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Beyond Composite Scores and Cronbach's Alpha: Advancing Methodological Rigor in Recreation Research

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Abstract

Critically examining common statistical approaches and their strengths and weaknesses is an important step in advancing recreation and leisure sciences. To continue this critical examination and to inform methodological decision making, this study compared three approaches to determine how alternative approaches may result in contradictory conclusions in the interpretation of the psychometric properties of a scale and in response to a given research question. To this end, this study explored what factors best predicted parental endorsement of competition climbing in a sample of 184 parents of youth competition climbers. The study findings suggest that the three distinct approaches provided meaningfully different conclusions regarding the adapted psychometric properties of the questionnaire, but offered no meaningful differences in the primary finding of the study: Parent–coach relationship quality is the best predictor of parental endorsement of competition climbing. The results suggest that deeper examination of self-report questionnaire data may advance our understanding of complex recreation and leisure constructs beyond what can be understood with less advanced analytic techniques.

KEYWORDS: Cronbach's alpha; applied statistics; applied research methods; factor analysis; parental involvement; PCIS; competition climbing

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In recreation and leisure research, self-report measures are frequently used to assess, observe, and/or describe a broad range of behaviors and phenomena. These measures typically assess latent (i.e., unobservable) dimensions of constructs. Self-report measures and subsequent latent variables can produce reliable results if they are well designed and implemented; however, recreation and leisure researchers often employ inappropriate analytical methods, particularly when dealing with error-prone self-report data. Thus, this paper compares the use of three common analyses of self-report data, described in Table 1, within the context of leisure and recreation research, to address the research question, what factors most contribute to parental support of competition climbing? This article provides background information on parental support and competition climbing to contextualize the three analyses, presents the results of differing analytic approaches applied to identical data, and provides recommendations for future research in this area.

Parental Involvement in Sport and Recreation

A central goal within the study of recreation broadly and within youth sport specifically is to understand factors that influence participation. For youth athletes, parents are often the key decision makers when it comes to their child's sport involvement. Parents can shape how their children are socialized into a sport (Wheeler & Green, 2014), the goals that their children establish for their sport performance (Wolfenden & Holt, 2005), and how their children are involved in sport throughout their lives (Côté, 1999). Therefore, a deeper understanding of factors that contribute to parental involvement within the context of youth sport can help recreation practitioners better engage parents as partners to produce positive outcomes for their child athlete.

Parental endorsement of a child's participation in youth sport has been identified as an important contributor to the quality of a young athlete's experience (Smoll, Cumming, & Smith, 2011). Research suggests that several factors may influence parental support for a child's involvement in a sport, including the nature of the parents' own involvement with the sport (Côté, 1999), the parents' relationship with the coach (Smoll et al., 2011), and the degree of parents' communication and contact with the coach (Holt, Tamminen, Black, Sehn, & Wall, 2008). Each of these factors has been described within the context of youth sport. For example, parental involvement has been defined in terms of both level (i.e., amount of resources invested) and degree (i.e., perception of effort ranging from too little to too much) of involvement (Stein, Raedeke, & Glenn, 1999). In addition, the quality of the parent–coach relationship has been described as coaches and parents cooperating to support the child athlete's performance goals (Jowett & Timson-Katchis, 2005). Finally, the ways in which parents and coaches communicate have been described as essential for understanding how parents and coaches can cooperate successfully. As Smoll et al. (2011) stressed, "Coaches should be willing to answer questions and remain open to parents' input . . . communication is a two-way street. If coaches keep the lines of communication open, they will be more likely to have constructive relations with parents" (p. 18).

Together, these factors (i.e., parental involvement, parent–coach relationships, and parent–coach communication) may predict the extent to which parents support their child's involvement in sport. In other words, parental endorsement of a child's sport may be more likely to occur when parents are involved in their child's sport and when parents have a cooperative, communicative relationship with their child's coach. Although links between these factors have been studied in the education literature (Kohl, Lengua, & McMahon, 2000; Mautone, Marcelle, Tresco, & Power, 2015), studies that have examined these factors within the context of youth sport have most often targeted mainstream sports such as football, basketball, gymnastics, and swimming (Dorsch, Smith, & McDonough, 2009; Dukes & Coakley, 2002; Dunn, Dorsch, King, & Rothlisberger, 2016; Holt et al., 2008). Considering the evidence supporting parents as critical figures in facilitating their child's experiences within elite individual sports (Bremer, 2012) and not just within select mainstream sports, the possible relationship between parental involvement factors is ripe for further study in alternative sport contexts such as competition climbing.

Table 1
Brief Description of Study Analyses

Analysis	Description
1	Cronbach's Alpha as the only measure of psychometric reliability and validity → Items averaged into hypothesized composite factors → Multiple Regression with Independent Variables explaining Dependent Variable (Parental Endorsement of Competition Climbing)
2	Combination of Exploratory Factor Analysis and Cronbach's Alpha as measure of psychometric reliability and validity → Items averaged into indicated composite factors → Multiple Regression with Independent Variables explaining Dependent Variable (Parental Endorsement of Competition Climbing).
3	Combination of Confirmatory Factor Analysis, Cronbach's Alpha, Jöreskog's Rho, Average Variance Extracted, Between-Factor Correlations, and Model Fit Indices as measures of psychometric reliability and validity → Structural Equation Model with Independent Latent Variables explaining Dependent Variable (Parental Endorsement of Competition Climbing).

Competition Climbing

Competition climbing has only recently emerged as a formalized U.S. sport, with the national governing body, USA Climbing (USAC), founded in 1998. However, the sport and the supporting organization have experienced rapid growth and secured external recognition from bodies such as the International Olympic Committee (IOC) and the International Federation of Sport Climbing (IFSC). As a sport, indoor competition climbing typically takes places in purpose-built facilities and consists of three primary subsports, bouldering, sport (i.e., lead) climbing, and speed climbing, at youth (ages 8–19 years) and adult (ages 18/19 and up) levels (USAC, n.d.). Given the limited research into alternative sports and parental involvement, the remainder of this paper examines the strengths and limitations of three analytic approaches through an exploration of parental involvement in indoor competition climbing.

At a simple level, the purpose of recreation and leisure research is to explore, explain, and/or predict "something" with accuracy. In this pursuit, the fields of recreation and leisure continue to advance in their testing of relatively complex phenomena. However, the implementation of inappropriate or outdated techniques to measure and describe relationships persists. These issues are not limited to recreation and leisure research, yet they remain prominent despite the wide availability of resources and training to mitigate them. The following sections describe two issues that continue to be improperly utilized within the context of leisure and recreation research: Cronbach's alpha and composite scores.

Cronbach's Alpha

Cronbach's alpha measures how related a set of items (i.e., questions) are when they are grouped together resulting from an examination of their covariance matrices (e.g., see Table 2; Cohen, Cohen, West, & Aiken, 2003). More specifically, as a statistic, Cronbach's alpha provides only partial evidence of the strength of relationships between items on a scale. This overreliance on Cronbach's alpha highlights a problem within recreation and leisure research wherein the utilization of α is presented as the only measure of a scale's reliability (or as a justification for the use of a previously developed scale). This unidimensional approach is common, but there are several limitations associated with the exclusive use of Cronbach's alpha to demonstrate a scale's reliability. First, Cronbach's alpha relies on interitem covariances; a factor demonstrating a "good" Cronbach's alpha can be produced with differing levels of between-item covariance. As noted by Schmitt (1996) in Table 2, the two matrices indicate equivalent Cronbach's alpha, but also clear differentiation in interitem covariance (presented as correlations for parsimony). Indeed, although the Cronbach's alpha level of .86 may indicate unidimensionality of the factor, a deeper examination of the interitem correlations suggests that in the first matrix, two factors may be present, whereas in the second matrix only one is suggested. This "hidden inequivalence" demonstrates another limitation of Cronbach's alpha. Specifically, when presented with a Cronbach's alpha value of .86, a researcher may not examine data at a deeper level (e.g., the covariance matrix) to determine if additional factors may be possible.

The second challenge embedded within the use of Cronbach's alpha is that it is sensitive to scale length (i.e., number of questions). Specifically, as more items are added to a scale, Cronbach's alpha generally gets higher, even when multiple factors (i.e., constructs) are present within a scale (Streiner, 2003). More plainly, simply adding items to scales (even unrelated ones), can increase the Cronbach's alpha level despite the lack of empirical relationship between items. A third limitation associated with the utilization of Cronbach's alpha relates to the "myth" that Cronbach's alpha represents a measure of internal consistency. As illustrated in Table 2, the same Cronbach's alpha level was generated despite the inconsistency between items, demonstrating "that one needs the additional information to know what alpha stands for, alpha itself cannot be interpreted as a measure of internal consistency" (Sijtsma, 2009, p. 119). In review, Cronbach's alpha provides a summary of the average relationship between items on a scale and is vulnerable to a number of limitations, including an inability to reveal the existence of multiple factors, a sensitivity to larger numbers of items, and a misconception that Cronbach's alpha represents a measure of internal consistency without the examination of other corresponding statistical parameters.

Composite Scores

The term *composite score* (i.e., composite measure, composite variable) generally refers to a variable comprising multiple items or clusters of items and encompasses multiple approaches including indexes, scales, aggregated categorical variables, weighted designs, and refined and nonrefined factor scores (Babbie, 2013; DiStefano, Zhu, & Mindrila, 2009). Refined factor scores (e.g., Bartlett scores, regression scores) differ from nonrefined scores (e.g., sum scores, average scores) in that they require more sophisticated analyses and may produce more precise, standardized estimates (DiStefano et al., 2009). The authors of this study, when referring to composite scores, uses the commonly employed nonrefined average score method. With this approach (presented in Table 3), this study created composite scores by summing a participant's responses to a series of questions that are hypothesized to be related and then dividing this sum by the number of questions within that factor. For example, this study calculated the composite score of Participant A in Table 3 by adding the scores for Q1 through Q4 and then dividing it by the number of questions (15 ÷ 4) to create a composite score (3.75). This approach is more widely used because of its straightforwardness; however, the use of average composite scores (and composites generally) can be problematic.

Compared to latent measures, and more refined composite scores for that matter, the average composite approach is inaccurate because "all items on a factor are given equal weight, regardless of the loading value" (DiStefano et al., 2009, p. 3). In other words, average composite scores incorrectly treat items as equivalent. The potential for error associated with this approach is made clear in a comparison of participants A and D within Table 3. Participants A and D both have an average composite score of 3.75 and are therefore statistically identical at the aggregate level (i.e., composite); however, at the item level, these participants clearly indicate response differences. Thus, composite scores can potentially mask or fail to account for salient individual

Table 2
Sample Interitem Matrices With Equal Cronbach Alpha

Variable	1	2	3	4	5	6	Variable	1	2	3	4	5	6
1	-						1	-					
2	.8	-					2	.5	-				
3	.8	.8	-				3	.5	.5	-			
4	.3	.3	.3	-			4	.5	.5	.5	-		
5	.3	.3	.3	.8	-		5	.5	.5	.5	.5	-	
6	.3	.3	.3	.8	.8	-	6	.5	.5	.5	.5	.5	-
		α = .86							α = .86				

Note. All examples are written in correlational form for ease of presentation and interpretation. Adapted from "Uses and Abuses of Coefficient Alpha," by N. Schmitt, 1996, *Psychological Assessment, 8,* p. 351.

differences. For example, Participant A scored a 1 on Q3 and Participant D scored a 5 on that item. Latent modeling, in contrast, accounts for these item-level differences and further assumes a more error-prone measurement model (Coffman & MacCallum, 2005).

One advantage to latent modeling compared to composite scoring is that it "distinguish[es] the error component from what is shared with a factor" (DiStefano et al., 2009, p. 7). In other words, latent models appropriately extract measurement error, allowing for true score variance to be represented; thus, in most cases, latent measures are preferred because they produce more accurate and often greater effect sizes (Ledgerwood & Shrout, 2011; Stephenson & Holbert, 2003). Similarly, although composite scores tend to be more precise (i.e., produce smaller standard errors) compared to latent variables, they are more likely to produce type I error (i.e., incorrectly rejecting a null hypothesis). Further, the precision advantage of composite scores decreases as the sample size increases (Ledgerwood & Shrout, 2011). Composite scores are also overreliant on measures with high reliability as determined by the Cronbach's alpha level, which has been identified as a flawed indicator of reliability (Ledgerwood & Shrout, 2011). In review, widely used composite scores are created by summing responses to a series of related questions in a factor and then dividing the sum by the number of questions within that factor. Composite scores are limited because they fail to account for individual differences in participant responses (i.e., responses for all items are treated as equivalent) and are more susceptible to type I error.

Study Purpose and Contribution

Within mainstream sport contexts (e.g., football, basketball, tennis) prior research indicates parental endorsement of a child's participation within a sport can lead to sport success and positive developmental outcomes. In this vein, this study explores factors that contribute to parental endorsement within an alternative sport context, competition climbing, using three analytical approaches common to recreation and leisure research (summarized in Table 1). Specifically, the purpose of this study was to explore the potential benefits and consequences of each analytical approach and to continue the advancement of methodological rigor within leisure and recreation sciences. Concurrently, this study of parental behaviors establishes a foundation for future investigation of parental involvement in competition climbing and assists competition climbing providers and coaches in better understanding factors that influence parental endorsement of the sport of climbing. The following sections describe the study procedures, detail the analytic approaches, present the results, and discuss the consequences of each approach for future research.

Table 3
Sample Composite Scores

	Participant				
Question	**A**	**B**	**C**	**D**	**E**
Q1	4	1	5	3	5
Q2	5	2	5	3	1
Q3	1	1	5	5	1
Q4	5	2	5	4	4
Σ	15	6	20	15	11
Composite Score	3.75	1.5	5	3.75	2.75

Method

Participant Characteristics and Procedures

As part of a larger study examining the indoor competition climbing community, parent respondents completed a questionnaire (see Table 4 for items and basic descriptive statistics) relating to support of their child's participation within the sport of competition climbing. Respondents in this portion of the study were parents of active[1] USAC youth athletes (aged 8–19), and were primarily White (n = 165, 89.2%), female (n = 142, 75.5%), highly educated (79.2%, n = 148, reported a bachelor's degree or higher), and high-income earners (average income of $150,164, *SD* = $78,820). Respondents were encouraged to participate in the study with a raffle entry to win a $250 outdoor equipment package and recruited via social media through a link posted on USAC's Facebook page (four posts over 21 days) and two e-mails to USAC's membership list. Internal tracking conducted by USAC of e-mail and social media engagement (e.g., unique viewing of Facebook posts) indicated a sample of 1,490 potential respondents for the larger study (inclusive of youth climbers, parents, coaches, volunteers, and other stakeholders within the climbing community). Of these potential respondents, 965 completed the relevant questionnaires. Respondents were directed through the Qualtrics survey software (embedded with "skip logic") to relevant question sets and excluded from completing unrelated questions (e.g., parent respondents did not answer questions about coaching strategies or climbing-wall management).

Response Rate and Power Analysis

The combination of study announcements and incentives led to a 64.76% response rate to the larger study (965 ÷ 1,490) and a subsample of 189 parents for this study. As described in Table 1, three analytic approaches were utilized to explore the research question, how do common parental behaviors predict parental endorsement of competition climbing? Prior to these techniques being used to answer the question, a power analysis was conducted to determine if a sufficient sample size was present given the number of factors (four total, three independent and one dependent). The results of this power analysis indicated that a power level of .05 (λ = 10.90, k = 3) can be achieved with a sample of 102, and this would be adequate to illustrate significant predictive relationships at an R^2 level of .10, indicating that the preliminary study sample (N = 189) was adequate for Analysis 1 and Analysis 2. An additional power analysis was conducted for the confirmatory factor analysis component of Analysis 3, more precisely the level of necessary power to examine convergent (e.g., √Average Variance Extracted) and discriminant validity of the latent factors at a correlational level (between-factor r = .4, $p \leq .05$). This analysis

[1]Active participants competed within a USAC-sanctioned youth event within the past or current year.

indicated that a sample of 189 exceeded the desired level of power ($\lambda \geq 10.90$) for evaluating the latent convergent and discriminant relationships between and within the factors ($\lambda = 362.00$). In aggregate, these results suggest that the sample size was adequate enough for an exploration of the research question with the three approaches described in Table 1 (see also Cohen et al., 2003, for a detailed explanation of power analysis strategies).

Development of the Parent–Coach Involvement Scale

The Parent–Coach Involvement Scale (PCIS) was adapted for this study from the Parent–Teacher Involvement Questionnaire (PTIS; Corrigan, 2002; Miller-Johnson & Maumary-Gremaud, 1995; Walters, 2001). The PTIS was selected because of its fit with the research question and extensive evidence of reliability and validity across a range of advantaged and disadvantaged groups (Kohl et al., 2000; Mautone et al., 2015). The goal of the PTIS is to assess "the amount and type of contact that occurs between parents and teachers, the parent's interest and comfort in talking with teachers, the parent's satisfaction with their children's school, and the parent's degree of involvement in the child's education" (Walters, 2001, p. 1). More specifically, the PTIS measures four dimensions of parent–teacher involvement: (1) frequency of parent–teacher contact (e.g., I have called my child's teacher), (2) parental involvement (e.g., I have attended parent–teacher conferences), (3) parent–teacher relationship quality (e.g., I enjoy talking with my child's teacher), and (4) parental endorsement of child's school (e.g., my child's school is a good place for them). Dependent upon the factor, items in the PTIS were measured on a 5-point Likert scale in terms of frequency (e.g., *never, once or twice a year, almost every month, almost every week, more than once per week*) or as level of agreement (*strongly disagree, disagree, not sure, agree, strongly agree*), for which higher scores indicate higher frequency or support.

Prior psychometric investigation (Kohl et al., 2000) of the PTIS through confirmatory factor analyses indicated acceptable levels of model fit (e.g., CFI = .89, RMSEA = .07), reliability across the four factors (e.g., α = .71 to .92), and discriminant validity between factors (e.g., r = -.09 to .61). Despite the overall evidence of reliability and validity of the PTIS, the CFA results provided by Kohl et al. (2000) also suggested challenges with low individual item loadings within the frequency of parent–teacher contact factor (e.g., item loadings between .13 and .58). For this study, the PCIS was adapted from the PTIS to reflect an out-of-school-time sport/recreation context, with items adjusted to reflect the relationship between a parent and coach rather than a parent and teacher. For example, the item "You feel welcome in your child's school" was adapted to "You feel welcome at your child's climbing competitions." Beyond these adaptations, three items were dropped because of their school-centric context (e.g., I take my child to the public library). Finally, a similar 1–5 Likert-style frequency or agreement approach was utilized in this study, with higher scores also indicating higher levels of frequency or support for the questionnaire statements.

Data Preparation

Prior to the analyses, the data were examined for outliers, normality, and missingness within SPSS 24 software. First, boxplots of each variable were examined for highly unusual data for which respondents provided scores that were more than three interquartile range(s) from the end of the boxplots (Frigge, Hoaglin, & Iglewicz, 1989). This process uncovered eight highly unusual cases, which were removed from the data set. Second, the data were examined for multivariate normality utilizing Mahalanobis distance and the chi-square distribution ($p \leq .001$) function. The results of this combination of tests indicated that six additional respondents were negatively influencing multivariate normality within the data set and thus were removed from later analyses. After the removal of outlier cases, the data were screened for nonnormality through an examination of skewness and kurtosis levels. As noted in Table 4, most variables exhibited a slight to moderate negative skew. Further, for the variable-level data, eight of the 20 variables also possessed moderate to high levels of kurtosis. Similar findings of nonnormality were also detected in prior studies utilizing the measures of interest, and the use of robust techniques to address these potential issues associated with skewness did not yield meaningful differences in effect size or model fit (Kohl et al., 2000; Mautone et al., 2015).

Table 4
Item-Level Descriptive Statistics

Proposed factor and question	*M* (*SD*)	Skewness	Kurtosis
Frequency of Parent–Coach Contact			
In the past year, have you called your child's climbing program leader or coach	2.25 (.998)	.560	-.271
In the past year, your child's climbing program leader or coach has called you	1.98 (.952)	.696	-.438
In the past year, you have written (including social media and email) your child's climbing coach or program leader	2.69 (.989)	.035	-.454
In the past year, your child's climbing program leader or coach has written you (including social media and email)	3.00 (1.033)	-.245	-.385
Parent–Coach Relationship Quality			
You feel welcome at your child's climbing competitions	4.41 (.817)	-1.590	2.836
You enjoy talking with your child's climbing program leader/coach	4.23 (.970)	-1.396	1.822
You feel your child's climbing program leader/coach cares about your child	4.38 (.986)	-1.665	2.056
You think your child's climbing program leader/coach is interested in getting to know you	3.64 (1.259)	-.618	-.521
You feel comfortable talking with your child's climbing program leader/coach about your child	4.26 (.987)	-1.407	1.417
You feel that your child's climbing program leader/coach pays attention to your suggestions	3.81 (1.144)	-.683	-.309
You ask your child's climbing program leader/coach questions or make suggestions about your child	3.48 (1.247)	-.310	-.892
Parental Involvement			
In the past year you have visited your child's climbing program to speak with the coach or program leader	3.13 (1.101)	.008	-.734
In the past year you have been invited to your child's climbing program for a special event	2.12 (.767)	.680	1.363
In the past year you have visited your child's climbing program for a special event	2.18 (.795)	1.133	2.492
You help your child at home with areas that your child is struggling with in regards to climbing competitions	2.98 (1.197)	-.006	-.790
You volunteer to help with your child's climbing competitions and programs	2.97 (1.395)	.105	-1.237

Table 4 (cont.)

Proposed factor and question	*M* (*SD*)	Skewness	Kurtosis
Parental Endorsement of Competition Climbing			
Your child's climbing program is a good place for them to be	4.61 (.627)	-1.607	2.012
The staff at your child's climbing program is doing good things for your child	4.43 (.786)	-1.238	.668
You have confidence in the people in at your child's climbing program	4.44 (.819)	-1.478	1.826
Your child's climbing program is doing a good job preparing them for the future	4.27 (.929)	-1.191	.849

Note. All descriptive statistics are based upon expectation maximization (EM) missing data imputation. Raw data means are available upon request from first author.

Missing Data Management

Missing data management is a critical, yet often overlooked, issue within recreation and leisure research. A complete discussion of this topic is beyond the purpose and scope of this paper, but scholars have noted that "leisure researchers rarely describe how missing data have been handled" (Freire & Caldwell, 2013, p. 221). More specifically, within the context of many recreation and leisure studies, the reader frequently assumes that no missing data were embedded within a study (e.g., all respondents completed all measurements) or in some cases methodologically outdated techniques were utilized to address missing data (e.g., listwise or pairwise deletion, mean imputation). These approaches, although seemingly normative within recreation and leisure research (and arguably the broader educational and social sciences, see Enders, 2001), do not reflect current methodological techniques. Further, ". . . ignoring this step is poor science, and results reported without attention to missing data can misinform our scientific understanding and misguide policy and practice" (Schlomer, Bauman, & Card, 2010, p. 8). As such, a more contemporary approach called expectation maximization (EM) was utilized to manage and impute missing data in this study. Although more sophisticated approaches can provide missing data information more easily for the researcher (e.g., full information maximum likelihood [FIML] also provides standard errors, see Graham, 2009), EM is the most contemporary technique currently available within SPSS software (SPSS 24) and is mathematically equivalent to FIML in most cases, especially when no systematic patterns of missingness exist within the data (Enders, 2001).

Within this study, Little's (1988) test of MCAR in SPSS 24 software was used to screen the data for missingness to determine if data were missing completely at random (MCAR) or missing not at random (MNAR). Descriptive tests indicated that complete (i.e., all questions completed) information was available for 162 parent respondents (92.57% of total sample) and no item (i.e., question) had a level greater than 6.88% of missing values (1.59% to 6.88%). The nonsignificant results of Little's test of MCAR, $\chi^2(72) = 67.546$, $p = .627$, indicated that the data was MCAR, demonstrating that the use of an EM technique would be appropriate to manage and impute missing data for relationship testing (e.g., psychometric examination, regression modeling) within the three analyses.

Analysis 1

Cronbach's alpha was designed to serve only as a partial indicator of a scale's reliability and validity in combination with other statistical tools (e.g., factor analysis, examination of covariance matrix, exploration of item variances, theoretical precedence). However, in practice the intention behind the design of Cronbach's alpha does not always bear out; a research team may select a previously designed instrument (i.e., scale) and report the Cronbach's alpha (1) only when justifying the scale (or subscales) inclusion within a study and/or (2) only when examining (or at least only presenting) Cronbach's alpha as a measure of scale reliability or validity when proceeding to later relationship testing. Thus, to demonstrate the potential limitations of this unidimensional and limiting approach, the first analysis utilized Cronbach's alpha as the sole indicator of psychometric reliability for the four hypothesized factors of the PCIS. If the results of the examination of Cronbach's alpha levels indicated unusually low levels (e.g., $\alpha \leq .5$), the "alpha-if-item-dropped" function in SPSS would have been utilized to address poor fit and/or factor modification. The results indicated acceptable Cronbach's alpha levels for all four factors (Table 5). Although there are no "golden rules" for acceptable levels of Cronbach's alpha, prior research has indicated that levels at or above .7 are often utilized as a benchmark for acceptability (see Schmitt, 1996, for a deeper criticism of this approach); however, the use of this criterion (although pervasive in the extant literature) also arbitrarily implies that a Cronbach's alpha of .69 would be unacceptable and a .71 would be acceptable. Despite the obvious limitation of the cut-off criteria frequently associated with Cronbach's alpha, in this study a .7 criterion was utilized to determine if all four factors demonstrated acceptable levels of Cronbach's alpha (e.g., $\alpha \geq .70$), and no items were dropped. The results of this analysis indicated evidence of reliability in all four factors, and the mean transformation function in SPSS 24 was used to transform the individual items into their respective composite variables to explore the research question, which factors most contribute to parental endorsement of competition climbing?

The research question was addressed through a series of multiple regressions, the results of which indicated that when all three independent variables were entered into the model, neither frequency of parent–coach contact ($\beta = -.068$, $p = .946$) nor parental involvement ($\beta = -.160$, $p = .873$) were significant predictors of parental endorsement of competition climbing. However, the results indicated that parent–coach relationship quality was a significant predictor of parental endorsement of competition climbing ($\beta = .703$, $p \leq .001$, adjusted $R^2 = .478$). More simply, for every one-unit increase in parent–coach relationship quality, parental endorsement of competition climbing increased by .703 units. The results of this analysis suggest that neither parents' contact with climbing coaches (e.g., phone calls or e-mails) nor parental involvement (e.g., volunteering) enhance parental support of climbing, but a parent's relationship with the child's coach can positively influence their endorsement of climbing as a sport that contributes to their child's development.

Analysis 2

The second analysis utilized exploratory factor analysis (EFA) and Cronbach's alpha to test the psychometric properties of the PCIS scale and theorized four-factor solution. Suitability for EFA was assessed in four phases: (1) Inspection of the correlation matrix showed that all variables had at least one correlation above 0.3, (2) the overall Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was .882, (3) the inspection of the anti-image correlation matrix indicated item-level KMO scores at or above .5, and (4) the Bartlett test of sphericity was significant, $\chi^2(190) = 2535.423$, $p \leq .001$. The combination of the acceptable sphericity and KMO scores indicated that the sample was adequate in size and likely factorable. An EFA was then conducted employing maximum likelihood estimation and a promax rotation (orthogonal). These approaches were selected because they do not assume that variables within different factors are uncorrelated (Tabachnick & Fidell, 1996).

As indicated by the hypothesized factors (Table 4), four factors were specified. Next, the pattern matrix[2] was examined for multidimensional items (i.e., loaded at similar levels across differing factors with no primary factor indicated) and for items with nonsubstantive loadings on

[2]Iterative pattern matrices available upon request from first author.

Table 5
Analysis 1, Descriptive Statistics (N = 175)

Composite factor	*M* (*SD*)	α
Frequency of Parent–Coach Contact (4 items)	2.50 (.764)	.780
Parental Involvement (5 items)	2.67 (.730)	.715
Parent–Coach Relationship Quality (7 items)	4.07 (.827)	.916
Parental Endorsement of Competition Climbing (4 items)	4.46 (.674)	.910

Note. All descriptive statistics are based upon expectation maximization (EM) imputation. Raw data means are available upon request from first author.

multiple factors (i.e., all loadings ≤ .2). In the first iteration of analyses, three items were removed because of evidence of multidimensionality and one item was removed because of weak loadings across all factors (Field, 2013; Yong & Pearce, 2013). In the second iteration, an additional item was dropped because of its poor conceptual fit with the factor, which was indicated by the pattern matrix and corresponding poor loading in relation to other items within the same factor (i.e., loading was .426, with next closest loading at .633). The EFA results also suggested that an item originally designated for the parental involvement factor better fit on the parent frequency of contact factor because of its poor loading on the hypothesized factor, moderate loading on the suggested factor, and conceptual fit with the suggested factor because of its similar wording. The third and final iteration (Table 6) indicated support for the four-factor model with a reduction in five items total, three items from the parental involvement factor (one migrated to parent frequency of contact), one item from parent–coach relationship quality, and two items from the parent frequency of contact factor.

After scale validity was illustrated by the EFA, factor reliability was examined with Cronbach's alpha for three of the factors and a Pearson's correlation for the two-item parental involvement factor (with two-item factors, the results of Cronbach's analysis are largely meaningless; see Eisinga, Grotenhuis, & Pelzer, 2012). As demonstrated in Table 7, the Cronbach's alpha levels were acceptable for the frequency of parent–coach contact, parent–coach relationship quality, and parental endorsement of competition climbing factors. Additionally, the two-item parental involvement factor indicated a statistically significant correlation. The evidence of sufficient reliability and validity provided through the EFA, Cronbach's alpha levels, and similarity to past psychometric testing of the PTIS (e.g., Kohl et al., 2000; Walters, 2001) suggested the four-factor model was appropriate for relationship testing. Thus, the mean transformation function in SPSS 24 was used to transform the individual items into composite factors.

Factors that most contributed to parental endorsement of competition climbing were determined through a series of multiple regressions. Paralleling the results of Analysis 1, the results of Analysis 2 show that the addition of the parent–coach relationship quality variable into the regression model mitigated the significant predictive qualities of frequency of parent–coach contact (β = .272, p = .001 to β = .043, p = .516) and parental involvement (β = .154, p = .047 to β = .049, p = .436) on parental endorsement of competition climbing. Indeed, parent–coach relationship quality was the only significant predictor of parental endorsement of competition climbing (β = .633, $p \leq .001$, adjusted R^2 = .439) when introduced into the regression model. As with the results of Analysis 1, these results suggest that parental involvement and parent frequency of contact are inconsequential predictors of parental endorsement of competition climbing when examined in concert with parent–coach relationship quality. The results revealed a slightly lower beta level (e.g., β = .703 in Analysis 1 to β = .633 in Analysis 2), presumably in part due to the one item removed from the parent–coach relationship quality factor.

Table 6
Analysis 2, Pattern Matrix

Factor/item	F1	F2	F3	F4
Parent–Coach Relationship Quality (F1)				
You feel that your child's climbing program leader/coach pays attention to your suggestions	**.837**	.025	-.098	.031
You feel comfortable talking with your child's climbing program leader/coach about your child	**.813**	.117	.002	-.044
You enjoy talking with your child's climbing program leader/coach	**.807**	.144	.004	-.051
You think your child's climbing program leader/coach is interested in getting to know you	**.806**	.088	.071	-.064
You ask your child's climbing program leader/coach questions or make suggestions about your child	**.685**	-.207	.256	.050
You feel welcome at your child's climbing competitions	**.655**	.057	-.167	.055
Parental Endorsement of Competition Climbing (F2)				
The staff at your child's climbing program is doing good things for your child	.003	**.883**	.004	.027
You have confidence in the people in at your child's climbing program	.055	**.877**	-.011	-.041
Your child's climbing program is doing a good job preparing them for the future	-.006	**.848**	.102	.032
Your child's climbing program is a good place for them to be	.262	**.573**	-.034	.046
Parent Frequency of Contact (F3)				
In the past year, you have written (including social media and email) your child's climbing coach or program leader	-.014	-.004	**.970**	-.070
In the past year, your child's climbing program leader or coach has written you (including social media and email)	-.171	.148	**.803**	.021
In the past year, you have visited your child's climbing program to speak with the coach or program leader	.244	-.117	**.488**[a]	.136
Parental Involvement (F4)				
In the past year, you have visited your child's climbing program for a special event	-.004	-.021	-.009	**1.009**
In the past year, you have been invited to your child's climbing program for a special event	-.005	.067	.024	**.789**

Note. All descriptive statistics are based upon expectation maximization (EM) missing data imputation. Raw data means are available upon request from first author. Items in bold indicate factor and composite.

[a]Item transferred from the parental involvement factor to the parent frequency of contact factor.

Table 7
Analysis 2, Descriptive Statistics (N = 175)

Composite factor	*M* (*SD*)	α
Frequency of Parent–Coach Contact (3 items)	2.96 (.869)	.799
Parental Involvement (2 items)	2.15 (.735)	.810*
Parent–Coach Relationship Quality (6 items)	4.01 (.850)	.903
Parental Endorsement of Competition Climbing (4 items)	4.46 (.674)	.910

Note. All descriptive statistics are based upon expectation maximization (EM) imputation. Raw data means are available upon request from first author.

*Pearson's bivariate correlation, $p \leq .001$.

Analysis 3

In the third analysis, the data were transferred from SPSS to EQS 6.3 for investigation of the psychometric properties of the PCIS and relationship testing through confirmatory factor analysis (CFA) and structural equation modeling (SEM). CFA and corresponding statistics (e.g., those providing evidence of discriminant and convergent validity) were utilized to determine the psychometric reliability and validity of the PCIS scale. First, the four-factor 20-item model was specified with all items "caused" by their theorized factor (Table 4). Examination of the data for multivariate kurtosis suggested acceptable levels of nonnormality (Mardia's coefficient = 67.839, normalized estimate = 15.126), indicating that no additional cases needed to be removed from the data set. However, the model fit indices suggested that respecification of the model was necessary to improve fit indices, $\chi^2(164) = 555.771$, $p \leq .001$, N-NFI = .815, CFI = .841, SRMR = .128, RMSEA = .117, 90% CI [.106, .128]. Inspection of factor loadings in the first CFA model indicated poor loadings (e.g., $\lambda \leq .4$) for two items within the theorized parent frequency of contact factor and three items within the parental involvement factor. Further exploration of possible alternative factors for these items through the LaGrange multiplier chi-square difference function suggested no meaningful improvement of the model with their migration to an alternative factor. As such, the four poor-performing items were removed from the CFA model and later relationship testing. The removal of these items improved the CFA model fit, $\chi^2(84) = 185.856$, $p \leq .001$, N-NFI = .938, CFI = .950, SRMR = .057, RMSEA = .083, 90% CI [.067, .099], and corresponding factor loadings for the remaining items.

As evidenced in Table 8, the four factors demonstrated good convergent validity (e.g., items are highly correlated within a hypothesized factor) established by the factor loadings, average variance extracted (AVE) scores, and reliability supported by Jöreskog's rho (ρ) and Cronbach's alpha. Cronbach's alpha is only reported due to its heavy use in the social sciences; Jöreskog's rho is a more robust reliability measure than Cronbach's alpha in SEM because it is based on factor loadings rather than on correlations between observed variables (Chin, 1998). Evidence of the discriminant validity of the four-factor model is provided in Table 9 in the form of square rooted AVE scores and between-factor correlations. More specifically, acceptable AVE values (e.g., $\sqrt{AVE} \geq .5$) demonstrate that at least 50% of variance is not due to measurement or nonrandom error, rather variance is captured by the construct (i.e., factor; Fornell & Larker, 1981). Further verification of discriminant validity is provided in Table 9. Between-factor correlations were not unusually high nor at unexpected levels; more specifically, high correlation levels (e.g., .7 to .9) could indicate factors are sharing high levels of variance, suggesting the need to combine and/or respecify factors because of empirical underidentification (e.g., $r = .9+$ suggests factors are measuring identical constructs; Kline, 2011). In summary, the convergent and discriminant validity[3] indicate construct validity of the four-factor, 16-item model and the appropriateness to proceed to further relationship testing.

[3]Final CFA and SEM covariance matrices are available upon request from first author.

Table 8
Analysis 3, CFA Descriptive Statistics

Factor and question	*M* (*SD*)	λ	*r*	α	ρ	AVE
Frequency of Parent–Coach Contact			.828*	-	-	.837
In the past year, have you called your child's climbing program leader or coach	2.25 (.998)	.850				
In the past year, your child's climbing program leader or coach has called you	1.98 (.952)	.975				
Parent–Coach Relationship Quality			-	.922	.925	.642
You feel welcome at your child's climbing competitions	4.41 (.817)	.630				
You enjoy talking with your child's climbing program leader/coach	4.23 (.970)	.901				
You feel your child's climbing program leader/coach cares about your child	4.38 (.986)	.833				
You think your child's climbing program leader/coach is interested in getting to know you	3.64 (1.259)	.869				
You feel comfortable talking with your child's climbing program leader/coach about your child	4.26 (.987)	.882				
You feel that your child's climbing program leader/coach pays attention to your suggestions	3.81 (1.144)	.816				
You ask your child's climbing program leader/coach questions or make suggestions about your child	3.48 (1.247)	.629				
Parental Involvement			.809*	-	-	.813
In the past year, you have been invited to your child's climbing program for a special event	2.12 (.767)	.858				
In the past year, you have visited your child's climbing program for a special event	2.18 (.795)	.943				
Parental Endorsement of Competition Climbing			-	.915	.918	.737
Your child's climbing program is a good place for them to be	4.61 (.627)	.759				
The staff at your child's climbing program is doing good things for your child	4.43 (.786)	.891				
You have confidence in the people in at your child's climbing program	4.44 (.819)	.895				
Your child's climbing program is doing a good job preparing them for the future	4.27 (.929)	.882				

Note. λ = standardized coefficient (factor loading); *r* = Pearson's correlation; ρ = Jöreskog's rho; α = Cronbach's alpha; AVE: average variance extracted. All descriptive statistics are based upon expectation maximization (EM) imputation. Raw data means are available upon request from first author.

*$p \leq .01$.

Table 9
Analysis 3, Evidence of Discriminant Validity

Factor	F1	F2	F3	F4
F1. Frequency of Parent–Coach Contact	**.914**			
F2. Parental Involvement	.431**	**.901**		
F3. Parent–Coach Relationship Quality	.414**	.300**	**.801**	
F4. Parental Endorsement of Competition Climbing	.248*	.258*	.770**	**.858**

Note. Bold indicates √AVE.
*$p \leq .01$. **$p \leq .001$.

Which factors most contributed to parental endorsement of competition climbing were determined through a structural equation model (SEM; Figure 1). The results of the SEM provided evidence of acceptable model fit, $\chi^2(84) = 185.857$, $p \leq .001$, N-NFI = .938, CFI = .950, SRMR = .057, RMSEA = .083, 90% CI [.067, .099]. As demonstrated in Figure 1, neither frequency of parent–coach contact (β = -.112, *SE* = .035, p = .096) nor parental involvement (β = .067, *SE* = .044, p = .304) significantly predicted parental endorsement of competition climbing. However, the SEM results illustrated that parent–coach relationship quality significantly predicted (β = .795, *SE* = .051, $p \leq .001$) parental endorsement of competition climbing. In sum, the SEM results indicate that for every one-unit increase in parent–coach relationship quality, parental endorsement of competition climbing rose by .795 units. This finding is comparable to those in Analysis 1 (β = .703) and Analysis 2 (β = .633), in which parent–coach relationship quality was also the only significant predictor of parental endorsement of competition climbing, albeit the examination of the research question through a SEM approach provided the highest beta level (β = .795).

Discussion

The primary goal of this paper was to compare the results, limitations, and strengths of three distinct statistical analytical approaches when applied to the same research question and data. Perhaps unsurprisingly, a similar overall conclusion was reached regardless of the statistical analysis approach used; parent–coach relationship quality was the best (and only) significant predictor of parental endorsement of competition climbing. The lack of predictive influence from parental involvement (e.g., event attendance and volunteering) and frequency of parent–coach contact may indicate that climbing organizations and their coaches should seek to develop relationships with parents of youth climbers to ensure the sustainment of parental confidence in, and support for, competition climbing. The importance of relationship building between parents and coaches in this study supports other studies of parental involvement in sport (Jowett & Cockerill, 2002; Jowett & Timson-Katchis, 2005; Smoll et al., 2011). Furthermore, although beyond the scope of this paper, the tests of convergent and discriminant validity conducted within Analysis 3 (Tables 1, 8, and 9) indicate that the adaptation of the PTIS to the PCIS was partially successful (e.g., four items were dropped because of fit issues) with better fit indices, higher factor loadings, similar between-factor correlations, and improved reliability levels than those presented in Kohl et al. (2000). The results of this study, although preliminary, suggest that the PCIS is a promising measure for exploring the factors contributing to parental endorsement of the child's sport.

The three distinct statistical approaches resulted in near equivalent overall conclusions to the research question. For example, in Analysis 1, the only parameter for a factor being reliable and valid, and thus appropriate for later relationship testing, was Cronbach's alpha. Although this strategy is an inappropriate use of this statistic, it is still commonly utilized in this manner as the

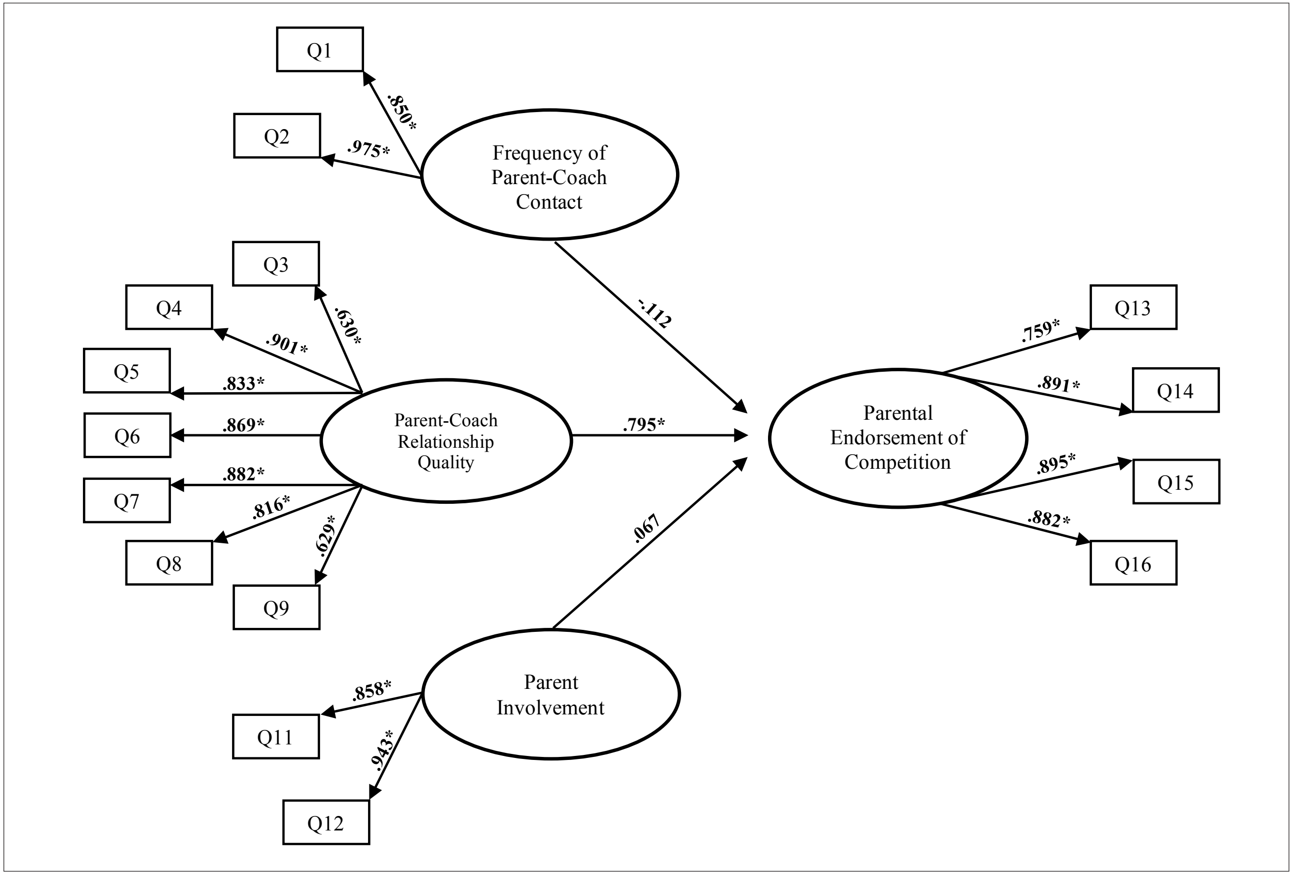

Figure 1. Structural model of factors influencing parental endorsement of competition climbing. Error terms and constant excluded for parsimony of presentation.

*$p \leq .05$.

sole criterion to establish construct validity of a (sub)scale either for inclusion of a scale within a study and/or as a justification for relationship testing (Schmitt, 1996; Tavakol & Dennick, 2011). The approach in Analysis 1 resulted in a four-factor solution, with none of the 20 items being dropped. However, deeper examination of the construct validity of the PCIS conducted in Analyses 2 (EFA) and 3 (CFA) suggested that items (albeit for partially contrasting reasons) should be dropped or modified within the PCIS. Thus, both EFA and CFA resulted in a more parsimonious version of the PCIS for future research and implementation.

Although perhaps not a major limitation for many studies, the lack of psychometric similarity between the three approaches highlights the continuing need for efficiency in research. For instance, if a researcher were to rely on the psychometric technique of Analyses 1 or 2, they may conclude that the parental involvement and/or frequency of parent–coach contact factors are "good" measures and utilize them for future research despite their reduction to "underidentified" factors evidenced within the results of Analysis 3 (e.g., factors consisting of two items can introduce linear dependencies and harm model parsimony, Kline, 2011). Such replication would further the use of items that exhibit poor psychometric properties and harm the efficacy of ongoing scientific inquiry. An additional difference in the psychometric results occurred between Analysis 2 and Analysis 3; specifically, the frequency of the parent–coach factor indicated three reliable items according to the EFA in Analysis 2, but in Analysis 3 the parent contact frequency factor indicated only two reliable items. In other words, the use of CFA may better capture the "true" (literally "true score variance") measurement of parental contact frequency and the challenges therein.

Another limitation of this study was suggested by the EFA results (Analysis 2). The basic premise underpinning EFA is that it allows data to drive decisions rather than theory (capitalizing on chance relationships between variables), reflective of a pseudo-scientific approach to empirical research. In other words, EFA uncovers (i.e., creates) theory and typically confirms assumptions, wherein "true" scientific inquiry is intended to disconfirm or falsify theory (Popper, 1981). Further, EFA approaches may be susceptible to confirmation bias, wherein researchers do not disconfirm their findings, but rather take an "oh that makes sense" approach and modify their findings accordingly (i.e., type I error). Indeed, this pseudo-scientific modification occurred within Analysis 2; an item was moved from the parental involvement factor to the frequency of parent–coach contact factor. Conversely in Analysis 3, the same problematic item was dropped from further analysis because of the additional information provided by the latent analysis.

Methods such as CFA and SEM provide more robust tools within the data analysis process, tools that are unavailable with more primitive techniques. For example, CFA extracts the true score variance from an indicator, more accurately accounting for error and providing more precise measures of the effect of an indicator (Hurley et al., 1997; Kline, 2011). This differentiation in precision was evidenced in Analysis 3, wherein a higher beta level ($\beta = .795$) was detected than in either Analysis 1 ($\beta = .703$) or Analysis 2 ($\beta = .633$). This differentiation potentially introduced a partial type II error when the composite-score-based strategies of Analyses 1 or 2 were utilized (e.g., saying there is no effect when there is one, in this case diminishing the magnitude of effect). The strategies employed in this study with this data set and this scale resulted in three similar conclusions to the research question. It is possible that other data sets would produce vastly different results when these three analytic approaches are applied. Thus, even though the findings in this study were similar, it should not be assumed that EFA and composite approaches could or should be used in place of CFA and SEM.

Limitations

Although promising in scope, this study had a few limitations. The convenience sample was overwhelmingly White, affluent, and highly educated. Although this demographic homogeneity may be normative to the sport of competition climbing (Gagnon, Stone, Garst, &

Arthur-Banning, 2016), the lack of diversity within the sample may have masked effects that would otherwise be present; that said, exploration of the PTIS by Kohl et al. (2000) demonstrated no meaningful differences based upon similar demographic variables. An additional problem highlighted by the multiple analyses of the PCIS suggested that additional development and/or exploration of the frequency of parent–coach contact and parental involvement factors may be necessary. Specifically, the CFA conducted in Analysis 3 resulted in four of the items being dropped (20% of the total PCIS). Beyond the homogeneity present within the sample and the problematic items within two factors, the item-level statistics implied a noticeable degree of negative skew and kurtosis within several items. Although a similar limitation was noted by Kohl et al. (2000) and Mautone et al. (2015), this nonnormality could have negatively influenced the analyses conducted in this study. In future usage of the PCIS, a broader Likert approach (e.g., 1–7 vs. current 1–5 approach) may address this nonnormal variance. Finally, a deeper exploration of the factor structure within Analysis 3 was possible; more specifically, an examination of alternative models may have uncovered models of better fit (Byrne, 2006). However, because a goal of this paper was to confirm past modeling work (e.g., Kohl et al., 2000), this additional approach was not selected.

Future Directions and Conclusion

The future research directions provided by this study are two-fold: (1) exploring and developing the PCIS and (2) continuing to illustrate the consequences of the utilization of inappropriate and/or antiquated techniques to explore common questions within the recreation and leisure sciences. More simply, the analytic approaches necessary to tell the story of leisure and recreation research are a moving target, likely requiring a career-long commitment to methodological training on the part of researchers at conceptual and applied levels. Researchers should not only be able to "do" the appropriate analyses for the question they are asking, but also (and arguably more important) be prepared to translate that story to the community of recreation and leisure practitioners they are charged with serving.

References

Babbie, E. R. (2013). *The basics of social research.* Boston, MA: Cengage Learning.

Bremer, K. L. (2012). Parental involvement, pressure, and support in youth sport: A narrative literature review. *Journal of Family Theory & Review, 4,* 235–248. https://doi.org/10.1111/j.1756-2589.2012.00129.x

Byrne, B. (2006). *Structural equation modeling with EQS* (2nd ed.). New York, NY: Psychology Press. https://doi.org/10.1207/s15328007sem1302_7

Chin, W. W. (1998). The partial least squares approach for structural equation modeling. In G. A. Marcoulides (Ed.), *Modern methods for business research* (pp. 295–236). London, England: Lawrence Erlbaum Associates.

Coffman, D. L., & MacCallum, R. C. (2005). Using parcels to convert path analysis models into latent variable models. *Multivariate Behavioral Research, 40,* 235–259. https://doi.org/10.1207/s15327906mbr4002_4

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). New York, NY: Routledge.

Corrigan, A. (2002). *Parent–teacher involvement questionnaire: Parent version* (Fast Track Project Technical Report). Retrieved from http://www.fasttrackproject.org

Côté, J. (1999). The influence of the family in the development of talent in sport. *The Sport Psychologist, 13,* 395–417. https://doi.org/10.1123/tsp.13.4.395

DiStefano, C., Zhu, M., & Mindrila, D. (2009). Understanding and using factor scores: Considerations for the applied researcher. *Practical Assessment, Research, & Evaluation, 14*(20), 1–11.

Dorsch, T. E., Smith, A. L., & McDonough, M. H. (2009). Parents' perceptions of child-to-parent socialization in organized youth sport. *Journal of Sport and Exercise Psychology, 31,* 444–468. https://doi.org/10.1123/jsep.31.4.444

Dukes, R. L., & Coakley, J. (2002). Parental commitment to competitive swimming. *Free Inquiry in Creative Sociology, 30,* 185–198.

Dunn, C. R., Dorsch, T. E., King, M. Q., & Rothlisberger, K. J. (2016). The impact of family financial investment on perceived parent pressure and child enjoyment and commitment in organized youth sport. *Family Relations, 65,* 287–299. https://doi.org/10.1111/fare.12193

Eisinga, R., Grotenhuis, M., & Pelzer, B. (2012). The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown? *International Journal of Public Health, 58,* 637–642. https://doi.org/10.1007/s00038-012-0416-3

Enders, C. K. (2001). The performance of the full information maximum likelihood estimator in multiple regression models with missing data. *Educational and Psychological Measurement, 61,* 713–740. https://doi.org/10.1177/0013164401615001

Field, A. (2013). *Discovering statistics using IBM SPSS Statistics* (4th ed.). Thousand Oaks, CA: Sage.

Fornell, C., & Larker, D. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18,* 39–50. https://doi.org/10.2307/3151312

Freire, T., & Caldwell, L. L. (2013). Afterthoughts on leisure and future research directions. In T. Freire (Ed.), *Positive leisure science: From subjective experience to social contexts* (pp. 213–223). New York, NY: Springer. https://doi.org/10.1007/978-94-007-5058-6_12

Frigge, M., Hoaglin, D. C., & Iglewicz, B. (1989). Some implementations of the boxplot. *The American Statistician, 43*(1), 50–54. https://doi.org/10.1080/00031305.1989.10475612

Gagnon, R. J., Stone, G. A., Garst, B. A., & Arthur-Banning, S. (2016). Competition climbing: From leisure pursuit to lifestyle sport. *Journal of Unconventional Parks, Recreation, and Tourism Studies, 6*(1), 2–12.

Graham, J. W. (2009). Missing data analysis: Making it work in the real world. *Annual Review of Psychology, 60,* 549–576. https://doi.org/10.1146/annurev.psych.58.110405.085530

Holt, N. L., Tamminen, K. A., Black, D. E., Sehn, Z. L., & Wall, M. P. (2008). Parental involvement in competitive youth sport settings. *Psychology of Sport and Exercise, 9,* 663–685. https://doi.org/10.1016/j.psychsport.2007.08.001

Hurley, A., Scandra, T., Schriesheim, C., Brannick, M., Seers, A., Vandenberg, R., & Williams, L. (1997). Exploratory and confirmatory factor analysis: Guidelines, issues, and alternatives. *Journal of Organizational Behavior, 18,* 667–683. https://doi.org/10.1002/(SICI)1099-1379(199711)18:6<667::AID-JOB874>3.0.CO;2-T

Jowett, S., & Cockerill, I. (2002). Incompatibility in the coach–athlete relationship. In I. M. Cockerill (Ed.), *Solutions in sport psychology* (pp. 16–31). London, England: Thomson Learning.

Jowett, S., & Timson-Katchis, M. (2005). Social networks in sport: Parental influence on the coach–athlete relationship. *The Sport Psychologist, 19,* 267–287. https://doi.org/10.1123/tsp.19.3.267

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). New York, NY: The Guilford Press.

Kohl, G. O., Lengua, L. J., & McMahon, R. J. (2000). Parent involvement in school: Conceptualizing multiple dimensions and their relations with family and demographic risk factors. *Journal of School Psychology, 38,* 501–523. https://doi.org/10.1016/S0022-4405(00)00050-9

Ledgerwood, A., & Shrout, P. E. (2011). The trade-off between accuracy and precision in latent variable models of mediation processes. *Journal of Personality and Social Psychology, 101,* 1174–1188. https://doi.org/10.1037/a0024776

Little, R. J. A. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association, 83,* 1198–1202. https://doi.org/10.1080/01621459.1988.10478722

Mautone, J. A., Marcelle, E., Tresco, K. E., & Power, T. J. (2015). Assessing the quality of parent–teacher relationships for students with ADHD. *Psychology in the Schools, 52,* 196–207. https://doi.org/10.1002/pits.21817

Miller-Johnson, S., & Maumary-Gremaud, A. (1995). *Parent–teacher involvement: Parent version* (Fast Track Project Technical Report). Retrieved from http://www.fasttrackproject.org/

Popper, K. (1981). Science, pseudo-science, and falsifiability. In R. D. Tweney, M. E. Doherty, & C. R. Mynatt (Eds.), *On scientific thinking* (pp. 92–99). New York, NY: Columbia University Press.

Schlomer, G. L., Bauman, S., & Card, N. A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling Psychology, 57*(1), 1–10. https://doi.org/10.1037/a0018082

Schmitt, N. (1996). Uses and abuses of coefficient alpha. *Psychological Assessment, 8,* 350–353. https://doi.org/10.1037/1040-3590.8.4.350

Sijtsma, K. (2009). On the use, the misuse, and the very limited usefulness of Cronbach's alpha. *Psychometrika, 74*(1), 107–120. https://doi.org/10.1007/s11336-008-9101-0

Smoll, F. L., Cumming, S. P., & Smith, R. E. (2011). Enhancing coach–parent relationships in youth sports: Increasing harmony and minimizing hassle. *International Journal of Sports Science & Coaching, 6*(1), 13–26. https://doi.org/10.1260/1747-9541.6.1.13

Stein, G. L., Raedeke, T. D., & Glenn, S. D. (1999). Children's perceptions of parent involvement: It's not how much, but to what degree that's important. *Journal of Sport Behavior, 22,* 591–601.

Stephenson, M. T., & Holbert, R. L. (2003). A Monte Carlo simulation of observable versus latent variable structural equation modeling techniques. *Communication Research, 30,* 332–354. https://doi.org/10.1177/0093650203030003004

Streiner, D. L. (2003). Starting at the beginning: An introduction to coefficient alpha and internal consistency. *Journal of Personality Assessment, 80*(1), 99–103. https://doi.org/10.1207/S15327752JPA8001_18

Tabachnick, B. G., & Fidell, L. S. (1996). *Using multivariate statistics* (3rd ed.). New York, NY: HarperCollins.

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education, 2,* 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

USA Climbing. (n.d.). About USA Climbing. Retrieved September 29, 2017, from http://www.usaclimbing.org/About_USA_Climbing.htm

Walters, E. (2001). *Parent–teacher involvement questionnaire: Parent version* (Fast Track Project Technical Report). Retrieved from http://www.fasttrackproject.org

Wheeler, S., & Green, K. (2014). Parenting in relation to children's sports participation: Generational changes and potential implications. *Leisure Studies, 33,* 267–284. https://doi.org/10.1080/02614367.2012.707227

Wolfenden, L. E., & Holt, N. L. (2005). Talent development in elite junior tennis: Perceptions of players, parents, and coaches. *Journal of Applied Sport Psychology, 17,* 108–126. https://doi.org/10.1080/10413200590932416

Yong, A. G., & Pearce, S. (2013). A beginner's guide to factor analysis: Focusing on exploratory factor analysis. *Tutorials in Quantitative Methods for Psychology, 9*(2), 79–94. https://doi.org/10.20982/tqmp.09.2.p079