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ABSTRACT
The Coaching Behavior Scale for Sport (CBS-S) is designed to evaluate coaches' involvement in developing athletes, taking into considerations the complex training and competition environment. Although the CBS-S has been used in a number of empirical studies, the factor structure of the instrument has not been examined rigorously. The present study was, therefore, conducted to assess the factor structure of the CBS-S for Singaporean youth athletes. A total of 519 participants completed the CBS-S, and their responses were examined with confirmatory factor analysis (CFA) and recent exploratory structural equation modeling (ESEM). Both seven-factor CFA and ESEM models fit to the sample data adequately. In addition, the sizes of factor loadings on target factors were substantial and found comparable between the CFA and ESEM solutions. The findings from this study supported the factorial validity of the CBS-S for the present sample.

Key words: Coaching Behavior, Talent Development, Youth Sport

INTRODUCTION

Coaching is a highly complex process and coaches are required to undertake a variety of tasks such as in-depth planning of training and competition, organizational tasks, and mentoring of athletes, which extend well beyond teaching skills and tactics.[1] Coaches' ability to deliver these key expectations is likely to determine their coaching effectiveness. Effective coaching is crucial to the development of athletic talent; however, the outcome of athletes' performance (i.e., win or loss) has been the dominant method to evaluate coaches' work and effectiveness.[2] Mallett and Côté[2] argued that such an approach is problematic because it does not take into account other important aspects of coaching (e.g., athlete-coach relationship),

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which might influence performance results. Increasingly, researchers have suggested evaluating coaches' abilities and performances from a multidimensional perspective.[1,2] Capturing the quality of coaches' work is the key to the ongoing professional development of coaches.[2]

Several conceptual frameworks and models have been developed to organize and explain the meaning of coaching effectiveness from high performance and youth sport coaching contexts.[3] Some of the most influential and often cited models are: the Mediational Model of Coaching Behaviors,[4,5] the Multidimensional Model of Coach Leadership,[6,7] the Model of Coaching Effectiveness,[8] and the Coaching Model.[9] The four models used to describe coaching effectiveness share the following assumptions: a) athletes' development is the key focus for coaches, b) coaches' beliefs and values are closely linked to coaching effectiveness, and c) coaching behaviors must be adapted to meet the specific needs of athletes in the specific coaching context.[3] Because the role of the coach should be focused on the holistic development of athletes,[10] he or she has "a significant effect on athletes' performance as well as their psychological or emotional well-being".[8] Therefore, having an instrument to assess athletes' perceptions and evaluation of coaches' competencies in coaching is important to the continued development and refinement of coaching effectiveness models.[11]

A range of methodologies have been developed and used to measure coaches' effectiveness. One of the methodologies is to observe *what* coaches do and *how* they behave during training sessions and competitions. Several instruments have been used in empirical research to systematically observe coaches' behaviors (e.g., Coach Behavior Assessment System;[4] Coach Analysis and Intervention System),[12] and to some extent, interaction with athletes (State Space Grid Method by Erickson).[13] In these studies, coaching behaviors are systematically assessed by trained observers, which are based on criteria described in the instrument.

Another methodology is to evaluate coaches' behavior from the athletes' perspective. Several self-report instruments such as the Leadership Scale for Sport,[7] the Coaching Behaviour Assessment System,[4] the Decision Style Questionnaire,[14] and the Controlling Coach Behavior Scale[15] have been developed to assess athletes' perceptions of coaching behaviours (e.g., efficacy, decision-making, controlling, or social-support styles) associated with athletes' outcomes (e.g., satisfaction, motivation, and enjoyment). Other instruments such as the Coaching Evaluation Questionnaire[16] and the Coaching Behavior Questionnaire (CBQ)[17] are designed to assess athletes' evaluative reactions to specific aspects of their coach's behavior such as personal qualities, professional relationships, and organizational skills. However, these instruments, such as CBQ, only measure certain coaching behaviors (e.g., negative activation and supportiveness, and emotional composure) and targeted scenarios (e.g., competition against a top opponent) rather than a more holistic view of the range of coaching behaviors, which has obvious limitations.[18] On the other hand, the Coaching Competency Scale,[18] Coaching Competency Scale II – High School Teams,[19] and Coaching Success Questionniare-2[20] have provided evidence to support athletes' evaluation of their coach's abilities to influence athletes' learning outcomes (e.g., self-confidence) [20] and performance, and predict athletes' satisfaction with the coach.[11] Nonetheless, more research is warranted to investigate the utility of coaching competency and other well-defined instruments within broader conceptions of coaching effectiveness to advance our knowledge in this field of research.[11] One such measure is the Coaching Behavior Scale for Sport (CBS-S), developed by Côté et al.[10]

Côté et al.[9] developed the Coaching Model (CM) using an expert systems approach to examine how expert coaches behaved. This model of coaching behaviors is suitable for all

forms of coaching, including participation and performance.[9] Central to the CM is the notion that expert coaches develop "mental models" that shape how coaches think about the potential of players/teams and subsequently direct their behaviors in competition, organization, and training. Consistent with Mageau and Vallerand's motivational model,[21] the CM proposes that coaches' behaviors are shaped by the interdependency between a coach's own characteristics, his/her perceptions of an athlete's characteristics, and the context in which coaching occurs (participation or performance). Athletes are key actors in the coach-athlete relationship and their views of the quality of coaching they receive are central to informing an understanding of that work.[22] Coaches are performers in their own right and athletes' feedback about the quality of coaching they receive should complement other data in making judgments about the performance of coaches.[2] To collect data from athletes about the coaching they received, Côté et al.[10] developed the CBS-S based on the CM. A key benefit of the CBS-S is that the instrument captures multidimensional aspects of coaches' work (discrete behaviors) that can be measured.

The CBS-S measures seven dimensions of a coach's consistent involvement with the athletes in the complex training and competition coaching environments.[2] They are Physical Training and Planning (the coach's involvement in the athlete's physical training and conditioning for training and competition), Technical Skills (the coach's provisions of feedback, demonstration, and cues), Goal Setting (the coach's involvement in identifying, developing, and monitoring the athlete's goals), Mental Preparation (the coach's involvement in providing the athlete with advice on how to perform well under pressure), Competition Strategies (the coach's constructive interaction with the athlete in competition), Personal Rapport (the coach's approachability, availability, and understanding of the athlete), and Negative Personal Rapport (the coach's use of negative techniques such as fear and yelling for coaching). Côté et al.[10,23,24]examined the psychometric properties of the original CBS-S that consisted of 44 items. The factor structure of the original CBS-S was examined by conducting exploratory factor analysis on the data collected from 205 young athletes (M_{age} = 19.6, SD_{age} = 4.4) from seven sports (majorities were from rowing, track and field, and rugby) and extracted the seven factors mentioned earlier.[10] Baker et al. examined predictive validity of the CBS-S responses on sport anxiety[23] and coaching satisfaction[24] by conducting multiple regression analyses. In the studies, participants were 228 young athletes (M_{age} = 18.3, SD_{age} = 3.8)[23] from 15 sports (majorities were from swimming, soccer, volleyball, and rowing) and 198 young athletes (M_{age} = 17.8, SD_{age} = 4.0)[24] from 14 sports including team and individual sports. While the scale has been used in a number of empirical studies,[23,24,25] its psychometric properties have not been assessed rigorously by using more advanced multivariate statistics. Moreover, the CBS-S was developed from a sample in Canada and has been used mainly for Caucasian adult athletes. Its psychometric properties have not been examined on data from other cultures, contexts, and age groups, to ensure that the instrument is robust, reliable and valid. Hence, this lack of empirical examination might limit the generalization of research findings to other cultural, ethnic, and age groups.

In Singapore, more than 200 championships over 29 sports are organized annually by the Singapore School Sports Councils for primary and secondary schools, and approximately 55,000 student-athletes have competed in the National Sports Games.[26] These figures show that large amount of students (about one-tenth of Singaporean students) competed in the games. Thus, it is critical for student's positive participation in sports to have a valid and reliable instrument for the assessment of a coach's ability in developing athletes' critical outcomes (e.g., competence, confidence).

Although Mallett and Côté[2] argued that the responses to the CBS-S provide a

comprehensive profile of coach behaviors that can be useful in assessing coaching performances and competencies, such an argument is based on the premise that the hypothesized factor structure of the CBS-S is valid. Given that developmental changes are significant from childhood to early adulthood, the hypothesized factor structure that was previously supported with young adults may not be tenable for children or adolescents. For example, Marsh[27] reported that the self-concepts of very young children tended to be uniformly high across different domains and relatively less differentiated, whereas self-concept became more differentiated during preadolescence. In the present study, therefore, the factor structure of the latest version of the CBS-S was rigorously assessed for the data collected from youth athletes using both confirmatory factor analysis (CFA) and exploratory structural equation modeling (ESEM).

METHOD

PARTICIPANTS AND PROCEDURE

Participants were 519 Singaporean competitive basketball players (378 boys and 124 girls; 17 participants did not report their gender) who have competed for their schools in the interschool competitions organized by the Ministry of Education (MOE), Singapore. They were recruited from 21 schools in support of MOE across the all four school zones in Singapore. Participants' ages ranged from 11 to 18 years (97 primary school students, 379 secondary school students, and 43 junior college students). The study was approved by an institutional review committee and adhered to the guidelines for ethical practice. Permission for conducting the study was also from the MOE and school principals. Informed consent was received from each participant's parent, and participants were told that participation was voluntary and they were free to withdraw from the study at any time. Surveys were conducted during the post season for all the participants. Because bilingualism is a cornerstone of Singapore's educational system, students are taught in English at schools in Singapore.[28] All participants were fluent English speakers and therefore, the questionnaires written in English were administered at the targeted schools. Participants were asked to think about the current coach who was responsible for the entire season with them. The first author was on site to answer questions and collect the completed questionnaires.

MEASURES

Perceived Coaching Behavior. The Coaching Behavior Scale for Sport (CBS-S)[10] is an instrument that assesses coaching behaviors from athletes' perspectives. It has been modified and the current version of the CBS-S consists of 47 items,[2] measuring seven dimensions of coaching behaviors: Physical Training and Planning (7 items), Technical Skills (8 items), Goal Setting (6 items), Mental Preparation (5 items), Competition Strategies (7 items), Personal Rapport (6 items), and Negative Personal Rapport (8 items). Example items from the CBS-S are "My coach provides me with structured training sessions" (Physical Training and Planning), "My coach makes sure I understand the techniques and strategies I am being taught" (Technical Skills), "My coach shows confidence in my ability during competitions" (Competition Strategies), and "My coach shows understanding for me as a person" (Personal Rapport). Respondents were asked to rate their coach's behaviors by responding to each of the items on a 7-point Likert scale, ranging from 1 (*never*) to 7 (*always*). One item about ensuring competition facilities and equipment was excluded from the subscale of competition strategies because of its irrelevance to the present sample's sport (i.e., basketball). Therefore, a 46-item revised version of the CBS-S was employed in this study.

Coaching Satisfaction. To evaluate concurrent validity of the CBS-S, athletes' satisfaction

with their coaches' coaching behaviors was measured with the Leadership subscale of the Satisfaction Scale that consists of two subscales (Leadership and Personal Outcome).[29] In the study by Chelladurai et al.[29] with Canadian and Japanese undergraduate male athletes, the internal consistency coefficient (Cronbach's alpha) of the Leadership scale was .95 and it was significantly correlated with leader behaviors perceived by the athletes for both cultural samples. Example items from the subscale are "The leadership provided by my coach" and "My coach's ability to teach me." Respondents indicated the degree of their satisfaction with their coaches' coaching behaviors by replying to each of seven items on a 7-point Likert scale, ranging from 1 (*dissatisfied*) to 7 (*very satisfied*).

DATA ANALYSES

CFA and ESEM were carried out using M*plus* (Version 6.12)[30] based on M*plus* robust maximum likelihood estimation (MLR). In typical CFA, each indicator is specified to load onto only one factor (target factor) and no cross-loadings are allowed. This stringent requirement, however, often causes poor fit of the hypothesized model to the data and leads to major model modification to find a well-fitting model.[31] Moreover, misspecification of zero cross-loadings usually inflates factor correlations to some extent unless all non-target loadings are almost zero.[31,32,33] Marsh and colleagues[32,33] demonstrated the usefulness of ESEM, an integration of CFA and exploratory factor analysis to overcome these methodological issues related to the traditional CFA approaches. They advised that, "subsequent CFA studies routinely consider ESEM solutions as a viable alternative, even when the fit of CFA solutions is apparently acceptable".[32] Therefore, both approaches are employed to examine the factor structure of the CBS-S and their solutions were compared for an accurate interpretation of individual parameters.[34] In ESEM, all items are allowed to load on every factor and all factor loadings are estimated in the ESEM model by imposing appropriate restrictions on the factor loading matrix and the factor covariance matrix[32,33] (see also Asparouhov and Muthén[31] for further details of the ESEM approach and identification issues). In addition, an oblique geomin rotation was used because a) the factors measured by the CBS-S are expected to covary and b) the geomin rotation criterion is the default in M*plus* and found the most effective criterion when the true factor loading structure is unknown.[31] The Expectation Maximization Algorithm was used to treat missing data (less than 0.5% missing responses for each scale). To assess overall model fit, several criteria were used: the MLR chi-square statistic,[35] the comparative fit index (CFI),[36] the Tucker-Lewis index (TLI),[37] and the root mean square error of approximation (RMSEA),[38] and the standard root mean square residual (SRMR).[39] Values on the CFI and TLI that are greater than .90 and .95 are generally taken to reflect acceptable and close fits to the data. For the RMSEA, values of .05 or less indicate a close fit, and .08 or less indicate an adequate fit.[40] Finally, values on the SRMR that are less than .08 indicate an adequate fit.[41] In a well-fitting model, this value should be small—.05 or less.

RESULTS

PRELIMINARY ANALYSES

Descriptive Statistics. Descriptive statistics for the CBS-S subscale and item scores are presented in Tables 1 and 2. Means and standard deviations of the 46 item scores ranged as follows: from 2.44 to 6.03 for means and from 1.14 to 2.01 for standard deviations. The items with the lowest and highest mean scores were from Negative Personal Rapport ("My coach uses power to manipulate me") and Technical Skills ("My coach provides visual examples to show how a skill should be done"), respectively. the CBS-S scores were also examined for

their normality. Univariate skewness and kurtosis of all item scores, except for Item 12, were less than the acceptable limit of ±2.00.[42] However, substantial multivariate kurtosis was observed (Mardia's normalized estimate = 115.11) and the CBS-S scores were considered non-normally distributed. Thus, the MLR parameter estimator was appropriate for subsequent data analyses (i.e., CFA and ESEM) because of its robust to non-normality.[35]

Multilevel Structure of Data. Because athletes were drawn from basketball teams competing for their schools, the athletes' responses were likely to be nested within their teams/schools. Intraclass correlation coefficients (ICCs) of the observed variables were examined to find out whether individual-level data (athletes' responses) were non-independent of the group-level factors (teams/schools). ICC values represent the ratio of between-group variance to total variance and range from 0.0 to 1.0.[43] Muthén[44] stated that data are considered hierarchically structured when group-level numbers exceed 15 and ICC values are of .10 or larger. Individual-level ICCs ranged from .05 to .20 (M = .13), with 37 of the 46 values being greater than .10 (see Table 2). These results indicated that athletes' responses to the CBS-S were hierarchically structured and nested within teams/schools. Because of the hierarchically structure of the data, multilevel modeling was considered suitable to examine the factor structure of the CBS-S responses. However, multilevel CFA models with MLR or weighted least square mean-adjusted estimation[45] produced improper solutions due to the small sample size (21 teams/schools) at the group level. Hox and Maas[46] recommended that the group-level sample size should be about 100. Therefore, single-level analyses focusing on the individual level were employed for the following analyses, acknowledging that standard errors might be underestimated.[47]

Table 1. Descriptive statistics of the subscales of the Coaching Behavior Scale for Sport

	All (n = 519)		Boys (n = 378)		Girls (n = 124)	
Variable	**M**	**SD**	**M**	**SD**	**M**	**SD**
Physical Training and Planning	5.38	1.00	5.38	1.00	5.40	.96
Technical Skills	5.79	.98	5.78	1.00	5.90	.94
Goal Setting	5.27	1.21	5.27	1.22	5.32	1.15
Mental Preparation	5.60	1.24	5.61	1.25	5.60	1.22
Competition Strategies	5.69	1.11	5.67	1.12	5.79	1.07
Personal Rapport	5.08	1.34	5.11	1.38	5.06	1.19
Negative Personal Rapport	2.73	1.53	2.94	1.59	2.01	1.06

Table 2. Descriptive statistics of the items of the Coaching Behavior Scale for Sport in confirmatory factor analysis (n = 519)

Item	M	SD	Skewness	Kurtosis	FL	R	ICC
Physical Training and Planning							
Item 01	5.50	1.23	-.490	-.322	.677	.542	.080
Item 02	5.72	1.24	-.759	.006	.766	.413	.120
Item 03	5.87	1.14	-.913	.445	.756	.428	.126
Item 04	5.40	1.36	-.928	.984	.603	.637	.096
Item 05	4.93	1.68	-.785	.081	.508	.742	.070
Item 06	5.31	1.39	-.672	.140	.687	.528	.185
Item 07	4.92	1.85	-.799	-.266	.418	.825	.049

Table 2 (Continued)

Item	M	SD	Skewness	Kurtosis	FL	R	ICC
Technical Skills							
Item 08	5.96	1.27	-1.338	1.693	.830	.311	.093
Item 09	5.90	1.21	-1.045	.625	.864	.253	.103
Item 10	5.87	1.19	-.985	.558	.841	.292	.113
Item 11	5.93	1.17	-1.096	.882	.846	.284	.103
Item 12	6.03	1.19	-1.416	2.150	.732	.464	.131
Item 13	5.80	1.23	-1.116	1.412	.635	.597	.144
Item 14	5.75	1.28	-1.128	1.311	.723	.477	.092
Item 15	5.12	1.77	-.962	.127	.422	.822	.096
Goal Setting							
Item 16	5.45	1.35	-.605	-.245	.883	.220	.149
Item 17	5.38	1.36	-.602	-.196	.904	.183	.191
Item 18	5.09	1.45	-.538	-.126	.728	.469	.171
Item 19	5.10	1.53	-.602	-.232	.801	.359	.121
Item 20	5.16	1.48	-.564	-.215	.758	.425	.148
Item 21	5.46	1.36	-.719	.129	.824	.321	.135
Mental Preparation							
Item 22	5.32	1.61	-.823	.031	.744	.446	.120
Item 23	5.58	1.43	-.964	.498	.839	.296	.111
Item 24	5.66	1.35	-.929	.368	.897	.195	.155
Item 25	5.64	1.39	-.976	.489	.893	.203	.139
Item 26	5.80	1.31	-1.151	1.083	.851	.276	.146
Competition Strategies							
Item 27	5.74	1.32	-.982	.470	.859	.262	.153
Item 28	5.78	1.27	-1.059	.857	.844	.288	.156
Item 29	5.59	1.30	-.687	-.200	.784	.386	.140
Item 30	5.71	1.24	-.847	.373	.876	.232	.129
Item 31	5.74	1.26	-.906	.474	.846	.284	.143
Item 32	5.55	1.36	-.794	.242	.757	.427	.133
Personal Rapport							
Item 33	5.52	1.41	-.772	.054	.840	.294	.119
Item 34	5.33	1.48	-.662	-.180	.872	.239	.172
Item 35	5.04	1.70	-.519	-.678	.847	.282	.177
Item 36	4.98	1.67	-.505	-.485	.773	.403	.162
Item 37	4.90	1.72	-.535	-.493	.725	.474	.108
Item 38	4.74	1.83	-.469	-.734	.609	.630	.079
Negative Personal Rapport							
Item 39	2.86	1.93	.690	-.787	.680	.537	.078
Item 40	2.97	1.91	.639	-.747	.645	.584	.117
Item 41	2.64	1.80	.886	-.284	.797	.365	.155
Item 42	2.94	2.01	.636	-.916	.732	.464	.139
Item 43	2.60	1.90	.875	-.505	.873	.238	.145
Item 44	2.44	1.85	1.058	-.120	.898	.194	.158
Item 45	2.56	1.87	.929	-.425	.820	.327	.196
Item 46	2.85	1.99	.733	-.732	.722	.479	.160

Note. FL= factor loadings; R = residuals. ICC = Intraclass correlation coefficient. All factor loadings are significant at $p < .05$.

CFA AND ESEM

Factor Structure. The CFA model provided a satisfactory fit to the data (MLRχ^2 [968, n = 519] = 2146.69, p < .001; CFI = .911, TLI = .905, RMSEA = .048, SRMR = .059). Factor loadings and latent factor correlations in the CFA solution are presented in Tables 2 and 3, respectively. All factor loadings were statistically significant (range = .42–.90, M = .77) and correlations among the seven factors ranged from -.10 to .81 (M = .70). The corresponding ESEM also provided an acceptable fit to the data (MLRχ^2 [734, n = 519] = 1941.11, p < .001; CFI = .933, TLI = .906, RMSEA = .056, SRMR = .024). Factor loadings and latent factor correlations in the ESEM solution are indicated in Tables 3 and 4, respectively. All items loaded on their target factors more than non-target factors (the range of factor loadings on target factors = .25–.89, M = .63), and latent factor correlations ranged from -.10 to .53 (M = .35). In comparison with the ESEM solutions, the size of factor loadings and inter-factor correlations was found inflated in the CFA solution by fixing all cross-loadings to be zero. Since the hypothesized seven factors were tenable based on the CFA and ESEM solutions, the internal consistency of the CBS-S factors was assessed with Cronbach's alpha. As presented in Table 4, the coefficients of the seven factors ranged from .82 to .93 (M = .90).

Table 3. Factor loadings and residuals in exploratory structural equation modeling (N = 519)

Item	F1	F2	F3	F4	F5	F6	F7	R
F1: Physical Training and Planning								
Item 01	**.304**	.141	.151	.054	.158	.117	-.004	.601
Item 02	**.382**	.178	.113	.069	.158	.083	-.041	.535
Item 03	**.418**	.244	.118	.037	.089	.072	-.061	.519
Item 04	**.650**	.023	.006	.094	.038	-.044	-.071	.522
Item 05	**.733**	-.055	-.074	.021	.038	-.018	.071	.478
Item 06	**.685**	.000	.150	-.003	.027	.070	-.021	.402
Item 07	**.647**	-.037	-.026	-.003	-.058	.039	.136	.575
F2: Technical Skills								
Item 08	.022	**.725**	.009	.076	.097	.084	.028	.277
Item 09	.023	**.738**	.058	.142	.030	.070	.011	.229
Item 10	.069	**.600**	.079	.075	.139	.139	.000	.296
Item 11	.015	**.715**	.024	.113	.076	.090	-.026	.260
Item 12	.160	**.471**	.160	.066	.108	.028	-.039	.463
Item 13	.112	**.382**	.152	.015	.179	.030	-.037	.585
Item 14	.115	**.443**	.144	.137	.138	-.004	-.069	.471
Item 15	.121	**.245**	.101	.024	-.011	.143	.041	.805
F3: Goal Setting								
Item 16	.051	.119	**.593**	.140	.150	.083	.047	.235
Item 17	.078	.114	**.685**	.116	.098	.054	-.031	.180
Item 18	.081	-.016	**.633**	.084	.072	.033	.041	.436
Item 19	.046	-.011	**.672**	.077	.057	.144	.068	.319
Item 20	.020	.003	**.584**	.120	.096	.115	-.002	.416
Item 21	.094	.113	**.562**	.070	.130	.117	-.020	.321

Table 3 (Continued)

Item	F1	F2	F3	F4	F5	F6	F7	R
F4: Mental Preparation								
Item 22	-.010	-.016	.078	**.623**	.093	.100	.005	.438
Item 23	.082	.032	.065	**.662**	.119	.069	-.017	.303
Item 24	.035	.107	.097	**.785**	.022	.026	-.007	.170
Item 25	.032	.043	.075	**.722**	.111	.103	.006	.196
Item 26	.072	.131	.015	**.617**	.209	.015	-.035	.271
F5: Competition Strategies								
Item 27	.042	.122	.147	.168	**.569**	.035	-.009	.271
Item 28	.053	.021	.056	.211	**.617**	.078	-.007	.288
Item 29	.042	.055	.150	.049	**.610**	.069	.020	.367
Item 30	.104	.052	.032	.114	**.742**	.031	-.006	.190
Item 31	.029	.103	.062	.127	**.617**	.124	.008	.283
Item 32	.038	.039	.192	.175	**.406**	.156	-.024	.424
F6: Personal Rapport								
Item 33	.007	.183	.176	.076	.171	**.495**	-.072	.312
Item 34	.051	.123	.131	.067	.104	**.619**	-.066	.289
Item 35	-.002	.056	.077	.087	.047	**.749**	.025	.254
Item 36	.054	.033	.066	.040	.031	**.733**	-.017	.329
Item 37	.047	.017	-.007	.098	.045	**.697**	.050	.399
Item 38	.081	-.004	.049	.042	.044	**.562**	.090	.575
F7: Negative Personal Rapport								
Item 39	.015	-.020	.019	-.030	.077	.072	**.674**	.527
Item 40	.021	.000	-.012	.010	.026	-.052	**.647**	.581
Item 41	.026	-.029	-.031	.027	-.012	-.032	**.796**	.358
Item 42	.086	-.061	.003	-.003	-.082	.003	**.715**	.450
Item 43	.010	.033	.016	.019	-.028	.083	**.876**	.221
Item 44	.013	-.005	.075	-.015	-.021	.010	**.891**	.192
Item 45	.042	-.062	.034	-.089	.028	-.005	**.803**	.322
Item 46	.007	-.033	-.058	-.094	-.060	-.045	**.713**	.430

Note. F= factor; R = residuals. Absolute factor-loading values above .02 are significant at $p < .05$. Target factor loadings are presented in bold.

Table 4. Latent factor correlations in the CFA (lower diagonal) and ESEM (upper diagonal) solutions for the CBS-S (n = 519)

Subscale	PTP	TS	GS	MP	CS	PP	NPP
Physical Training andPlanning (PTP)	(.82)	.27	.29	.23	.29	.21	.07
Technical Skills (TS)	.67	(.89)	.36	.38	.42	.33	-.10
Goal Setting (GS)	.67	.71	(.92)	.41	.47	.41	.01
Mental Preparation (MP)	.59	.70	.73	(.92)	.53	.34	-.07
Competition Strategies (CS)	.66	.75	.80	.81	(.93)	.37	-.05
Personal Rapport (PP)	.58	.68	.73	.65	.71	(.90)	.02
Negative Personal Rapport (NPP)	.02	-.10	.02	-.09	-.06	-.01	(.92)

Note. CFA = confirmatory factor analysis; ESEM = exploratory structural equation modeling; CBS-S = the Coaching Behavior Scale for Sport. Absolute correlation values above .07 and .03 are significant at $p < .05$ in the CFA and ESEM solutions, respectively. Coefficient alphas of the CBS-S subscale scores are presented in parentheses along the diagonal.

Concurrent Validity. Latent factor correlations between the CBS-S and the Coaching Satisfaction Scale responses were examined to assess concurrent validity of the CBS-S responses. As described earlier, the substantial bias was observed in the parameter estimates in the CFA solution. Therefore, the CBS-S factors were specified as ESEM factors and the Coaching Satisfaction factor was identified as a CFA factor. In this model, all CBS-S factors were freely correlated with the Coaching Satisfaction factor. It was proposed that except for Negative Personal Rapport, the CBS-S factors would correlate with Coaching Satisfaction in a positive direction. Because 21 participants missed responding to all Coaching Satisfaction items, their data were excluded from this analysis. Internal consistency coefficient for Coaching Satisfaction was .96. The model provided an acceptable fit to the data (MLRχ^2 [1063, n = 498] = 2626.83, p < .001, CFI = .929, TLI = .908, RMSEA = .054, SRMR = .024). All latent correlations between the CBS-S and Coaching Satisfaction factors were significant, ranging from -.16 to .62 (see Table 5). As expected, all CBS-S factors except for Negative Personal Rapport were positively correlated with Coaching Satisfaction. These results supported the concurrent validity of the CBS-S responses.

Table 5. Latent factor correlations between the subscales of the Coaching Behavior Scale for Sport (CBS-S) and coaching satisfaction

Variable	r
Physical Training and Planning	.36
Technical Skills	.54
Goal Setting	.46
Mental Preparation	.58
Competition Strategies	.62
Personal Rapport	.59
Negative Personal Rapport	-.16

Note. Inter-factor correlations between the CBS-S and Coaching Satisfaction were based on the data from 498 respondents.

DISCUSSION

Quality coaching is central to the development of athletic talent; therefore, it is essential to adequately assess the quality of coach's work and effectiveness beyond the outcome of athletes' performance (i.e., win or loss). Although the CBS-S has been used in a number of empirical studies and recommended as a useful instrument for assessing athlete's perceptions of coach behaviors,[2] the factor structure has not been rigorously examined for youth athletes using advanced statistical procedures. In order to resolve this gap in the literature, the factor structure of the CBS-S was carefully examined in the present study for Singaporean youth athletes by using CFA and ESEM approaches. The results from both approaches indicated that the seven-factor structure model adequately represented the CBS-S responses. In addition to model assessment as a whole, convergent and discriminant validity of the seven factors was supported through the examination of individual parameter estimates. Internal consistency estimates for the seven factors were also found to be satisfactory and indicated that all subscales were internally consistent.

The other significant finding in the current study was that a comparison of the CFA and ESEM solutions was useful to interpret individual parameters appropriately. The sizes of factor loadings on target factors were substantial and found comparable between the CFA and

ESEM solutions. This finding indicated that the items were good indicators for their target factors. Although ESEM is currently only available in the M*plus* statistical package, it is recommended considering ESEM solutions as a part of multivariate strategies for construct validity assessment.

In interpreting the current results, there are several limitations, which should be acknowledged. First, the data analyzed in the present study were hierarchically structured. Due to the improper solutions caused by the small size at the group level, however, multilevel analyses could not be completed and single-level analyses were employed instead. Therefore, caution is warranted to interpret the findings from this study because standard errors might be underestimated.[47] Second, the findings are based on one sample consisting of basketball players only. Although they were recruited from elite youth basketball teams at different school levels, coaching behaviors for team sports might be different from those for individual sports. Cross-validation studies are required to confirm the seven-factor structure of the CBS-S is also valid for the samples consisting of the athletes playing more diverse sports. In addition, the scale was originally developed with Canadian athletes and has been used in Canada, the United States, and Australia.[2,10] Cross-validation studies, therefore, should be conducted with those English-speaking samples. Second, measurement invariance across gender or school levels could not be examined due to sample size limitations (i.e., small numbers of female athletes as well as primary school and junior college students). In fact, the examination of measurement invariance across gender was attempted in the current study; however, the seven-factor ESEM model did not provide an acceptable fit to girls' data because of its small sample size and could not proceed further to test measurement equivalence. Given that measurement invariance is required to make appropriate group comparison,[48] invariance tests should be conducted for the CBS-S responses across common comparison groups (e.g., gender, age, performance levels, or different sports). To illustrate this issue, a 2 (gender) × 3 (school level) between-subjects multivariate analysis of variance (MANOVA) was additionally conducted on the CBS-S 7-subscale scores. Main effects of gender and school level were found significant (for gender: Pillai's Trace = .04, $F[7, 490] = 2.97$, $p < .01$, partial $\eta^2 = .04$; for school level: Pillai's Trace = .22, $F[14, 982] = 8.46$, $p < .001$, partial $\eta^2 = .11$). However, these significant mean differences cannot be interpreted appropriately until the measurement invariance is achieved across the groups at the unit (factor loading) and origin (intercept) level.[48]

CONCLUSION

There are several practical implications from this study. First, the CBS-S has been considered practically useful to provide feedback to coaches about their practice in team sport settings.[25] Moreover, the psychometric support found for this measure provides increased confidence in using the instrument in a youth population for both future research and professional practice. Second, data from the CBS-S could be used to facilitate reflection on specific coaching behaviors and improve coaching practice. It could also be used as a potential source for dialogue between the coach and other key stakeholders to complement other performance data such as competition results. Third, collecting data from athletes about coaching practice might show that the coach values their opinion, which has the potential to enhance the coach-athlete relationship. The perceptions of athletes are an important source of data that should be valued because coaching behavior impacts the quality of the sporting experience and subsequent athlete outcomes.

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