JOURNAL OF APPLIED SPORT PSYCHOLOGY, 26: 225–240, 2014

ISSN: 1041-3200 print / 1533-1571 online
DOI: 10.1080/10413200.2013.821637

Routledge
Taylor & Francis Group

A Direct Observation of the Dynamic Content and Structure of Coach-Athlete Interactions in a Model Sport Program

JENNIFER TURNNIDGE, JEAN CÔTÉ, AND TOM HOLLENSTEIN

Queen's University

JANICE DEAKIN

Western University

The purpose of this study was to analyze the coach-athlete interactions in a successful sport program for athletes with disabilities and their able-bodied siblings. The coach and 24 athletes were observed over multiple practice sessions. Measures of interaction content and structure were derived using state space grid (SSG) analysis. Results indicated that interactions were patterned and included behaviors such as individualized instruction, organization, and feedback. Interaction style changed according to the athletes' competitive level, but no differences emerged based on disability status. This successful sport environment was characterized by patterned and positive coach-athlete interactions that were athlete, rather than disability-focused.

Coaches' behaviors play a central role in shaping their athletes' experiences. One methodological approach that has greatly contributed to our understanding of the coaching process is behavioral observation (Kahan, 1999). Observation-based studies indicate that effective coach-athlete interactions are typically characterized by high amounts of instruction, feedback and encouragement, and management behaviors that are delivered in a positive manner (e.g., Curtis, Smith, & Smoll, 1979; Cushion & Jones, 2001; Ford, Yates, & Williams, 2010). Furthermore, interactions that embody these qualities are linked with a myriad of positive athlete outcomes, including enjoyment, self-esteem, and persistence (e.g., Black & Weiss, 1992; Smith & Smoll, 1990). Studies examining coach-athlete interactions are an important cornerstone of coaching research and have informed coaching behavior guidelines and training interventions (Horn, 2008). However, it is important to recognize some key limitations of the current coaching behavior literature.

First, there is a need to investigate how coaching behaviors can be shaped by contextual variables. Indeed, how coaches interact with their athletes can be influenced by factors such as practice activities (Ford et al., 2010), coaches' philosophies (Cushion & Jones, 2001), and sport setting (i.e., practice vs. competition; Smith & Cushion, 2006). Studies examining such contextual variables, however, have produced equivocal results. For instance, although theoretical research suggests that effective coaching behaviors may differ according to the

Received 27 November 2012; accepted 29 June 2013.
Address correspondence to Jennifer Turnnidge, School of Kinesiology and Health Studies, Queen's University, Kingston, Ontario, K7L 3N6 Canada. E-mail: 5jm14@queensu.ca

competitive level of the athletes (Côté & Gilbert, 2009), previous studies have found limited empirical support for this contention (Ford et al., 2010). As such, there is a clear need to further explore the influence of contextual variables, such as athletes' competitive level, on coach-athlete interactions.

Another important contextual variable that has received limited attention within the coaching literature is an athlete's disability status (Banack, Sabiston, & Bloom, 2011). Although coaching athletes with disabilities may require many of the same skills as coaching able-bodied athletes, there may be circumstances and considerations that are specific to coaching athletes with disabilities (Cregan, Bloom, & Reid, 2007). For example, coaches may need to develop an understanding of the nature of the disability and its necessary biomechanical adaptations (DePauw & Gavron, 2005). Moreover, coaches may need to be creative in designing the structure and activities of their practices in order to suit each athlete's specific needs, skill level, or sport commitment (Cregan et al., 2007).

Although previous studies indicate that coach-athlete relationships may shape the quality of athletes' sport experiences within disability sport, the behaviors that make up these relationships have yet to be empirically evaluated. Furthermore, given that current research has predominantly focused on the experiences of coaches of elite athletes with a disability, research examining coaches of young athletes with disabilities is particularly under-developed. Investigations of the interactive coach-athlete behaviors specifically within youth disability sport context are warranted. Such investigations can provide valuable insight into what coaches actually do within this context and can serve as an important foundation for future research and coach education programs. In addition, by supplementing our understanding of the coaching process with a unique population, these investigations can strengthen existing coaching theories.

A second important limitation of the current literature is that coaching behaviors have typically been recorded through the use of frequency counts or duration recordings. As such, there are several behavioral aspects of the coaching process that have not been fully captured by traditional observational instruments (Horn, 2008). In particular, although previous studies have provided tremendous insight into what coaches do, questions still remain regarding how coaches exhibit these behaviors. For instance, there is a need to examine the temporal structure of coaches' real-time, moment-to-moment interactions with their athletes. This is further underscored by the fact that a unique advantage of behavioral observation is its ability to capture the patterns of reactivity that characterize social interactions. Placing a greater emphasis on the temporal elements of the coaching process may highlight real-time points of intervention for coaches who wish to improve the quality of their coach-athlete interactions.

Lastly, a limitation of the coaching literature is that previous studies have generally viewed coaching as a unidirectional process (Kahan, 1999). More specifically, observational research has primarily explored how coaching behaviors influence athletes' experiences, without accounting for how athletes' may actively shape the coaching process. This is an important limitation to acknowledge because coaching is inherently a relational activity that is dependent on the reciprocal actions of both the coach and athlete(s). For example, observations could explore how athletes both respond to coaches' behaviors and elicit particular coach behaviors. Examining athlete behaviors, in conjunction with coaches' behaviors, may contribute to a more in-depth understanding of the coaching process.

Fortunately, researchers have expressed a growing interest in adopting methodologies that more accurately capture the contextualized, dynamic, and reciprocal nature of coach-athlete interactions. For example, recent research advocates that state space grid methodology (SSG; Lewis, Lamey, & Douglas, 1999) may be a valuable technique for studying coach-athlete interactions (Erickson, Côté, Hollenstein, & Deakin, 2011). Building upon dynamic systems

principles, the SSG method is designed to account for the reciprocal and dynamic structure of social processes. Erickson et al. (2011) used the SSG method to compare the coach-athlete interactions of two teams that differed on their levels of performance success and positive athlete experiences. Results indicated that there were significant differences between the two teams on measures related to interaction variability, behavioral content patterns, and sequences of coaching behaviors. Interaction variability referred to the degree to which the coach-athlete dyads changed their behavior over the course of an interaction. The more successful team was characterized by more patterned, less variable interactions between the coach and her athletes. This general pattern of coach-athlete interactions consisted of more individualized technical feedback and positive reinforcement and significantly less use of negative feedback. The sequencing of coach behaviors placed a heavy emphasis on the pairing of corrective technical feedback and positive reinforcement. In contrast, the less successful team was characterized by more variable coach-athlete interactions and the coach spent significantly more time providing organizational instructions and negative feedback.

These findings imply that the characteristics of coach-athlete interactions, with respect to interaction variability, behavioral content patterns, and behavioral sequencing, may influence the performance outcomes and experiences of youth sport participants. Erickson et al.'s (2011) study also provides valuable insight into how these previously unquantifiable qualities of coach-athlete interactions may contribute to positive sport experiences. In doing so, it highlights the need for further observation of the dynamic and structural elements that comprise coach-athlete interactions. Furthermore, the work of Erickson et al. (2011) illustrates how the SSG method can be effectively applied to field-based youth sport research.

The purpose of the present study was to conduct an in-depth case study of an exemplary coach in a successful swim program for young athletes with disabilities and their able-bodied siblings. This study incorporated SSG methodology to examine the content and structure of the coach-athlete interactions occurring within this program. More specifically, this study wished to address the three following research questions: (a) How variable are the coach-athlete interactions? (b) are these interactions characterized by specific behavioral sequences? and (c) to what content patterns do these interactions tend to be drawn? A secondary goal of this study was to investigate any differences in the coach-athlete interactive patterns in relation to two distinct contextual variables: the athletes' (a) competitive level and (b) disability status.

METHOD

Participants

The program in this study was a competitive swim team for athletes with disabilities and their able-bodied siblings, located in southeastern Ontario, Canada. This team is one of the largest programs of its kind in Canada. Participants included the female head coach and athletes ($n = 24$) from this swim program (54.2% female, 45.8% male). The coach of this program was 49 years of age and had over 30 years of coaching experience. She had served as the founder and head coach of this particular program for 8 years. The athletes averaged 4.45 years of swimming experience and were between the ages of 8–19: 12 and under ($n = 10$), 13–15 ($n = 6$), and 16 and over ($n = 8$).

Participants represented a wide range of disabilities as determined by their sport classification categories. Swimmers with a disability are classified based on several factors (e.g., muscle strength and movement co-ordination). Within this classification system, the lower the number of the class, the greater the functional impairment (e.g., Class 1 represents a severe disability and Class 10 represents a less severe disability). Class 14 represents swimmers

with an intellectual disability and Class 15 represents swimmers with a hearing impairment. Participants from this particular program ranged from most severe to least severe as follows: Classes 4 ($n = 1$), 5 ($n = 1$), 6 ($n = 3$), 8 ($n = 2$), 9 ($n = 1$), 10 ($n = 3$), 14 ($n = 1$), and 15 ($n = 1$). Eleven of the participants were the able-bodied siblings of the athletes with disabilities.

A unique aspect of this program was that it allowed its participants to choose to focus on either recreational participation or elite performance while working with the same coach. Athletes who chose the recreational stream practiced between two and four times a week, while athletes in the competitive stream practiced between five and seven times a week. As a result of this structure, the athletes in this program tended to be grouped by their competitive level, rather than by their ages. Twelve of the participants (two athletes with disabilities and 10 able-bodied siblings) were recreational athletes who competed at the local or age group level. Twelve of the athletes (11 athletes with disabilities and one able-bodied sibling) were competitive athletes who competed at the regional ($n = 4$), provincial ($n = 4$), national ($n = 2$), and international ($n = 2$) levels.

This particular program was selected because it has both a record of elite performance and a reputation as a positive sport environment. Two athletes from this program have competed at international competitions and several athletes have competed at the provincial and national levels. This program has also been recognized for its high level of community involvement and its dedication to charitable endeavors by both local and national media. Another distinctive aspect of this program was that the head coach intentionally designed the program for athletes with disabilities. This is in contrast to Cregan et al.'s (2007) finding that elite coaches of swimmers with a disability tended to coach able-bodied athletes until an athlete with a disability arrived at one of their practices.

Finally, this program was selected for its diverse range of athletes who train under the tutelage of the same coach. Therefore, by evaluating the nature of one coach's interactions with a diverse range of athletes, the present study provided a unique opportunity to enhance our understanding of the influence of specific contextual variables on the coaching process, namely athletes' competitive level and disability status. Given the program's structure, it was felt that these two variables were the most salient contextual factors in this sport environment.

Measures

Coach-athlete interaction measure

Coach and athlete behaviors were coded with a contextually based coding system developed for this study. This system was developed in accordance with Brewer and Jones' (2002) recommendations for systematic observation instruments in sport psychology. The Para-Coach Athlete Interaction Coding System (Para-CAICS) provides an exhaustive categorization of coach-athlete behavior content. All categories within each of the behavioral dimensions are mutually exclusive.

Coach and athlete behavior content

The process of developing the Para-CAICS began with the modification of the Coach-Athlete Interaction Coding System (CAICS; Erickson et al., 2011) to capture both the coach's and athletes' behavioral content. The CAICS was created for use in a youth synchronized swimming context and allows for the continuous measurement of coach and athlete behavior content, affect, and context. One of the concerns that necessitated the modification of the CAICS for use in the current study was the fact that the CAICS was initially developed in a female competitive context. As such, the categories were not completely representative of

the behaviors occurring in a co-ed swimming context designed for both (a) athletes with disabilities and able-bodied athletes and (b) competitive and recreational athletes.

The first step involved in modifying the CAICS was the observation of several practice sessions and the subsequent development of the behavioral priorities that would guide the coding system. Several categories were added based on three behavioral priorities: (a) behaviors that were unique to the disability sport context (coach category: physical assistance; athlete category: helping others), (b) instructional behaviors (coach categories: technical instruction with modeling, cues, and coach-initiated athlete input; the categories of positive reinforcement and corrective encouragement were also collapsed into one category), and (c) behaviors that could be conducive to creating a positive environment (coach categories: inter/intra personal instruction and humor; athlete category: positive response).

Overall, the modification of the CAICS resulted in a total of 16 coach behavior content categories: (a) humor, (b) positive reinforcement/encouragement, (c) coach-initiated athlete input (which refers to those interactions where the coach asked an athlete how he or she was feeling, or asked the athlete's opinions on a certain set or drill), (d) technical instruction with modeling, (e) technical instruction, (f) cues, (g) inter/intra personal instruction (which refers to the coach's deliberate attempts to instill attitudes, skills, etc., that are related to personal development, such as setting an example or teaching responsibility), (h) organization, (i) observation, (j) general communication, (k) physical assistance, (l) keeping control, (m) error technical (which refers to technical feedback without corrective information), (n) negative evaluation, (o) not engaged, and (p) uncodable. The athletes' behavioral content consisted of 10 categories mostly derived from the CAICS: (a) helping others, (b) positive response, (c) technical talking, (d) clarification, (e) acknowledgement, (f) general communication with an athlete, (g) general communication with the coach, (h) engaged, (i) disengaged, and (j) not codable. The coding instrument was pilot tested with several videos as a means of determining its ability to categorize and differentiate the coach-athlete behaviors that were relevant to the research questions of this study.

Coder training and reliability

For the purposes of establishing inter-coder reliability, agreement referred to the total number of occurrences in which both coders activated the same specific behavioral category within a three-second window**.** The primary researcher (the gold-standard coder) and an independent coder were trained to meet a minimum agreement of 75.0% for two 10 min video segments before being allowed to code full video segments that were used in the study's analysis (Erickson et al., 2011). Once both coders met the required reliability standard, they began coding the segments designated for analysis. Two full 30 min segments were randomly selected to be coded by both coders, after which the coded data for these segments were compared in a further inter-rater reliability check. Again, percentage agreement for frequency of behaviors displayed by both coaches and athletes was calculated, with both meeting adequate reliability (Erickson et al., 2011; Segment 1 agreement = 76.0%, *kappa* = .75 and Segment 2 agreement = 77.0%, *kappa* = .76). This reliability check was followed by collaborative discussions to resolve any conflicts.

Sport experience measures

Athletes' personal development was assessed using the Youth Experience Survey for Sport (YES-S; MacDonald, Côté, Eys, & Deakin, 2012). The YES-S is a 37-item questionnaire that measures youth experiences on five dimensions: personal and social skills (14 items), cognitive skills (five items), goal-setting (four items), initiative (four items), and negative experiences (10 items). Athletes reflected on their current sport involvement and responded to

each statement using a 4-point Likert-type scale ranging from 1 (*not at all*) to 4 (*yes definitely*). Reliability analyses of the subscales in the previous research produced Cronbach alpha values between .82 and .94 (MacDonald et al., 2012). The second measure was an adapted version of the Basic Need Satisfaction in Relationships Scale (BNSRS; La Guardia, Ryan, Couchman, & Deci, 2000). This instrument consists of nine items and assesses need satisfaction in athletes' relationships with their coach. Athletes responded to each item on a 7-point scale ranging from of 1 (*not at all true*) to 7 (*very true*). Mean scores on this measure reflected the extent to which the athletes' perceived that their basic needs for autonomy (three items), competence (three items), and relatedness (three items) were satisfied in their interactions with their coach. Reliability analysis in previous research produced Cronbach alpha values between .83 and .84 for the three subscales (Coatsworth & Conroy, 2009).

Procedure

Ten practices were videotaped during a 6-week period in the middle of the competitive season. During these sessions, the coach wore an omni-directional wireless microphone to capture her own and the athletes' verbalizations. Two trial recordings were used to acclimatize the coaches and athletes to the presence of the researcher and to the recording process in an effort to minimize reactivity. The videos for each of the practices were used to code coach and athlete interactive behaviors. Two representative 30-min segments were selected for analysis from each of the remaining eight practices, resulting in a total of 8-hr of observation time spread over 16 video segments to be coded. Segments were selected to ensure that all of the recorded practices included a warm-up, several main sets, and a cool-down period. This standardization allowed for the consistent opportunity to record coach-athlete behaviors in multiple naturally occurring practice contexts. The variables of interest (coach/athlete behavior) were recorded continuously for each participant using real time, duration-based coding.

At the beginning of the last recorded practice, athletes were asked to complete the YES-S (MacDonald et al., 2012) and the BNSRS (La Guardia et al., 2000), keeping in mind their experiences within this sport program. These measures were included to assess the quality of the athletes' experiences within this program and to evaluate the degree to which this program was a salient context for youth development. The time needed for participants to complete the questionnaires was approximately 30 to 40 min. Although efforts were made to ensure that all athletes completed the questionnaire, one athlete was unable to complete the questionnaire due to limitations in communication abilities. All procedures for this study were approved by the research ethics board at the researchers' university before contact with participants. The coach, the athletes, and their parents were required to provide written consent prior to participation.

Data Analysis

Coach-athlete behavior was assessed using the SSG method (Lewis et al., 1999). This technique utilizes observational data and quantifies these data according to two ordinal variables that represent a dyadic system (i.e., coach and athlete behavior). The dyad's real-time behavioral trajectory is then plotted on a grid representing all possible behavioral combinations. Similar to a scatter plot, the coach's behavior at any point in time can be plotted on the x-axis and the athlete's simultaneous behavior can be plotted on the y-axis. Each point on the grid, thus, represents a joint behavioral event. A trajectory is then drawn through successive dyadic points in the temporal sequence that they were observed. For example, if a coach is observing the athlete make a technical error, the coach may stop the athlete and have a technical discussion. These changes in behaviors are depicted as an interaction's trajectory in the SSG. By

observing changes in the dyad's location within the grid over time, it is possible to determine the sequences and patterns of behaviors that occur during an interaction. The movements across the SSG provide insight regarding the variability and sequences of interactive behaviors, while the location in the SSG provides information about the levels of particular behaviors exhibited during interactions.

Individual coach-athlete dyads were the primary unit of analysis, comprised of the coach and each individual athlete, with 24 coach-athlete dyads analyzed in total. Measures of coach-athlete interaction content and structure were calculated using GridWare software (Version 1.1; Lamey, Hollenstein, Lewis, & Granic, 2004), which is designed for the SSG method. Measures were calculated for three concepts related to the research questions: (a) variability, (b) coaching behavior sequences, and (c) behavioral content patterns. These measures were derived from SSG's constructed for each coach-athlete dyadic pair (i.e., coach and Athlete A, etc).

Dyad measures as dependent variables were grouped together to examine the team as a whole, and were subsequently grouped by competitive level and disability status for comparison purposes. Measures were also compared across three observed practices. The three time points represented the first, middle, and last practice that each athlete attended over the course of the eight practices used for analysis. For those athletes who participated in an even number of practices and, thus, had two possible middle time points, the practice with the higher attendance rate was selected as the middle practice. Differences between groups were tested statistically with 2 (group [competitive, recreational or able-bodied athletes, athletes with a disability]) $\times$ 3 (time [first, middle, last practice]) repeated measures ANOVAs, using Bonferonni-corrected alpha values for multiple comparisons within each conceptual grouping. This technique was selected because it allowed the researchers to control for practice effects when comparing the different groups of athletes. This was important because the athletes' behavioral measures were not independent across the different practice sessions.

Variability of behaviors

Variability refers to the degree to which dyads change their behavior over the course of their interaction and can provide valuable information about the quality of social interactions. The variability of the coach-athlete interactions in this study was assessed by two whole grid parameters. The first parameter was the number of different cells (joint behavioral events) visited over the course of the interaction; higher numbers of cells visited indicated more frequent changes in behavioral states and therefore, a more variable pattern of behavior. The second parameter assessed variability by measuring the number of transitions between cells, with more transitions signifying greater variability. Variability was assessed for both the team as a whole and compared between different groups within the team (i.e., groups based on competitive level and disability status).

Coaching behavior sequences

One of the key advantages of using SSG methodology is its ability to capture the sequences of coach behaviors as they occur in real-time. These behavioral sequences were analyzed using lagged phase plots, in which coach behavior at any given time (t) was plotted along the x-axis and the subsequent coach behavior (t + 1) was plotted along the y-axis. Each cell in the SSG, thus, represented the transition from one coach behavior to another, with more visits in a particular cell indicating a more frequently occurring coaching behavior sequence. Since behavioral sequences were evaluated using a unique type of SSG, sequences could only be assessed for the team as a whole.

Behavioral content patterns (attractors)

In contrast to variability, which was assessed by whole grid measures, behavioral content patterns were identified by computing and comparing parameters for each cell of the SSG. These content patterns, also known as attractors, referred to those behavioral pairings to which the coach-athlete dyads tended to be drawn over the course of an interaction. These were identified through two parameters, averaged across athletes and practices. First, they were identified by how much time was spent in a particular region of the grid, with longer times indicating a stronger attraction. This was measured by the mean total duration (measured in seconds) spent in each cell. The second parameter was the mean number of visits, with stronger attractor cells reflected by higher numbers of visits. A cell visit referred to one or more consecutive events occurring within a cell, beginning upon the dyad's entry into the cell, and ending upon its exit. Behavioral content patterns were identified for the team overall and were then compared between the different groups with regards to the differences or similarities in the cells that exerted the most pull on the interactions.

RESULTS

Scores on the YES-S demonstrate that the athletes' experiences within the program were quite positive ($M = 3.1$ on a 4-point scale for the positive subscales and 1.3 on a 4-point scale for the negative subscale). The results from the BNSRS indicate that the athletes' felt that their needs for autonomy, competence, and relatedness were satisfied by their relationships with the coach ($M = 5.9$, 6.3, and 5.9 on a 7-point scale, respectively). Using a Bonferroni-corrected p value of .003, no significant differences emerged based on the athletes' competitive level or disability status.

Coach and Athlete Behavior: SSG Analysis

Variability of behaviors

The first research question of this study was to examine the variability (the degree to which behavior patterns change) of the coach-athlete interactions occurring within this program. Overall, the coach-athlete interactions in this sport program were structured in nature. On average, the dyads visited 31.43 cells ($SD = 8.93$) of the possible 200 cells of the SSG (averaged across athletes and practice sessions). In addition, the dyads made an average of 238 transitions ($SD = 34.58$) during the course of their interactions. Four separate 2 (group) $\times$ 3 (time) repeated measures ANOVAs were conducted to compare the variability of the coach-athlete interactions between competitive and recreational athletes and between athletes with disabilities and able-bodied athletes. The corrected p value for these analyses was .0125. The dependent variables for these analyses were the number of cells visited and the number of transitions between cells. Results revealed that there were no significant differences in the mean number of cells visited based on the athletes' competitive level or disability status. However, there was a main effect for competitive level on the mean number of transitions per practice session $F(1, 2) = 8.24$, $p = .009$, $\eta_p^2 = .27$. Specifically, the mean number of transitions between cells was significantly higher for interactions occurring between the coach and competitive athletes ($M = 250.12$, $SD = 37.44$) than those between the coach and recreational athletes ($M = 233.92$, $SD = 32.76$).

Coaching behavior sequences

The aim of the second research question was to capture the behavioral sequences that characterized the coach's interactions with her athletes. The sequences with the highest frequencies

Table 1
Mean Duration (s) and Mean Visits for Coach Behaviors while Athletes were Engaged

	Duration		Frequency	
	M	%	*M*	%
Humor team	8.09	0.55	1.61	0.85
Humor athlete	24.75	1.67	6.71	3.56
Positive reinforcement team	4.04	0.27	1.74	0.92
Positive reinforcement athlete	32.23	2.17	14.52	7.70
Coach-initiated athlete input	48.39	3.26	9.82	5.21
Technical instruction team	25.53	1.72	2.36	1.25
Technical instruction athlete	92.67	6.24	8.58	4.55
Technical instruction with modeling team	30.88	2.08	4.23	2.24
Technical instruction with modeling athlete	97.39	6.56	15.88	8.42
Cues athlete	7.66	0.52	3.78	2.00
Personal instruction	17.46	1.18	2.13	1.13
Organization team	99.06	6.68	18.77	9.95
Organization athlete	142.17	9.58	28.71	15.22
Observation	718.11	48.39	54.21	28.74
General communication team	4.15	0.28	0.57	0.30
General communication athlete	83.43	5.62	10.25	5.44
Physical assistance	14.71	0.99	2.54	1.35
Negative behaviors	3.48	0.23	0.99	0.52
Not engaged	29.15	1.96	1.16	0.62
Uncodable	0.60	0.04	0.03	0.02
Total	1483.95	100	188.59	100

were the transition from the observational category into the organizational categories (M visits $= 13.75$) and the reverse transition ($M = 16.69$). Outside of the organization/observation pairing, the coach often combined observation with subsequent positive reinforcement ($M = 8.68$), technical instruction with modeling ($M = 7.06$), technical cues ($M = 5.38$), or general communication to individual athletes ($M = 5.38$). A longer, frequently employed sequence of three coaching behaviors included the coach observing the athletes, providing individualized instruction or feedback, and then resuming observation.

Content of the coach's behaviors

The third research question related to the behaviors that were most commonly exhibited during the coach-athlete interactions. The athletes spent the vast majority of their time engaged in practice activities (82.8% of the practice time), not directly interacting with the coach or their peers. As such, the content of coach behaviors while the athletes were engaged will be the focus of these results. Table 1 displays the mean duration and mean number of visits per practice session for coach behavior while the athletes were engaged. Of the nearly 1,500 s that the athletes were engaged, the coach spent the majority of this time silently observing the athletes (48.4%), followed by providing organizational instruction targeted towards both individual athletes (9.6%) and the team as a whole (6.7%), and then by providing individualized technical instruction both with (6.6%) and without modeling (6.2%). The coach displayed higher usage of positive coaching behaviors, such as positive reinforcement (2.4%) in comparison to negative coaching behaviors, such as keeping control (0.2%). Finally, the coach of this program spent

more practice time exhibiting behaviors that were directed towards individual athletes (37.8%), as opposed to the team as a whole (13.8%). This pattern was evident for several behavioral categories, including humor, positive reinforcement, organization, general communication, and technical instruction with and without modeling.

In line with the secondary purpose of this study, the coach's behaviors were then compared between competitive and recreational athletes and between able-bodied athletes and athletes with disabilities. Given that the coach spent more practice time displaying behaviors that were targeted towards individual athletes, in comparison to the whole team, these attractor analyses focused on individualized coaching behaviors. The p value for attractor state comparisons was set at .005. Ten separate 2 (group) $\times$ 3 (time) repeated measures ANOVAs were conducted to analyze the five most frequently occurring individualized coaching behaviors (organization, technical instruction with modeling, positive reinforcement, general communication, and coach-initiated athlete input). When comparing competitive and recreational athletes, the ANOVAs revealed a significant main group effect for positive reinforcement $F(1, 2) = 24.29$, $p < .001$, $\eta_p^2 = .53$ and technical instruction with modeling $F(1, 2) = 20.74$, $p < .001$, $\eta_p^2 = .49$. Results indicated that the coach spent a significantly greater duration of time providing individualized positive reinforcement to the competitive athletes ($M = 37.20$, $SD = 19.36$) relative to the recreational athletes ($M = 25.79$, $SD = 21.54$). Furthermore, the competitive athletes ($M = 113.98$, $SD = 79.03$) received significantly higher levels of technical instruction with modeling compared to the recreational athletes ($M = 75.82$, $SD = 70.62$). When comparing the coach's behavior relative to the athletes' disability status, there was no main group effect for any of the behaviors.

Finally, when comparing the content of the coach's behaviors between competitive and recreational athletes, significant main effects for time were found for technical instruction with modeling, positive reinforcement, general communication, and coach-initiated athlete input. These time effects indicate that there was significant variation in the duration for which these behaviors were exhibited between the practices. These main effects for time were also evident when comparing coaching behaviors in relation to disability status.

Content of the athletes' behaviors

As stated above, the athletes spent the majority of their practice time engaged in practice activities ($M = 1483.95$ s, $SD = 435.67$), such as swimming during assigned sets or resting during appropriate rest periods. Other commonly exhibited athlete behaviors included talking with their teammates ($M = 47.94$ s, $SD = 90.85$) and discussions with the coach about technical, performance-related topics ($M = 37.13$ s, $SD = 54.04$) or general, non-sport related topics ($M = 19.68$ s, $SD = 69.50$). Eight separate 2 (group) $\times$ 3 (time) repeated measures ANOVAs were conducted to examine the four most commonly exhibited interactive athlete behaviors (technical talking, general talking coach, general talking athlete, and acknowledgment). When comparing the athletes' behaviors based on competitive level and disability status, the corrected p value was set at .00625. Results revealed that there were no significant main group effects for either competitive level or disability status. In addition, there were no significant main effects for time.

DISCUSSION

The purpose of the present study was to examine both the content and structure of the coach-athlete interactions occurring in a model sport program for athletes with disabilities and their able-bodied siblings. The discussion will primarily focus on the novel measures

of coach-athlete interaction structure, variability and behavior sequences, as well as unique aspects of the behavioral content patterns of the coach-athlete interactions. Although no causal links between the coach-athlete interaction structures and the athletes' sport experiences can be established, the patterns of coach-athlete behaviors will be used to characterize this unique sport environment.

With regards to both the variability and content of coach-athlete interactions, it is interesting to note that the results revealed no significant differences in the coach's or athletes' behaviors in relation to the athletes' disability status. This finding indicates that coaching athletes with disabilities may require many of the same skills as coaching able-bodied athletes and, thus, coaches can employ similar coaching behaviors (i.e., individualized technical instruction, positive reinforcement; DePauw & Gavron, 2005). Consistent with the work of Robbins, Houston, and Dummer (2010), this finding also implies that a unique benefit of sport for individuals with disabilities is that it may be one context in which their disability is not the central focus. It is hoped that these results will encourage coaches within disability sport settings to view participants as athletes who have a disability, rather than as disabled people who participate in sport. Given the lack of differences in coach-athlete interaction style in relation to the athletes' disability status, the next sections will focus on the coach-athlete interactions for the team as a whole and the influence of the athletes' competitive level on these interactions.

Variability

The coach-athlete interactions of this team were very structured. Indeed, the interactions functioned in a few select, mutually defined behavioral pairings and were limited to a small area of the total potential state space. This finding implies that this successful program was characterized by consistent and patterned coach-athlete interactions. Erickson et al. (2011) similarly found that the coach-athlete interactions of a more successful team (with regards to both performance outcomes and athletes' experiences), exhibited less variability than the interactions of a less successful team. Together, these studies indicate that reduced variability in coach-athlete interactions (i.e., more predictable interactions) may be a key feature of positive sport environments.

Predictable coach-athlete interactive patterns may help to foster positive sport experiences. When coaches behave in a consistent manner, their athletes know what to expect from them and can focus on their own development and performance (Becker, 2009). Conversely, inconsistencies in coaches' behaviors can become a distraction for athletes as they may worry about how their coaches will react. Coaches may enhance the consistency of their interactions by developing a strong understanding of their coaching values and beliefs and by making an effort to demonstrate these values and beliefs in their interactions with their athletes (Becker, 2013). It is possible that coaches who are firm and confident in their values are more likely to behave in a consistent manner because their behaviors are a reflection of something stable (i.e., an underlying belief system) rather than unstable (i.e., situational variables; Becker, 2013). However, further research is needed to substantiate this claim. Future studies may, thus, wish to examine how coaches' values and beliefs influence their coaching behavioral patterns.

Interestingly, between-group differences emerged for one measure of variability. Specifically, the mean number of transitions between cells was higher for those interactions occurring between the coach and competitive athletes than between the coach and recreational athletes. In real-world terms, this indicates that although there were a few select behaviors exhibited during the interactions of both competitive and recreational athletes, there were more transitions between those select behaviors for interactions occurring with the competitive athletes.

One possible explanation for these results is that the coach employed a more interactive style with the competitive athletes. Although it is unclear why this may be the case, it may be that this communication style emerges with athletes who have greater knowledge of the sport or who are more comfortable speaking with their coach. Bloom, Schinke, and Salmela (1997) lend support to this proposition as they found that coaches at the novice level tended to utilize an autocratic communication style with club level athletes, whereas coaches at the more advanced levels employed a two-way communication style with their elite athletes. However, further exploration is necessary to understand the influence of athletes' competitive level on the variability of coach-athlete interactions. In particular, it may be worthwhile to investigate how coaches' expectations of athletes in different competitive levels may shape their coach-athlete interaction patterns.

Interpreting the results of the present study in light of previous research, it might be argued that the variability of coach-athlete interactions may have important implications for youth development in sport. Consequently, the ability to quantitatively assess this construct holds significant potential for coaching researchers. The behavioral measures provided by the SSG method may complement research that has primarily focused on coaches' and athletes' perceptions of predictability within coach-athlete interactions. Moreover, these measures may have practical applications for coaches and practitioners. For instance, although coaching can often be a chaotic process, it may be beneficial for coaches to respond to this chaos in relatively patterned, consistent ways. Furthermore, it may be important for coaches and practitioners to consider how this patterning of behavior may be shaped by contextual variables, such as coaches' expectations of their athletes, coaching philosophies, or athlete characteristics.

Coaching Behavior Sequences

Another unique aspect of this study was the examination of the coach's behavioral sequences. The most commonly occurring behavioral sequence was observation followed by organization. Outside of this pairing, the coach often combined observation with subsequent positive reinforcement, technical instruction with modeling, or general communication to individual athletes. Interactive coach behaviors, such as instruction and feedback, were often interspersed between periods of sustained observation. The coach of this program tended to conform to a pattern of coaching similar to that observed by Cushion and Jones (2001) and Potrac, Jones, and Cushion (2007) in which after getting the athletes on task, coaches quietly observed athletes for a while before intervening. Following intervention, the coaches often transitioned back into observation, giving instruction and feedback as deemed necessary.

By examining these results, it is possible that observation provides coaches with an opportunity to reflect and analyze before proceeding to the next behavior (Smith & Cushion, 2006). For example, the coach often displayed a period of observation in between providing technical instruction and positive reinforcement. In doing so, the coach may be ensuring that her athletes adhered to her feedback before giving praise. By linking observation with organizational and technical instruction, the coach may have enhanced the quality of information delivery. Consistent with this perspective, Cushion and Jones (2001) suggest that silence can ensure that the impact of instructions is not diluted by continuous intervention and decrease the likelihood of overloading athletes with information. Although further research is needed, the results provide some initial support for the notion that observation may be a key element of effective coaching. It may, thus, be beneficial for coaches to consider incorporating observation into their everyday coaching practice. Furthermore, the findings highlight how measures of the temporal sequencing of behaviors may enhance our understanding of coach-athlete interactions in sport.

Coach-Athlete Interaction Behavioral Content

In assessing the content of the coach-athlete interactions within this program, it is evident that the results are fairly consistent with previous studies that have mainly focused on this dimension of coaches' behaviors. As might be expected, observation was the largest coaching behavioral category in both frequency and duration. Other behaviors commonly exhibited were technical (16.6%) and organizational (16.3%) instructions. This finding adds to a growing body of research that indicates that organization and instruction are important elements of effective coaching (Cushion & Jones, 2001; Potrac et al., 2007). Given that the majority of previous studies focused on such behaviors in team sport settings, the present finding also extends the body of evidence within individual sport contexts.

Although the occurrence of these behaviors may have been expected, there are two unique aspects of the interactions that may have enhanced the quality of the organizational and technical instructions. First, although the majority of the coach's instructions occurred while the athletes were engaged, it is interesting to note that the athletes exhibited other behaviors during these interactions. For example, the athletes in this program also used these interactions to discuss technical matters and to ask questions to clarify instructions. This finding implies that these types of instruction-based interactions may create opportunities for athletes to take an active role in their practice sessions. By considering athletes' behaviors in conjunction with specific coaching behaviors, the methods used in the present study enable us to present a more complete picture of coach-athlete interactions than can be provided by traditional observational methods.

A second important aspect of the coach's instructions was that they were very individualized. One possible explanation for this finding may be that the coach had to adapt her organizational and technical instructions to the unique needs and abilities of each of the athletes on the team, thereby increasing the frequency of these behaviors. Indeed, it was often observed that the coach would individualize the qualities of certain practice sets according to each athlete's competitive level and swimming abilities. Cregan et al. (2007) echoed this sentiment as they found that successful coaches of elite swimmers with disabilities tended to individualize their coaching strategies.

The coach of this program also employed an individualized style of providing feedback. The coach frequently used short bouts of positive reinforcement and spent more time directing positive reinforcement to individual athletes, in comparison to the whole team. Erickson et al.'s (2011) findings support this approach to providing feedback as they found that the individualization of positive reinforcement was one of the key variables that differentiated a more successful coach from a less successful coach. Given that swimming is an individual sport, one may argue that it is not surprising that the coach individualized her technical instructions and feedback. However, it is important to acknowledge that the coach also individualized behaviors that were not practice or technique related. For example, the vast majority of coach-athlete interactions involving humor (80.0%) and general communication (95.0%) were also directed towards individual athletes. These results indicate that individualized interactions may be an important characteristic of positive sport environments. Previous research supports this assertion as one-on-one coaching has been linked with positive athlete outcomes (Fraser-Thomas, Côté, & Deakin, 2008). Moreover, they highlight that coaches should be aware of both the content and target of their behaviors.

The results also imply that the coach's use of certain individualized behaviors was influenced by the competitive level of the athletes. Specifically, the coach exhibited higher levels of individualized positive reinforcement and technical instruction combined with modeling with the competitive athletes in comparison to the recreational athletes. This behavioral pattern

might be attributed to the competitive stream of this program being purposefully structured to improve performance levels and to facilitate skill development. It is also possible that the coach of this program may have balanced the increased use of corrective technical instruction with increased use of positive reinforcement to maintain a positive environment for all athletes. Although these findings offer some insight into how athletes' competitive level may affect coaching behavior, further investigation in this area is certainly needed. In particular, it may be beneficial for studies to examine how coaches' perceptions of athletes in various competitive levels (e.g., coaches' expectations; Solomon, 1998) may shape their interactive behaviors.

Finally, a significant effect for time emerged when comparing the behavioral content of the coach-athlete interactions between the different athlete groups, but not when comparing the variability of these interactions. This finding implies that although the duration of certain behaviors varied between practices, the range of coach-athlete behaviors did not differ between practice sessions. Future studies may therefore wish to examine how the content of practice sessions (individual drills vs. team activities) or the timing of practice sessions relative to the competitive season may influence coach-athlete interactions.

Overall, this study advanced our understanding of coach-athlete interactions, especially within the disability sport context, by illustrating both the content and structure of the interactions that occur in a model sport program. Given the very distinctive nature of this program, this program provided a unique opportunity for the researchers to investigate novel aspects of coach-athlete interactions and to examine the influence of contextual variables on these interactions. The results revealed that the coach-athlete interactions of this program were characterized by deliberate patterns, individualized attention, and athlete-, rather than disability-centered relationships. Coaches and practitioners who wish to increase the quality of their athletes' sport experiences can consider these factors when designing their own sport programs.

Practical Applications and Future Directions

The findings of this study add to the coaching literature by exploring coach-athlete interactions in an understudied population with a method that captures novel aspects of coach-athlete interactions. This study also has important applied applications. First, the potential importance of observation and reflection implies that coaches should consider employing observation during their coach-athlete interactions. For instance, coaches may wish to observe how their athletes incorporate technical feedback into their performances prior to providing positive reinforcement. Coaches may also consider ways of enhancing the consistency of their coaching behaviors, such as developing strong coaching values. Finally, given the benefits of individualized coaching behaviors, coaches and practitioners may be advised to adapt their coaching style to suit each athlete's specific needs, whether or not they have a disability. Such suggestions can also be incorporated into the design of certification programs that will enable coaches to cultivate positive sport environments. Future studies can build upon the results of this case-study by conducting research with multiple programs to see how generalizable the present findings are to other sports or competitive contexts, such as with team sports or with elite level athletes. In addition, a possible limitation of this study was that it was only able to examine the influence of two contextual variables. Further examination of the influence of contextual variables on coach-athlete interactions would, thus, be highly beneficial. Such studies may shed light on possible confounding factors, such as coaches' expectations, that could influence the association between contextual variables and coach-athlete behaviors. Finally, future qualitative studies may be useful in exploring the reasoning behind the content and structure of coach-athlete interactions. If all athletes, regardless of disability status, experience

sport in positive and supportive coaching environments, this will have important implications for youth development.

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