *accumulated experience and professional development* (4); *preferred personal attributes of coaches* (3); *coaching behaviours maximizing efficiency* (6); *feedback* (5); *practice strategies* (3)*; structural elements of the program* (3); *interactions related to competition* (4); *need to know* (3); *self-direction* (3); *life experiences* (5); *readiness to learn* (4); *problem-centered orientation* (4); *motivated by internal cues* (4). Coaches rated all items on a 7-point Likert scale anchored at 1 (never) and 7 (always).

**Data analysis.** The primary analyses were performed using the M*plus* latent variable modeling program (Muthén & Muthén, 1998-2017) and were conducted using the robust maximum likelihood estimator (MLR). MLR generates model fit statistics and standard errors that are robust to non-normally distributed data. Exploratory structural equation modeling (ESEM; Marsh et al., 2009) was used for the evaluation of latent variables. ESEM is a contemporary method that allows items to load on unintended factors while still producing model fit statistics. Oblique target rotation for our ESEM analyses were employed and 'targeted' unintended factor loadings were set to be *near* zero. Target rotation was chosen because it is considered more effective than the commonly used geomin rotation for more complex models (i.e., models containing three or more factors; Asparouhov & Muthén, 2009), and there was conceptual justification for our items loading on specific factors. The following criteria were also used to assess item-level performance: items were required to have factor loadings ≥ .32 on their intended factors and could not have cross-loadings ≥ .32 on unintended factors (Tabachnick & Fidell, 2013). Various indices were considered for model fit: (a) chi-square ($\chi^2$), (b) normed chi-square ($\chi^2/df$), (c) comparative fit index (CFI), (d) standardized root mean square residual

(SRMR), and (e) root mean square error of approximation (RMSEA). Of note, the $\chi^2$ significance model test has been criticized for being sensitive to sample size (Kline, 2010) and for being unecessarily strict (Muthén & Asparouhov, 2012). Thus, Hair et al.'s (2010) criteria were relied upon primarily to indicate good model fit: $\chi^2/df \leq 5$; CFI $\geq .90$; SRMR $\leq .08$; and RMSEA $\leq .05$. Additionally, once a final model was determined, Bayesian Confirmatory Factor Analyses (BCFA) were performed because they offer an alternative significance test. Specifically, BCFA allowed for model testing using posterior predictive checking, which is less sensitive than $\chi^2$ with regard to ignorable degrees of model misspecification (Muthén & Asparouhov, 2012).

## Results

**Preliminary analyses.** Inspection of the dataset revealed that 0.40% of the data were missing. Replacing missing values is appropriate when less than 5% of the data are missing (Tabachnick & Fidell, 2013). Missing data were treated with multiple imputations using an expectation-maximization method (Tabachnick & Fidell, 2013).

**ESEM.** The 51-item, 13-factor model was tested with data from Masters coaches. Results indicated good model fit: $\chi^2$ (690) = 1089.985, $p < .001$, $\chi^2/df = 1.58$, CFI = .921, SRMR = .023, RMSEA = .039 (90% CI = .034-.043). However, 19 items failed to load $\geq .32$ on any factor, and six items showed problematic cross-loadings (> .32 on a non-targeted factor). Despite having good fit indices, results suggested the factor structure did not represent the coach data well and post-hoc modification procedures were warranted.

**ESEM post-hoc modifications.** For the post-hoc modifications, the 23 items and seven factor structures for the pool derived from Callary et al.'s (2015) qualitative themes for the coached MA context were explored first. The rationale for exploring this factor structure, independently, and before the structure for items derived from the andragogic pool, was twofold:

(a) the 51 item, 13-factor item pool from Study 1 was initially composed from items derived from two unique sources, and (b) independent analyses maximized the sample size to items ratio for determining which items were problematic. After determining the factor structure of each independent pool, the lists were merged and the factor structure was explored again.

***Ensuring the integrity of the Callary et al. (2015) pool of items.*** A MLR estimator and an oblique target rotation was used (Muthén & Muthén, 1998-2017). The factor structure for all 23 items showed adequate fit on the seven factors: $\chi^2$ (130) = 294.200, $p < .001$, $\chi^2/df = 2.26$, CFI = .905, SRMR = .026, RMSEA = .057 (90% CI = .049-.066). However, 11 items failed to load ≥ .32 on any factor and five items had problematic cross-loadings (> 32). Results suggested the structure was not well represented by the coach data, justifying exploratory analyses. A parallel Monte Carlo analysis (Tabachnick & Fidell, 2013) was used to determine the number of factors to extract. Results showed the 23 items were best represented by two factors. ESEM with a MLR estimator and an oblique geomin rotation (Muthén & Muthén, 1998-2017) was run. The 23 items were free to load on both factors, meaning no targeted loadings were set. The 23 item, 2-factor solution fell short of acceptable fit: $\chi^2$ (208) = 409.639, $p < .001$, $\chi^2/df = 1.97$, CFI = .884, SRMR = .046, RMSEA = .050 (90% CI = .043-.057). An iterative process of deleting problematic items and re-assessing the factor structure was performed. Items were removed if they cross-loaded > .32 on more than one factor or failed to load > .32 on any factor. The process resulted in five items being removed (items 6, 8, 12, 13, and 16). The final 18-item 2-factor solution had acceptable fit: $\chi^2$ (118) = 262.96, $p < .001$, $\chi^2/df = 2.23$, CFI = .903, SRMR = .041, RMSEA = .057 (90% CI = .047-.066) and no problematic items.

***Ensuring the integrity of the andragogic-based pool of items.*** A MLR estimator and an oblique target rotation (Muthén & Muthén, 1998-2017) was used to test 28 items representing six

factors. Results suggested good fit: $\chi^2$ (203) = 347.00, $p < .001$, $\chi^2/df = 1.71$, CFI = .936, SRMR = .026, RMSEA = .043 (90% CI = .035-.051). However, 11 items did not load ≥ .32 on any factor, 11 items had problematic cross-loadings, and three factors had less than three items with primary loadings ≥ .32. Results justified exploratory analyses. A parallel Monte Carlo analysis (Tabachnick & Fidell, 2013) was used to determine the number of factors to extract, and results suggested the 28 items were best represented by four factors. ESEM with a MLR estimator and an oblique geomin rotation (Muthén & Muthén, 1998-2017) was used. The 28 items were free to load on either of the four factors. The 28 item, 4-factor solution showed good fit: $\chi^2$ (272) = 485.41, $p < .001$, $\chi^2/df = 1.78$, CFI = .906, SRMR = .038, RMSEA = .045 (90% CI = .039-.052). However, seven items failed to load ≥ .32 on any factor and three items had problematic cross-loadings. An iterative process of deleting problematic items and re-assessing the structure was performed. Items were removed if they cross-loaded ≥ .32 on more than one factor or failed to load ≥ .32 on any factor. Ten items were removed (items 28, 29, 30, 33, 36, 37, 39, 48, 49, 50). The final 18-item, 4-factor solution had no problematic items and had acceptable fit: $\chi^2$ (87) = 179.74, $p < .001$, $\chi^2/df = 2.07$, CFI = .927, SRMR = .033, RMSEA = .053 (90% CI = .042-.064).

***Merging the pools into one catalogue and checking the integrity of the model.*** The two refined item pools were re-combined. The new 36-item six-factor solution was explored using ESEM with a MLR estimator and an oblique target rotation (Muthén & Muthén, 1998-2017). Items were targeted to their representative factors from the independent analyses. The model had adequate fit to the data: $\chi^2$ (429) = 746.86, $p < .001$, $\chi^2/df = 1.74$, CFI = .899, SRMR = .033, RMSEA = .044 (90% CI = .039-.049). However, five items failed to load > .32 on any factor, and five items had problematic cross-loadings. An iterative process of deleting problematic items

and re-assessing the factor structure was performed. Seven items and one factor were deleted. The factor was removed for failing to retain a minimum of three items (Hair et al., 2010).

At this time, a 29-item, 5-factor model showed good fit statistics, $\chi^2$ (271) = 518.88, $p$ < .001, $\chi^2/df$ = 1.91, CFI = .902, SRMR = .034, RMSEA = .049 (90% CI = .042-.055), but much of the modifications had been data-driven. Within this more data-driven process, several factors had been lost, and because each item was allowed to be freely estimated in portions of the trimming process, items from different factors were combined to create new ones. Thus, it was important to re-examine the items to ensure they were conceptually consistent (i.e., each item represented the same new theme).

***Conceptual verification and final measurement model fit.*** The first three authors independently examined each factor and their respective items and flagged any item that was not consistent with the theme. Responses were collated and any item flagged by all three researchers was removed. In total, five items (items 1, 5, 11, 20, and 43) were removed. Finally, it was important to test whether the conceptual trimming caused statistical issues with the structure. The 24-item, 5-factor model was tested using a MLR estimator and an oblique target rotation (Muthén & Muthén, 1998-2017). Results showed good fit: $\chi^2$ (166) = 278.72, $p$ < .001, $\chi^2/df$ = 1.68, CFI = .940, SRMR = .029, RMSEA = .042 (90% CI = .033-.051). One problematic cross-loading was found (item 32). After removing it, the model was re-tested and had good fit: $\chi^2$ (148) = 246.35, $p$ < .001, $\chi^2/df$ = 1.66, CFI = .942, SRMR = .029, RMSEA = .042 (90% CI = .032-.051). This time, one item (item 23) failed to load on its target factor ≥ .32 and was removed. A final 22-item, 5-factor model was tested and results showed good fit: $\chi^2$ (131) = 202.56, $p$ < .001, $\chi^2/df$ = 1.55, CFI = .956, SRMR = .027, RMSEA = .038 (90% CI = .027-.048). The factor names, descriptive statistics, construct reliability (CR) scores, and latent factor

359 correlations (after post-hoc modifications) are in Table 2. CR scores indicated adequate internal
360 consistency for three factors (range: 60 to .62) and strong internal consistency (>.7) for two
361 factors (Hair et al., 2010). Table 3 reports all loadings associated with this final ESEM factor
362 structure. No problematic loadings existed. Appendix B lists the 22 items included in this final
363 version. We hereafter refer to this resultant model and its associated items as the Adult-Oriented
364 Sport Coaching Survey (AOSCS).

365 **BCFA.** Importantly, the significant $\chi^2$ test for the ESEM, $\chi^2$ (131) = 202.56, $p < .001$,
366 was concerning since it signaled potential misspecification in the final model, despite having
367 encouraging approximate fit indices. As such, a supplementary test was employed using BCFA
368 (Muthén & Asparouhov, 2012) with approximate-zero prior distributions for constrained
369 parameters (cross-loadings + error covariances). After 10 000 iterations, the highest potential
370 scale reduction (PSR) in the model estimation was 1.030 (which did not increase with additional
371 iterations tested) indicating appropriate convergence of the simulation. Likewise, the highest
372 PSR for computing the prior posterior predictive *p*-value (PPPP) was PSR = 1.007, which
373 indicated that the MCMC iterations for estimation of the minor parameters appropriately
374 converged. After confirming that the estimation converged, we evaluated the model fit using
375 posterior predictive checking (PPC). The 95% CI of the difference between the observed and
376 model-generated $\chi^2$ values included zero (−81.804-51.035), and the posterior predictive *p*-value
377 (PPP) was 0.68. Based on this information, we concluded that the model fits the data well. The
378 PPPP was 1.000, which indicated that we could not reject the hypothesis that our estimates in our
379 model were outside the N(0, 0.01) distribution. Similar to our ESEM analysis, theses results
380 showed that all the target factor loadings (i.e., the factor loading of each item to its underlying
381 factor) were statistically significant and greater than the conventional cut-off point of 0.32. No

cross-loadings were statistically significant or greater than .32. All error covariances were small and non-significant, except for one error covariance that was small but significant between two items in the first factor (0.147). The results from this BCFA supported the results of the approximate fit indices in our ESEM analysis, attesting that the final model is a good fit.

**Discussion**

We explored the factorial validity of the AOSCS using a large sample of Masters coaches' responses. Ultimately, pools of items that assessed coaching practices derived from qualitative research in the coached Masters context (Callary et al., 2015) and andragogic principles in sport (Callary, MacLellan et al., 2015; MacLellan et al., 2015), were refined through independent analyses and then re-combined. Rigorous steps ensured that this merged catalogue of items met criteria for factorial validity, yet still encapsulated adult-oriented practices in coaching Masters sport. The AOSCS comprised the following factors:

1) *Considering the individuality of athletes* (4 items) assesses the frequency at which a coach considers and tailors his/her approach to each adult athlete's experiences and motives in the planning, organization, and delivery of practice.
2) *Framing learning situations* (7 items) refers to the frequency at which a coach frames learning situations for his/her adult athletes through self-discovery, problem-based scenarios, modeling, and assessments.
3) *Imparting coaching knowledge* (3 items) refers to the frequency at which a coach shares his/her own relevant athletic experience, coaching knowledge, and professional coaching development.
4) *Respecting preferences for effort, accountability and feedback* (3 items) assesses how frequently a coach adapts his/her approach to consider how each adult athlete wishes to

be held accountable for working hard and giving effort, and how they wish to receive feedback at practice

5) *Creating personalized programming* (5 items) is the frequency at which a coach considers and tailors aspects of scheduling (practices and competitions), season-long programming, and support at competitions, to an adult athlete's needs and abilities.

## Study 3: Corroborating Construct Validity Based on Athletes' Report

The purpose of Study 3 was to cross-check our findings from Study 2 with an independent sample (DeVellis, 2017). An independent confirmatory sample is important because it is possible during the modification process to capitalize on unstable chance-based factors when determining the fit and factor structure of the model. With an independent sample, no such chance exists because the data from the confirmatory sample did not influence which items were trimmed or retained. Therefore, we aimed to replicate the factor structure of the AOSCS with a sample of MAs who provided data on their coaches in Study 3.

### Method

**Procedure.** Following institutional ethics clearance, MAs were recruited via email in the summer and fall of 2018 and winter of 2019. Emails were forwarded to participants by directors of Masters sport organizations and via their social media platforms. Recruitment information linked to a SurveyMonkey survey. In total, 874 MAs consented to participate, and 736 completed this study. We removed 248 MAs because they did not meet the inclusion criterion of reporting they had a coach. We deleted 21 more participants who did not meet the inclusion criteria for classification as MAs (Young et al., 2011) for being less than 35 years-old and/or indicating that they trained zero times weekly (i.e., did not intentionally prepared to compete).

**Participants.** There were 467 MAs (274 females, 190 males, three undisclosed; $M_{age}$ = 56.69 years, range = 35-87, *SD* = 10.95) who reported having a coach, whose primary sports were swimming (49.7%), track and field (10.5%) and cross-country running (9.9%), and various others such as triathlon, speed skating, and cycling (remaining 29.9%). They were primarily Canadian (72.4%) and American (17.3%), with several countries in the remaining 10.3%. The sample was predominantly Caucasian (92.9%). MAs reported competing across several competitive levels, but their highest competitive participation was at international (33.1%), national (26.2%), provincial (12.0%), regional (12.0%), and recreational (16.6%) levels. MAs trained/practiced, on average, 4.42 times per week (range = 1-20, *SD* = 2.07), of which 2.59 times per week (range = 1-10, *SD* = 1.71) were spent training/practicing in the presence of a dedicated coach.

**Measures.** MAs' perceptions of the frequency with which they felt their coaches used adult-oriented coaching practices were assessed via a slightly modified version of the AOSCS (see Appendix C in supplementary material). The AOSCS items from Study 2 were 'flipped' such that the stem preceding each item was "My coach/instructor…".

**Data analysis.** M*plus* (Muthén & Muthén, 1998-2017) was used to test the fit and factor structure with both ESEM and confirmatory factor analysis (CFA) procedures. Marsh et al. (2014) recommended using both ESEM and CFA and comparing the results for confirmatory analyses. A MLR estimator for the ESEM and the CFA, and the same model fit criteria and the same criteria to judge item-level performance in ESEM as described in Study 2 was used.

## Results

448 **Preliminary analyses.** Inspection of the dataset revealed that 0.98% of the data were
449 missing. Missing data were treated with multiple imputations using an expectation-maximization
450 method (Tabachnick & Fidell, 2013).

451 **ESEM.** The 5-factor ESEM model had excellent fit, $\chi^2$ (131) = 234.89, $p < .001$, $\chi^2/df$ =
452 1.79, CFI = .977, SRMR = .019, RMSEA = .041(90% CI = .033-.050). All items had loadings ≥
453 .32 on intended factors, and no problematic cross-loadings. Descriptive statistics, internal
454 consistencies and latent factor correlations for the AOSCS factors are in Table 2. All CR scores
455 were > .698 suggesting strong internal consistency. All factor loadings are in Table 4.

456 **CFA.** The 5-factor CFA model produced excellent fit statistics, $\chi^2$ (199) = 436.69, $p <$
457 .001, $\chi^2/df$ = 2.19, CFI = .951, SRMR = .036, RMSEA = .049 (90% CI = .043-.056). All items
458 had loadings ≥ .32 on their intended factors (right-most column in Table 4).

459 **BCFA.** Once again, the significant $\chi^2$ tests results for the ESEM analysis, $\chi^2$ (131) =
460 234.89, $p < .001$, and CFA, $\chi^2$ (199) = 436.69, $p < .001$, suggested potential misspecification. As
461 such, a supplementary test was employed using BCFA with approximate-zero prior distributions
462 for cross-loadings and error covariances. After 10 000 iterations, the highest PSR in the model
463 estimation was 1.043 (which did not increase when tested with additional iterations tested)
464 indicating appropriate convergence of the simulation. Likewise, the highest PSR for computing
465 the PPPP was PSR = 1.016, which indicated that the MCMC iterations for estimation of the
466 minor parameters appropriately converged. After confirming that the estimation converged, we
467 evaluated the model fit using PPC. The 95% CI of the difference between the observed and
468 model-generated $\chi 2$ values included zero (−64.583, 38.931), and the PPP was 0.755. Based on
469 this information, we concluded that the model fits the data well. The PPPP was 0.998, which
470 indicated that we could not reject the hypothesis the estimates in our model were outside the N(0,

0.01) distribution. The results also showed that all the major/target factor loadings were statistically significant and greater than the conventional cut-off point of 0.32. None of the cross-factor loadings were statistically significant or greater than .32. With regard to error covariances, only 12 of the 231 were significant and all 12 were small loadings. BCFA results supported our previous findings from the ESEM analysis and the CFA that the final model fits the data well.

## General Discussion

This investigation aimed to establish a survey capable of assessing adult-oriented practices used when coaching MAs. Via three studies, we followed DeVellis' (2017) guidelines to (a) create items that were conceptually informed by andragogic principles and by sport-specific themes for coaching MAs, (b) find evidence for the face validity of the items by having coaches confirm their relevance, (c) determine a factor structure for the AOSCS using a sample of Masters coaches, and (d) confirm the factor structure of the AOSCS using an independent sample of MAs while demonstrating good internal consistency reliability.

Emergent literature underscores there may be particularly nuanced ways of approaching sport coaching with adult sportspersons (Callary et al., 2015), and growing qualitative evidence suggests andragogic principles might be more effective when working with adult athletes (Callary et al., 2017; MacLellan et al., 2019). However, until now, it has been impossible to quantitatively test these hypotheses due to the absence of a valid assessment tool. The advent of the AOSCS is timely given recent interest and offers the only validated scale that specifically targets coaching principles oriented towards adult athletes and adult learning in sport.

Recent research attempted to derive a coaching self-assessment instrument from the field of adult education and tested it in the coaching domain (Young et al., 2020). However, there were problems with the face validity and factor structure of that survey. Its constituent items

494 taken from the parallel domain of adult learning proved inappropriate for measuring coaches' use
495 of adult-oriented learning principles. These findings appeared somewhat counterintuitive to the
496 existing body of qualitative sport research, which highlights synergies between andragogic
497 principles and the actions and strategies that Masters coaches employ with adult athletes (Callary
498 et al., 2017; MacLellan et al., 2018; 2019). Addressing this, Young et al. (2020) disclosed that
499 the language of items imported from adult education (i.e., a non-motor, non-competitive domain)
500 was not sufficiently contextually-sensitive to capture the nuances in the domain of adult sport.
501 Our research was predicated on the notion that a quantitative tool embodying sport, particularly
502 adult learning in Masters sport, may have superior integrity. In the development of the AOSCS, a
503 balance between content informed by qualitative findings related to Masters coaches' behaviours
504 and strategies (Callary et al., 2015) and findings for how Knowles et al.'s (2012) andragogic
505 principles have been represented in the coaching of MAs was sought (Callary et al., 2017;
506 MacLellan et al., 2018; 2019). This content merged in the final structure of the AOSCS.
507 Through three studies, we established foundational evidence for the reliability and
508 validity of the AOSCS. Notably, within the process, many items were eliminated and several
509 themes from two catalogues of items were merged. We thus put forth that the AOSCS is not a
510 direct measure of andragogic principles within the adult sport context. Instead, the AOSCS
511 should be considered an assessment tool of adult-oriented coaching practices specific to (a)
512 planning, organization, and delivering practices that are tailored to adult athlete's experiences
513 and motives, (b) framing learning situations through athlete-discovery, problem-based scenarios,
514 modeling, and assessment, (c) enriching the learning environment by sharing relevant athletic
515 experience, coaching knowledge, and professional coaching development, (d) adapting

approaches to respect how each adult wishes to be held to account for giving effort, and their feedback preferences, and (e) tailoring scheduling according to athletes' needs and abilities.

There are appreciable aspects to the content of the retained items. The wording of many items captures inherent aspects of sport such as the use of performance assessments (e.g., time trials) and competitive opportunities at practice, managing vicarious influences from other peers/competitors, support at competitions, and tailoring both practice and competitive scheduling to adults' needs. The AOSCS also retained themes from Callary et al. (2015). Specifically, how Masters swimmers judged coach credibility based on attributes related to knowledge, rich athletic experiences, and professional development. Items also embody MAs' preferences for coaches who craft intellectually stimulating practices (e.g., asking athletes to relate drills to problems they are trying to remedy in their performance) and who maintain a climate of accountability by organizing the practice, monitoring and holding athletes to a standard for effort, and using time effectively (Callary et al., 2015). Many items assess processes of individualization and tailoring to adults' needs (especially their self-directedness and personal motives). Others assess approaches that encourage bidirectional communication (e.g., asking questions to adults, listening) between coaches and MAs, and the relinquishing of coach control in deference to athlete self-discovery. These latter themes were all at the fore in MacLellan et al.'s (2018; 2019) case study of a coach's tailored approaches to adult paddlers, and have found representation in our AOSCS. Altogether, many of the items, although regrouped under factor names specific to our instrument, capture essential aspects of andragogic principles (Callary et al., 2017. For these reasons, the AOSCS provides an assessment of adult-oriented coaching principles derived from a blend of qualitative research findings that attested to pertinent approaches to coaching MAs and andragogic practices in sport.

**Future Directions and Limitations**

The advent of the AOSCS will allow future studies to test the proposition that an adult-oriented approach, or specific adult-oriented facets (subscales), are related to quality sport experiences for MAs. Further validation will be predicated on showing relationships between AOSCS scores and athletes' reports for key criterion variables, in diverse adult sport settings, different levels of competitiveness, and as a function of MAs' and coaches' characteristics. Research may test whether AOSCS scores associate with athletes' liking of their coach, beliefs about their coach's teaching ability, desire to play for the coach (Smith, Smoll & Curtis, 1979), enjoyment of sport, and resolve to continue sport (Gardner, Magee & Vella, 2016). Future work might determine how AOSCS scores relate to athletes' satisfaction/thwarting of basic needs (Mageau & Vallerand, 2003), and especially autonomy support (Hoffmann, Young, Rathwell, & Callary, 2020), as such criterion measures associate with self-determined motivation and enhanced sport experiences among younger cohorts. In light of literature noting social development through adult sport (Gayman, Fraser-Thomas, Dionigi, Horton & Baker, 2017), researchers might examine associations between AOSCS scores and relatedness support to infer coaches' roles in facilitating social connections. Examining measures as a function of AOSCS factors is a next step in establishing criterion validity.

Future research may also examine if coach and athlete self-reported congruency is important in terms of how AOSCS facets mediate key criterion outcomes. Several cognitive-mediational leadership models in sport coaching posit that athlete outcomes are enhanced when coaching actions align with athlete perceptions of those actions (e.g., Chelladurai, 2007; Smith & Smoll, 1989). Under this premise, one may hypothesize that when there is congruency between coach- and athlete-reports, athletes' evaluations will be more favourable. Examining the average

perceptions of our coaches and MAs in Study 2 and 3 respectively, we note that coaches and MAs generally reported levels in a relatively similar fashion across subscales: considering individuality of athletes, coach *M* = 6.09, range = 2.75-7.00, *SD* = 0.85, athlete *M* = 4.92, range = 1.00-7.00, *SD* = 1.63; framing learning situations, coach *M* = 5.43, range = 2.29-7.00, *SD* = 0.90, athlete *M* = 4.42, range = 1.00-7.00, *SD* = 1.30; imparting coaching knowledge, coach *M* = 5.65, range = 1.00-7.00, *SD* = 1.02, athlete *M* = 5.09, range = 1.00-7.00, *SD* = 1.56; respecting preferences for effort, accountability and feedback, coach *M* = 5.81, range = 3.33-7.00, *SD* = 0.93, *M* = 5.18, range = 1.00-7.00, *SD* = 1.43; creating personalized programming, coach *M* = 5.34, range = 1.66-7.00, *SD* = 1.16, *M* = 4.69, range = 1.00-7.00, *SD* = 1.63. However, coaches generally reported higher levels for all AOSCS facets, and MAs' showed more variability. The caveat in inspecting these data is that the samples were unaffiliated. Future work might test the proposition that the value of AOSCS in explaining criterion outcomes for athletes might depend on a level of congruence between what coaches are saying they are doing and what athletes are saying they are receiving, using matched coach-athlete samples.

We were limited in not being able to recruit enough Masters coaches to split our sample into an exploratory and confirmatory sample in Study 2. Thus, the factorial validity and reliability of the AOSCS structure should be replicated in the future with independent coach samples. Nonetheless, results from our athlete sample were encouraging considering we found good fit with no required modifications. Having an athlete version offers certain advantages in future. Specifically, gaining insights from both athletes and coaches in the same study can help guard against social desirability (Brenner & DeLamater, 2014), which may provide more compelling evidence for the use of AOSCS practices in Masters sport. Another limitation was we did not provide evidence of predictive/nomological validity for the AOSCS. Researchers are

encouraged to explore the cross-sectional and longitudinal relationships between AOSCS factors and criterion measures of quality coaching, coach-athlete relationships, and quality adult sport experiences. It is also important to consider that the original content informing AOSCS factors was constrained to themes found in prior qualitative studies on coached Masters sport (Callary et al., 2015; 2017; MacLellan et al., 2018; 2019). Thus, the AOSCS may be missing some adult-oriented behaviours. Finally, Masters athletics in general has been criticized for being a leisure pursuit for only those who are socio-economically privileged (Dionigi & Litchfield, 2018). Likewise, our results were derived from relatively homogenous groups of coaches and athletes from westernized countries that were predominantly Caucasian. Although the current samples used in this study are representative of typical MAs, future research should continue to test whether the reliability and validity of the AOSCS changes as Masters athletics grows and becomes more inclusive.

In sum, three studies provided evidence for the validity and reliability of the AOSCS. The AOSCS can serve as a valuable self-assessment tool for coaches working with adult athletes, whereby coaches can acquire information pertaining to their use of adult oriented practices. Researchers can use the tool to assess the degree to which coaches use adult-oriented coaching facets with MAs, as well as test their associations with quality sport experiences for adults across different sports, competitive levels, and coaching contexts.

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**Figure 1. Frequency Counts Representing Responses from 12 Coaches for the 50 Numbered Items in the Survey Inventory in Study 1.**

*Note.* Numbered items on the x-axis can be found in Appendix A.

Table 2. ESEM Latent Factor Correlations, Internal Consistencies and Descriptive Statistics for Study 2 (Masters Coaches Sample) and Study 3 (Masters Athletes Sample).

| Factors | 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|---|
| 1. Considering the Individuality of Athletes | (.62) | .10 | .33** | .11 | .36** |
| 2. Framing Learning Situations | (.83) .64* | (.71) | .31** | .53** | .52** |
| 3. Imparting Coaching Knowledge | .49* | (.82) .72* | (.62) | .22* | .40** |
| 4. Respecting Preferences for Effort, Accountability and Feedback | .47* | .58* | (.82) .47* | (.60) | .43** |
| 5. Creating Personalized Programming | .62* | .71* | .61* | (.69) .58* | (.80) (.87) |
| Skewness (Coach Sample; Study 2) | -1.13 | -.53 | -1.09 | -.49 | -.78 |
| Kurtosis (Coach Sample; Study 2) | 1.42 | .07 | 2.00 | -.61 | .41 |
| *M* (Coach Sample; Study 2) | 6.09 | 5.43 | 5.65 | 5.81 | 5.34 |
| *SD* (Coach Sample; Study 2) | .85 | .90 | 1.02 | .93 | 1.16 |
| Skewness (Athlete Sample; Study 3) | -.61 | -.20 | -.74 | -.81 | -.50 |
| Kurtosis (Athlete Sample; Study 3) | -.47 | -.33 | -.28 | .32 | -.55 |
| *M* (Athlete Sample; Study 3) | 4.92 | 4.42 | 5.09 | 5.18 | 4.69 |
| *SD* (Athlete Sample; Study 3) | 1.63 | 1.30 | 1.56 | 1.43 | 1.63 |

*Note.* Internal consistencies (construct reliability) are on the diagonal. Subscale scores range from 1 (never) to 7 (always). *$p < .05$, **$p < .01$. Score reflecting the coach sample are found on top right portion of the correlation matrix, while the scores for the athlete sample are found on bottom left.

Table 3. ESEM Factor Structure for the 22-item, 5-Factor Model in Study 2 (Masters Coaches).

| Items | 1 | 3 | 3 | 4 | 5 | $R^2$ |
|---|---|---|---|---|---|---|
| Considering the Individuality of Athletes (CIA) | | | | | | |
| CIA1. (3) | **.50** | .03 | .05 | .04 | .02 | .29 |
| CIA2. (4) | **.69** | .07 | -.03 | -.16 | .05 | .49 |
| CIA3. (5) | **.46** | -.02 | -.03 | .19 | .10 | .31 |
| CIA4. (6) | **.41** | -.12 | .06 | .19 | .20 | .33 |
| Framing Learning Situations (FLS) | | | | | | |
| FLS1. (1) | .02 | **.45** | .02 | .17 | -.05 | .29 |
| FLS2. (2) | .13 | **.49** | .06 | -.04 | .03 | .30 |
| FLS3. (7) | -.26 | **.51** | -.00 | .17 | .12 | .49 |
| FLS4. (8) | -.00 | **.37** | .13 | .05 | .13 | .29 |
| FLS5. (9) | .29 | **.48** | .11 | .02 | -.13 | .33 |
| FLS6. (10) | -.02 | **.57** | .04 | .05 | .05 | .42 |
| FLS7. (11) | -.11 | **.44** | .00 | .05 | .16 | .31 |
| Imparting Coaching Knowledge (ICK) | | | | | | |
| ICK1. (12) | -.02 | .06 | **.76** | .01 | -.05 | .57 |
| ICK2. (13) | .02 | .12 | **.59** | -.14 | .01 | .38 |
| ICK3. (14) | -.06 | .02 | **.36** | .17 | .17 | .28 |
| Respecting Preferences for Effort, Accountability and Feedback (RPEAF) | | | | | | |
| RPEAF1. (15) | .00 | .08 | .03 | **.67** | -.03 | .50 |
| RPEAF2. (16) | .01 | .31 | -.03 | **.43** | .00 | .41 |
| RPEAF3. (17) | .15 | .10 | .03 | **.50** | .07 | .41 |
| Creating Personalized Programming (CPP) | | | | | | |
| CPP1. (18) | .01 | -.06 | .04 | .18 | **.57** | .43 |
| CPP2. (19) | .13 | -.02 | .15 | -.02 | **.59** | .51 |
| CPP3. (20) | .04 | .29 | -.19 | -.06 | **.66** | .59 |
| CPP4. (21) | .10 | -.12 | .11 | .02 | **.73** | .59 |
| CPP5. (22) | -.05 | .06 | -.02 | -.15 | **.66** | .39 |

*Note.* Factor loadings are standardized. Values loading on their intended factors are in bold. Item numbers corresponding with those found in the Appendix A are listed inside brackets.

Table 4. ESEM and CFA Factor Structure for the 22-item, 5-Factor Model in Study 3 (Masters Athletes).

| Items | 1 | 2 | 3 | 4 | 5 | $R^2$ | CFA |
|---|---|---|---|---|---|---|---|
| Considering the Individuality of Athletes (CIA) | | | | | | | |
| CIA1 (3) | **.55** | .11 | .05 | .17 | .06 | .64 | .81 |
| CIA2 (4) | **.72** | .06 | .11 | .06 | -.02 | .70 | .82 |
| CIA3 (5) | **.72** | .12 | .07 | -.05 | .06 | .74 | .83 |
| CIA4 (6) | **.49** | .03 | .07 | .14 | .23 | .66 | .82 |
| Framing Learning Situations (FLS) | | | | | | | |
| FLS1 (1) | .14 | **.78** | -.08 | .17 | -.27 | .56 | .69 |
| FLS2 (2) | .11 | **.53** | -.10 | .03 | .15 | .45 | .67 |
| FLS3 (7) | -.16 | **.65** | .13 | .06 | -.03 | .45 | .63 |
| FLS4 (8) | -.14 | **.56** | .01 | .15 | .06 | .40 | .63 |
| FLS5 (9) | .16 | **.56** | -.01 | -.09 | .10 | .48 | .70 |
| FLS6 (10) | .23 | **.52** | .01 | -.21 | .12 | .47 | .66 |
| FLS7 (11) | -.16 | **.47** | .17 | -.10 | .17 | .36 | .56 |
| Imparting Coaching Knowledge (ICK) | | | | | | | |
| ICK1. (12) | .15 | -.02 | **.82** | -.07 | -.07 | .66 | .77 |
| ICK2 (13) | -.04 | .02 | **.71** | .10 | .09 | .68 | .84 |
| ICK3 (14) | .00 | .05 | **.67** | .11 | -.02 | .57 | .77 |
| Respecting Preferences for Effort, Accountability and Feedback (RPEAF) | | | | | | | |
| RPEAF1 (15) | .13 | -.04 | .09 | **.60** | .17 | .68 | .79 |
| RPEAF2 (16) | -.02 | .16 | .07 | **.60** | .08 | .62 | .73 |
| RPEAF3 (17) | .25 | .15 | .14 | **.33** | .14 | .68 | .86 |
| Creating Personalized Programming (CPP) | | | | | | | |
| CPP1 (18) | .15 | .10 | .07 | .25 | **.42** | .68 | .84 |
| CPP2 (19) | .01 | -.03 | -.02 | .09 | **.82** | .71 | .81 |
| CPP3 (20) | -.04 | .15 | .17 | -.11 | **.69** | .70 | .81 |
| CPP4 (21) | .16 | -.12 | -.05 | .08 | **.82** | .73 | .79 |
| CPP5 (22) | -.05 | .24 | -.03 | .06 | **.54** | .51 | .72 |

*Note.* Factor loadings are standardized. Values loading on their intended factors are in bold. Item numbers corresponding with those found in the Appendix A are listed inside brackets. Factor loadings for each factor in the confirmatory factor analysis are found in the rightmost column.

**Appendix A. List of 50 Items Vetted by Coaches in Study 1 and 51 Items used in Study 2.**

*Need to Know*

1. Explain to your adult athletes why they are learning something (1)

2. Create situations wherein adult athletes discover for themselves why they are learning a skill/tactic (2)

3. Use performance assessments to help your adult athletes understand why they need to learn a skill/tactic (3)

*Self Direction*

4. Create situations in which your adult athletes take responsibility in training (4)

5. Allow your adult athletes to make their own decisions and choices with regards to their training (5)

6. Set up the training environment so that your adult athletes have choices? (6)

*Life Experiences*

7. Individualize your coaching for each adult athlete based on what s/he has been able to do in past experiences (7)

8. Help your adult athletes examine their habits and biases when they encounter something new (8)

9. Listen to your adult athletes' comments about their past experiences to inform how you set up their training (9)

10. Ask your adult athletes about their past experiences to help you plan their training (10)

11. Challenge your adult athletes to try something new (11)

*Readiness to Learn*

12. Expose your adult athletes to something new to prepare them for learning (12)

13. Design training to be sensitive to demands on your adult athletes' lives outside of sport (13)

14. Consider what your adult athletes want to accomplish when organizing their training (14)

15. Ready your adult athletes to learn by exposing them to higher skilled peers, competitors, or role models (15)

*Problem-Centered Orientation*

16. Ask your adult athletes what their goals are and how they hope to achieve them (16)

17. Ask your adult athletes to do drills in which they need to resolve a challenge (17)

18. Ask your adult athletes to relate drills/exercises to problems they are facing in sport (18)

19. Ask your adult athletes to relate their training to concerns they are facing outside of sport (19)

*Motivated by Internal Cues*

20. Purposefully incorporate variety in your adult athletes' training (20)

21. Set up opportunities for your adult athletes to experience success in practice (21)

22. Set up opportunities for competitive activities for your adult athletes during practice (22)

23. Consider your adult athletes' personal motives when planning your practices (23)

*Accumulated Experience and Professional Development*

24. Demonstrate to your adult athletes that you have knowledge tailored to coaching adults that is different from coaching youth (24)

25. Identify to your adult athletes how your own sport experience bears on the information that your share with them (25)

26. Share information from your own professional coaching development with your adult athletes (26)

27. Bring in information to adult athletes that you have picked up in your sport experiences elsewhere (i.e., outside of your current program or club) (27)

*Preferred Personal Attributes of Coaches*

28. Purposefully display your serious commitment to your adult athletes' program (28)

29. Make efforts to relate to your adult athletes in a social context (29)

30. Encourage friendships among your adult athletes (30)

*Coaching Behaviours Maximizing Efficiency*

31. Treat your athletes as adults (31)

32. Monitor your adult athletes' effort and work ethic (32)

33. Set up practices so that you are making the most efficient use of practice time (33)

34. Consider how each of your adult athletes wishes to be pushed during practice (34)

35. Consider your adult athletes' preferences for being held responsible for working hard (35)

36. Make unpopular coaching decisions if it helps your adult athletes get the most out of training (36)

*Feedback*

37. Use a variety of instructional styles when delivering a practice to your adult athletes (37)

38. Use positive and constructive feedback to encourage your adult athletes (38)

39. Pay close attention to the instructional needs of each adult athlete (39)

40. Take measures to better understand what each adult athlete wants in terms of coaching feedback (40)

41. Avoid negative feedback and criticism of individual adult athletes in front of others (41)

*Practice Strategies*

42. Explain the purpose of drills to your adult athletes (42)

43. Ensure that coaching resources (e.g., equipment, electronic media) and coaching personnel (e.g., assistant coach) are shared with all of your adult athletes (43)

44. Pay attention to where your adult athletes are in terms of their progress relative to season-long plans (44)

*Structural Elements of the Program*

45. Consider how to accommodate your adult athletes when you set up practice/competitive schedules (45)

46. Point out to your adult athletes aspects of long-term programming (e.g., practice/competitive schedules) that you have tailored to them (46)

47. Consider how to accommodate athletes in terms of programming, such as practice or competitive schedules. (NA)

*Interactions Related to Competition*

48. Compete at the same venue as your adult athletes (47)

49. Share information with your adult athletes about how they can improve their preparation for performances (48)

50. Have debrief meetings with your adult athletes after a competition (49)

51. Tailor your support to individual adult athletes at competitions (50)

*Note*. In order to cross-reference items in Appendix A with those found in Figure 1, we have included the corresponding item number from the x-axis in Figure 1 in parenthesis at the end of each item statement. NA = Not applicable is indicated in parenthesis when the item was not vetted by coaches in Study 1.

**Appendix B. Adult oriented sport coaching survey (AOSCS).**

**Instructions:** Based on your current or recent coaching/instruction in your primary Masters sport, please answer the following items.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Never | | | Sometimes | | | Always |

**How frequently do you:**

1. Create situations wherein your adult athletes discover for themselves why they are learning a skill/tactic
2. Use performance assessments to help your adult athletes understand why they need to learn a skill/tactic
3. Individualize your coaching for each adult athlete based on what s/he has been able to do in past experiences
4. Listen to your adult athletes' comments about their past experiences to inform how you set up their training
5. Ask your adult athletes about their past experiences to help you plan their training
6. Consider what your adult athletes want to accomplish when organizing their training
7. Ready your adult athletes to learn by exposing them to higher skilled peers, competitors, or role models
8. Ask your adult athletes to do drills in which they need to resolve a challenge
9. Ask your adult athletes to relate drills/exercises to problems they are facing in sport
10. Ask your adult athletes to relate their training to concerns they are facing outside of sport
11. Set up opportunities for competitive activities for your adult athletes during practice

12. Identify to your adult athletes how your own sport experience bears on the information that you share with them
13. Share information from your own professional coaching development with your adult athletes
14. Bring in information to your adult athletes that you have picked up in your sport experiences elsewhere (i.e., outside of your current program or club)
15. Consider how each of your adult athletes wishes to be pushed during practice
16. Consider your adult athletes' preferences for being held responsible for working hard
17. Take measures to better understand what each adult athlete wants in terms of coaching feedback
18. Pay attention to where your adult athletes are in terms of their progress relative to season-long plans
19. Consider how to accommodate your adult athletes when you set up practice/competitive schedules
20. Point out to your adult athletes aspects of long-term programming (e.g., practice/competitive schedules) that you have tailored to them
21. Consider how to accommodate your adult athletes in terms of programming, such as practice or competitive schedules
22. Tailor your support to individual adult athletes at competitions

Note. Considering the Individuality of Athletes (3, 4, 5, 6), Framing Learning Situations ( 1, 2, 7, 8, 9, 10, 11), Imparting Coaching Knowledge (12, 13, 14), Respecting Preferences for Effort, Accountability, and Feedback (15, 16, 17), Creating Personalized Programming (18, 19, 20, 21, 22)

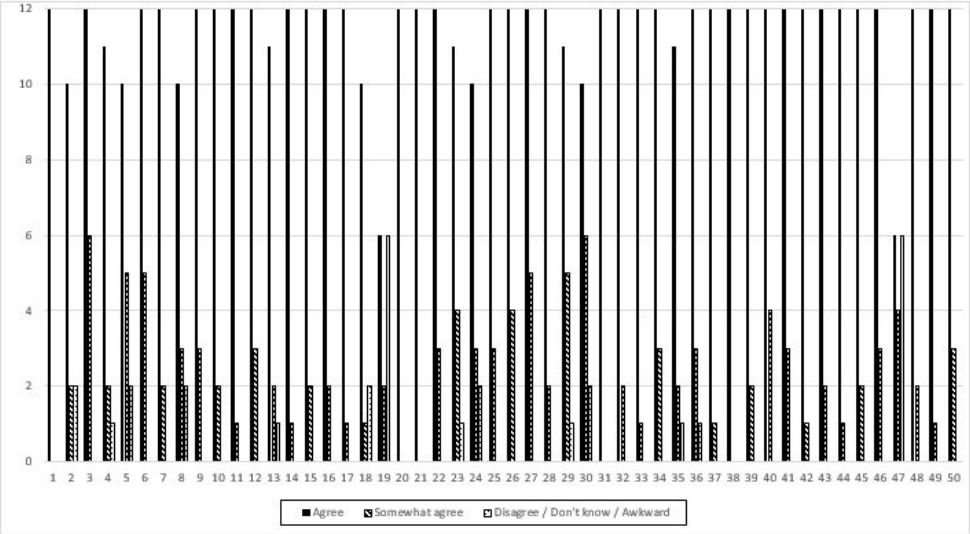


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**Table A.** Original List of Adult Oriented Coaching Survey Items and Decisions Regarding Items

| **Andragogic-based items** | **Decisions regarding items** |
|---|---|
| *Need to Know* | |
| 1. Explain to your adult athletes why they are learning something (1) | Cut in Study 2 for being conceptually problematic after merged trimming process |
| 2. Create situations wherein adult athletes discover for themselves why they are learning a skill/tactic (2) | Retained |
| 3. Use performance assessments to help your adult athletes understand why they need to learn a skill/tactic (3) | Retained |
| *Self-Direction* | |
| 4. Create situations in which your adult athletes take responsibility in training (4) | Cut in Study 2 after merging for low factor loading |
| 5. Allow your adult athletes to make their own decisions and choices with regards to their training (5) | Cut in Study 2 for being conceptually problematic after merged trimming process |
| 6. Set up the training environment so that your adult athletes have choices? (6) | Cut in Study 2 before merging for problematic cross-loading |

| | |
|---|---|
| *Life Experiences* | |
| 7. Individualize your coaching for each adult athlete based on what s/he has been able to do in past experiences (7) | Retained |
| 8. Help your adult athletes examine their habits and biases when they encounter something new (8) | Cut in Study 2 before merging for problematic cross-loading |
| 9. Listen to your adult athletes' comments about their past experiences to inform how you set up their training (9) | Retained |
| 10. Ask your adult athletes about their past experiences to help you plan their training (10) | Retained |
| 11. Challenge your adult athletes to try something new (11) | Cut in Study 2 for being conceptually problematic after merged trimming process |
| 12. Individualize your approach to coaching for each adult athlete based on what they know from their past experiences (NA) | Cut in item generation stage because it was difficult to understand |
| *Readiness to Learn* | |
| 13. Expose your adult athletes to something new to prepare them for learning (12) | Cut in Study 2 before merging for problematic cross-loading |

| | |
|---|---|
| 14. Design training to be sensitive to demands on your adult athletes' lives outside of sport (13) | Cut in Study 2 before merging for problematic cross-loading |
| 15. Consider what your adult athletes want to accomplish when organizing their training (14) | Retained |
| 16. Ready your adult athletes to learn by exposing them to higher skilled peers, competitors, or role models (15) | Retained |
| 17. Make your adult athletes aware of something they don't yet know as a strategy to prepare them for learning (NA) | Cut in item generation stage because it was difficult to understand |
| *Problem-Centered Orientation* | |
| 18. Ask your adult athletes what their goals are and how they hope to achieve them (16) | Cut in Study 2 before merging for problematic cross-loading |
| 19. Ask your adult athletes to do drills in which they need to resolve a challenge (17) | Retained |
| 20. Ask your adult athletes to relate drills/exercises to problems they are facing in sport (18) | Retained |

| | |
|---|---|
| 21. Ask your adult athletes to relate their training to concerns they are facing outside of sport (19) | Flagged in Study 1 during coach vetting but retained |
| 22. Help your adult athletes discover their goals (NA) | Cut in item generation stage for not helping us learn about adult-oriented coaching practices and for being difficult to understand. |
| *Motivated by Internal Cues* | |
| 23. Purposefully incorporate variety in your adult athletes' training (20) | Cut in Study 2 for being conceptually problematic after merged trimming process |
| 24. Set up opportunities for your adult athletes to experience success in practice (21) | Cut in Study 2 after merging for low factor loading and problematic cross-loading |
| 25. Set up opportunities for competitive activities for your adult athletes during practice (22) | Retained |
| 26. Consider your adult athletes' personal motives when planning your practices (23) | Cut for problematic cross-loading after conceptual trimming |
| 27. Set up social activities for your adult athletes (NA) | Cut in item generation stage because it was not an important indicator of its respective theme |

| | |
|---|---|
| 28. Encourage your adult athletes to take part in social activities organized by the club/team (NA) | Cut in item generation stage because it was not an important indicator of its respective theme |
| 29. Set up practice and interact with your adult athletes to help them feel confident in their abilities (NA) | Cut in item generation stage for being difficult to understand |
| **Items derived from Callary, Rathwell et al. (2015)** | |
| *Accumulated Experience and Professional Development* | |
| 30. Demonstrate to your adult athletes that you have knowledge tailored to coaching adults that is different from coaching youth (24) | Cut in Study 2 after merging for low factor loading and problematic cross-loading |
| 31. Identify to your adult athletes how your own sport experience bears on the information that your share with them (25) | Retained |
| 32. Share information from your own professional coaching development with your adult athletes (26) | Retained |
| 33. Bring in information to adult athletes that you have picked up in your sport experiences elsewhere (i.e., outside of your current program or club) (27) | Retained |
| *Preferred Personal Attributes of Coaches* | |

| | |
|---|---|
| 34. Purposefully display your serious commitment to your adult athletes' program (28) | Cut in Study 2 before merging for low factor loading |
| 35. Make efforts to relate to your adult athletes in a social context (29) | Cut in Study 2 before merging for low factor loading |
| 36. Encourage friendships among your adult athletes (30) | Cut in Study 2 before merging for low factor loading |
| 37. Engage in sport with your athletes (NA) | Cut in item generation stage for not helping us learn about adult-oriented coaching practices |
| 38. Present yourself in a professional manner (NA) | Cut in item generation stage for being difficult to understand |
| *Coaching Behaviours Maximizing Efficiency* | |
| 39. Treat your athletes as adults (31) | Cut in Study 2 after merging for low factor loading and problematic cross-loading |
| 40. Monitor your adult athletes' effort and work ethic (32) | Cut in Study 2 for problematic cross-loading after conceptual trimming |
| 41. Set up practices so that you are making the most efficient use of practice time (33) | Cut in Study 2 before merging for low factor loading |

| | |
|---|---|
| 42. Consider how each of your adult athletes wishes to be pushed during practice (34) | Retained |
| 43. Consider your adult athletes' preferences for being held responsible for working hard (35) | Retained |
| 44. Make unpopular coaching decisions if it helps your adult athletes get the most out of training (36) | Cut in Study 2 before merging for low factor loading |
| 45. Consider the life demands of your adult athletes (NA) | Cut in item generation stage for not helping us learn about adult-oriented coaching practices and not being an important indicator of its respective theme |
| 46. Take steps to safeguard the integrity of the practices you provide to athletes (NA) | Cut in item generation stage for being difficult to understand |
| 47. Hold athletes to account without being authoritative (NA) | Cut in item generation stage for not being an important indicator of its respective theme |
| *Feedback* | |
| 48. Use a variety of instructional styles when delivering a practice to your adult athletes (37) | Cut in Study 2 before merging for problematic cross-loading |

| | |
|---|---|
| 49. Use positive and constructive feedback to encourage your adult athletes (38) | Cut in Study 2 after merging for low factor loading and problematic cross-loading |
| 50. Pay close attention to the instructional needs of each adult athlete (39) | Cut in Study 2 before merging for problematic cross-loading |
| 51. Take measures to better understand what each adult athlete wants in terms of coaching feedback (40) | Retained |
| 52. Avoid negative feedback and criticism of individual adult athletes in front of others (41) | Cut in Study 2 after merging for low loading |
| *Practice Strategies* | |
| 53. Explain the purpose of drills to your adult athletes (42) | Cut in Study 2 after merging for low loading |
| 54. Ensure that coaching resources (e.g., equipment, electronic media) and coaching personnel (e.g., assistant coach) are shared with all of your adult athletes (43) | Cut in Study 2 for being conceptually problematic after merged trimming process |
| 55. Pay attention to where your adult athletes are in terms of their progress relative to season-long plans (44) | Retained |

| | |
|---|---|
| 56. Tell your athletes why they are doing a practice activity so they can make sense of a drill (NA) | Cut in item generation stage for being difficult to understand |
| 57. Set-up and plan practices that encourage your athletes to be more responsible for their training (NA) | Cut in item generation stage for being difficult to understand |
| 58. Create practices that consider athletes' preferences for how they wish to be challenged (NA) | Cut in item generation stage for being difficult to understand |
| 59. Take steps to vary elements in your practices (NA) | Cut in item generation stage for being difficult to understand |
| 60. Take steps to make your practices interesting to athletes (NA) | Cut in item generation stage for being difficult to understand |
| *Structural elements of the program and practice* | |
| 61. Consider how to accommodate your adult athletes when you set up practice/competitive schedules (45) | Retained |
| 62. Point out to your adult athletes aspects of long-term programming (e.g., practice/competitive schedules) that you have tailored to them (46) | Retained |
| 63. Consider how to accommodate athletes in terms of programming, such as practice or competitive schedules (NA) | Cut in item generation stage, reclaimed in order to maintain minimum of three items per subscale, and was retained. |

| | |
|---|---|
| *Interactions Related to Competition* | |
| 64. Compete at the same venue as your adult athletes (47) | Flagged in Study 1 coach vetting. Cut in Study 2 before merging for low factor loading |
| 65. Share information with your adult athletes about how they can improve their preparation for performances (48) | Cut in Study 2 before merging for low factor loading |
| 66. Have debrief meetings with your adult athletes after a competition (49) | Cut in Study 2 before merging for problematic cross-loading |
| 67. Tailor your support to individual adult athletes at competitions (50) | Retained |
| 68. Consider the wants and needs of individual athletes when giving information and support at competitions (NA) | Cut in item generation stage for being difficult to understand |

Note. Item # corresponding to Figure 1 is listed in brackets in the left hand column. NA = Not applicable (i.e., item was not vetted by coaches in Study 1).

Appendix C. Adult oriented sport coaching survey (AOSCS).

**Instructions:** Think about your current/recent involvement in your primary Masters sport. Consider the coach/instructor who primarily supports you while answering the following items.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Never | | | Sometimes | | | Always |

**How frequently does your instructor:**

1. Creates situations wherein I discover for myself why I am learning a skill/tactic
2. Uses performance assessments to help me understand why I need to learn a skill/tactic
3. Individualizes his/her coaching based on what I have been able to do in past experiences
4. Listens to my comments about my past experiences to inform how s/he sets up my training
5. Asks about my past experiences when planning my training
6. Considers what I want to accomplish when organizing my training
7. Readies me to learn by exposing me to higher skilled peers, competitors, or role models
8. Asks me to do drills in which I need to resolve a challenge
9. Asks me to relate drills/exercises to problems I am facing in sport
10. Asks me to relate my training to concerns I am facing outside of sport
11. Sets up opportunities for competitive activities for me during practice
12. Identifies how his/her own sport experience bears on the information that s/he shares with me
13. Shares information from his/her professional coaching development with me
14. Brings in information to me that s/he has picked up in his/her sport experiences elsewhere (i.e., outside of my current program or club)
15. Considers how I wish to be pushed during practice
16. Considers my preferences for being held responsible for working hard

17. Takes measures to better understand what I want in terms of coaching feedback
18. Pays attention to where I am in terms of my progress relative to season-long plans
19. Considers how to accommodate me when s/he sets up practice/competitive schedules
20. Points out aspects of long-term programming (e.g., practice/competitive schedules) that s/he has tailored to me
21. Considers how to accommodate me in terms of programming, such as practice or competitive schedules
22. Tailors his/her support to me at competitions

*Note.* Considering the Individuality of Athletes (3, 4, 5, 6), Framing Learning Situations ( 1, 2, 7, 8, 9, 10, 11), Imparting Coaching Knowledge (12, 13, 14), Respecting Preferences for Effort, Accountability, and Feedback (15, 16, 17), Creating Personalized Programming (18, 19, 20, 21, 22)