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The Role of Collective Efficacy in Adventure Racing Teams

William A. Edmonds
Nova Southeastern University
Gershon Tenenbaum
Akihito Kamata
Florida State University
Michael B. Johnson
Georgia Highlands College

This study examines the relationship between collective efficacy and performance in a single competition of adventure racing. Adventure racing is a team-based sport that requires the multidisciplinary tasks of trekking, mountain biking, canoeing, and climbing to navigate through a preplanned racecourse. Seventeen teams competing in an adventure race completed measures of prior performance, preparation effort, and a collective efficacy assessing perceptions of their team's functioning in six performance areas. Three in-race measures of collective efficacy and environmental factors-conditions are taken at various checkpoints. A correlational analysis indicates a positive relationship between preparation effort and initial perceptions of collective efficacy. A repeated measures analysis reveals the dynamic nature of collective efficacy and the reciprocal relationship between efficacy and performance. The results are consistent with D. L. Feltz and C. D. Lirgg's (1998) examination of collegiate teams and A. Bandura's (2000) contention that collective efficacy fosters a sense of motivational investment and an increased sense of staying power.

Keywords: *collective efficacy; performance; adventure racing*

Confidence is an important precursor in determining performance quality in sports. The terms *self-confidence* and *self-efficacy* have been used interchangeably to describe a person's perceived capability to accomplish a certain level of performance (Feltz & Chase, 1998). Bandura's

Authors' Note: Please address correspondence to William A. Edmonds, Nova Southeastern University, Applied Research Center, Fischler School of Education and Human Services, 1750 NE 167th Street, North Miami Beach, FL 33162; e-mail: edmonds@nova.edu.

(1997) model of self-efficacy has often been used to explain how self-confidence influences the success of an athlete's performance. He defined perceived self-efficacy as "the beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). Bandura (1997) argued that self-efficacy judgments influence people's levels of motivation as reflected in the challenges they undertake, the effort they expend in the activity, and their perseverance in the face of difficulties.

Collective Efficacy

In many sports, however, competition takes place between teams. In team sports, successful performance depends on the combined efforts of the team members to achieve the desired outcomes. As a result, Bandura (1986) extended the social-cognitive theory of self-efficacy by including the concept of collective efficacy to explain group motivation and performance. Bandura (1997) defined collective efficacy as "a group's shared belief in their conjoint capabilities to organize and execute the courses of action required to produce given levels of attainments" (p. 476).

Kozlowski and Klein (2000) posited that a group's shared perceptions influence the attitudes and behaviors of the group and this takes precedence over an individual's perceptions. Bandura further explained that a group's shared belief was reflected in individuals' perceptions of the group's capabilities. Collective efficacy beliefs across all domains (e.g., sport, business) are hypothesized to influence what people choose to do as a group, how much effort they put into their group endeavors, and their persistence when collective efforts fail to produce quick results or encounter obstacles to success. For example, Mulvey and Klein (1998) found that collective efficacy and social loafing influence motivation and performance in small work groups. Empirical research has also indicated that collective efficacy has been positively correlated with performance in educational systems (Parker, 1994) and combat teams (Jex & Bliese, 1999). Accordingly, a group's collective efficacy judgment can be derived from either an aggregation of individual members' judgments of personal capabilities to perform within the group or an aggregation of individual members' judgments of the group's capabilities as a whole to perform (i.e., individual perceptions of collective efficacy represent an emergent effect that emanates from the group).

In this study the determinants of collective efficacy and the separate and combined effects of collective efficacy and its determinants on adventure racing performance were explored. Aggregated self-efficacy of team members participating in highly interdependent sports (i.e., teammates relying on each other to execute tasks) is insufficient to successfully accomplish the team's goals. To illustrate the point, a sport team that is composed of the most talented individual athletes may collectively perform poorly because the teammates do not work well together. Feltz and Lirgg (1998) examined the influence of aggregated self-efficacy and aggregated collective efficacy on team performance in men's ice hockey over a season of competition. They reported that aggregated collective efficacy was a better predictor of team performance than was aggregated self-efficacy. Gully, Incalcaterra, Joshi, and Beaubien (2002) revealed through a meta-analytic analysis that across groups in various domains of functioning, the relationship between collective efficacy and performance got stronger as task interdependence increased.

Collective efficacy is believed to be state oriented and a dynamic construct. Research in collective efficacy postulates that it motivates behavior and is influenced reciprocally by performance outcomes and the behavior exhibited (i.e., reciprocal determinism; Bandura, 1997). Hodges and Carron (1992) verified the causal impact of perceived collective efficacy on team performance using an experimental design. Groups whose collective efficacy was raised improved subsequent team performance, whereas teams whose perceptions of efficacy were lowered suffered performance decrements. Correlational research in sport has also supported the reciprocal relationship between collective efficacy and performance in women's ice hockey (Myers, Payment, & Feltz, 2004) and in collegiate football (Myers, Feltz, & Short, 2004).

Determinants of collective efficacy are similar to those of individual efficacy (Bandura, 1997). As with self-efficacy, Bandura proposed that mastery experiences of the group would exert the most powerful influence on collective efficacy beliefs. In addition, because collective efficacy is rooted in self-efficacy, self-efficacy beliefs should also influence collective efficacy. Research in sport has supported these assertions (Magyar, Feltz, & Simpson, 2004; Watson, Chemers, & Preiser, 2001). However, Bandura (1997) also suggested that sources of collective efficacy might involve more complex socially and situationally mediated interactions than sources of self-efficacy. For instance, Chase, Feltz, and Lirgg (2003) found that past performance in practice or training sessions was the most selected source of information for collective efficacy over actual game performance. Zaccaro, Blair, Peterson, and Zazanis (1995) suggested that when groups are similar in skill level and ability, their members evaluate and compare themselves to each other's successes through their vicarious experiences, which ultimately enhance their perception of collective efficacy. Gould, Hodge, Peterson, and Giannini (1989) revealed that preparation effort (i.e., the sport-specific and general physical conditioning that athletes undertake for competition) was one of the highest-rated strategies used by elite coaches to enhance self-efficacy in athletes. Lastly, environmental factors-conditions (e.g., weather, time, location) are believed to intervene on the perceived efficacy of a team, generating powerful influences on perceived internal states.

A person or group is conceptualized as always being simultaneously embedded in the environment and actively defining and giving form to it. The environment presents psychological (e.g., perceptions), interactive (e.g., communication), and physical (e.g., hot, cold) parameters and barriers to action (Saegert, 1987). For example, intercollegiate basketball players perceived increased levels of collective efficacy when competing on their home court as opposed to playing on the road (Bray & Widmeyer, 2000).

Perceptions of collective efficacy are reciprocally determined based on performance outcomes, and collecting measures of a team's perceived collective efficacy prior to and throughout a competition is likely to reflect the nature of this construct. Within most sports there is a distinct start and finish time and it is not practical to interrupt a football player, for example, to determine his collective efficacy between each quarter. And unlike a business setting that allows for individuals within teams to make ongoing adjustments, we believe adventure racing to be an ideal sport for studying collective efficacy and related variables because of the multidisciplinary characteristics, dynamics, and tasks required for competition.

Adventure Racing

Adventure racing involves endeavors that require high system interdependence (i.e., team members must be highly coordinative and harmonized in their efforts with fellow team members to attain its goals). Specifically, adventure racing is team based and requires multidisciplinary skills to navigate virtually nonstop through a preplanned outdoor course. Teams must share common expectations (i.e., norms) to develop stability within the group and to increase the likelihood for success (Colman & Carron, 2001).

Adventure racing teams usually consist of two to five members. Most expedition races require that at least one member of a team be of the opposite sex. If one member of a team, for any reason, cannot complete a race, the team is disqualified. Therefore, teamwork and the role each teammate plays are essential components of adventure racing. Bona fide group theory posits that members of a group play key representative roles (Putnam & Stohl, 1990). For instance, if one team member is more skilled in rappelling or ascending on the fixed rope section, it will be his or her responsibility to guide the other members of the team through this section as quickly and efficiently as possible. Bona fide theory also assumes that teams are interdependent within the immediate context. The team must examine the ongoing behavior–environment relationship, and submit to a behavior that is reinforced by the environment (Danford, 1985). Therefore, the environmental conditions (i.e., context) of the racecourse influence the overall dynamic of the group. For example, because adventure racing is an extremely arduous sport, racers must support one another when the demands of a race begin to wear on their teammate's physical and mental capabilities.

Typical events that are part of most adventure racing courses include, but are not limited to, hiking, trail running, ascending and rappelling, mountain biking, lake or river kayaking, and mountaineering. All adventure races include some aspect of navigation and orienteering. The only tools that racers are allowed to use for navigation are a compass and a map; therefore, competence in the art of navigation and orienteering is one of the most important skills for an adventure racing team to possess (Mann & Schaad, 2001). In addition, each team must have a strategy to determine the best route and pace to maintain a high performance level while keeping the team intact and at the same time carrying only the necessary amounts of food and equipment. The multiple facets, skills, and the nature of this sport is ideal for studying the dynamic nature of specific psychological construct while allowing for the collection of data during multiple time points.

Hypotheses

The two overarching purposes of this study were to examine specific sources of collective efficacy and examine the relationship between collective efficacy and performance as it changes during a competition, in addition to testing a new measurement approach of the construct (i.e., repeated measures design). Although the literature reviewed supports the major assertions of this study, the reciprocal nature between collective efficacy and performance within a competition have not been investigated, which makes adventure racing an ideal sport to apply this design. Based on previous research and the theoretical tenets regarding collective efficacy, we hypothesized that (Hypothesis 1) prior performance, preparation effort, and perceived environmental factors–conditions would correlate to perceptions of collective efficacy. We also hypothesized that (Hypothesis 2) perceptions of collective efficacy would be strongly associated with performance throughout the race.

Method

Participants

Members of adventure racing teams (34 men and 17 women, *M* age = 34.3, *SD* = 5.5), competing in an adventure race in south Florida, volunteered to participate in this study. Seventeen teams consisted of three members per team (two men and one woman per team).

Instrumentation

Collective efficacy. Adventure racing is a sport that requires high system interdependence; consequently, performance outcomes depend on the combined and coordinated efforts of the teammates. Therefore, aggregating the individual member's judgments of his or her group's capabilities is most likely to determine the perceived collective efficacy of the group.

Collective efficacy was measured using a five-item scale that was developed based on suggestions from Bandura (1997) and Feltz and Chase (1998) and that reflected the variety of tasks, which were required of the group or team. To address face validity of the scale, the coordinator and race director of the adventure race was consulted to identify the competence areas relevant to success in this particular race. As a result, five performance areas were identified and are as follows: (a) marathon and trekking, (b) canoeing, (c) mountain biking, (d) climbing (e.g., rope skills), and (e) orienteering and navigating.

As previously noted, the sport of adventure racing requires teamwork and a variety of sub skills to compete. Depending on the design of the course, skills such as canoeing and running may vary. Therefore, a nonhierarchical scale was used to examine several variable paths and their relationship with collective efficacy; that is, a nonhierarchical scale can assess the participants' beliefs regarding their team's capabilities in the specific competence areas within adventure racing (see Feltz & Chase, 1998, for an in-depth review).

The strength of collective efficacy was assessed by asking the participants to rate the degree to which a team member is confident in his or her team's ability to execute a particular portion of the race (e.g., "How confident are you in the team's ability in executing the mountain biking portion of the race in order to secure a top-place finish?"). Response options were based on a scale that ranged from 0 (*not confident at all*) to 100 (*extremely confident*). Team efficacy scores were computed by taking the average (i.e., aggregated) of the five ratings made by each racer to make up a team score. Cronbach's α coefficients were .87, .93, .97, and .98 for the initial measure and at Checkpoints (CPs) 1, 2, and 3, respectively (see Table 3 for *M*s and *SD*s).

Prior performance. As part of the prerace questionnaire, participants were asked if the team they were competing within this particular race had ever raced together and, if so, in how many races had they competed. The next question asked participants to report their perception of their team's prior performance quality in adventure racing. The question asked specifically the members of the team to rate how well the team performed in the last competition scale using a 7-point rating ranging from 1 (*not good at all*) to 7 (*very good*). Only 10 teams reported having prior performance.

Preparation effort. In the prerace questionnaire, there were two questions that asked how much sport-specific physical training and conditioning and how much conventional or general physical training and conditioning the team had undergone to prepare for the race. A 7-point scale ranging from 1 (*none*) to 7 (*a lot*) was used for participants to rate their team's preparation effort for the two questions. The scores from the two questions were averaged to make up a preparation effort index. The Cronbach's α coefficient for the two items was .79.

Environmental factors-conditions. Four questions were used in the in-race questionnaire to assess the amount of environmental impact present during the race: "How has the weather conditions affected the team's overall performance?" "How has a *teammate's injury*, if any, affected the team's overall performance?" "How has the *complexity of the terrain* affected the team's overall performance?" and "How has the *time of day* affected the team's overall performance?" Response options were on a scale ranging from 1 (*none*) to 7 (*a lot*). The four scores were averaged to compose an environmental impact index. Cronbach's α coefficients were .82, .65, and .71 on the four items at CP1, CP2, and CP3, respectively.

Race performance. This particular adventure race was approximately 100 miles long. Performance was measured by recording the time (hours and minutes) it took to arrive at each of the three checkpoints. In addition, the total performance of teams' finishing times was also recorded.

Procedures

The coordinator and supervisor of the adventure race were contacted for permission to collect data at the upcoming competition. The race supervisor granted permission to conduct the research at his race. The prerace meeting was used to introduce the study and have participants fill out the prerace questionnaires.

The prerace meeting took place the night before the race. The race coordinator presented information to all of the competitors on the racecourse. At the end of the meeting, a brief overview of the study was presented to all the racers.

Prerace measures. All 17 teams agreed to participate in the study. The initial prerace questionnaires, along with consent forms, were administered to all of the racers. All participants were asked to complete their questionnaires individually. In addition, participants were assured of the confidentiality of their responses.

In-race measures. There were five CPs throughout the racecourse. CPs are designated locations in which race teams are required to stop on their journey to the finish line and have their passports signed, as well as for race officials to determine if teams are still intact and capable of moving on. All CPs were accessible by automobile.

The race officially started at 9:00 a.m. Racers started out on a trek and run to the Indian River where they had to take a canoe to CP1. The primary investigator and research assistant waited for teams to arrive at CP1 to administer the first set of in-race questionnaires. As teams arrived at CP1, participants were asked to complete the first in-race questionnaire. The questionnaires took approximately 30 to 90 seconds to complete. After the last team arrived at CP1, all teams were met at the next CP, where the subsequent measures were administered.

The primary investigator and research assistant were present at all the accessible CPs where data were collected. After the last team made it through CP2, enough time was available to drive to CP3, before the lead teams arrived, and gather the third and final in-race measure. By the time teams arrived at CP3, they had traversed, biked, and canoed many miles and exhaustion and fatigue were beginning to take a toll on many of the racers.

Nonetheless, the remaining teams maintained a certain level of enthusiasm in completing the final in-race questionnaires. At this CP, day had turned into night, and teams were administered the final questionnaires with the aid of a flashlight. It was approximately 1:00 a.m. by the time the last team passed through CP3, at which point the final measures for the study were taken.

Results

As a consequence of sample size (N = 17), as well as theoretical considerations (i.e., data collected from only one race), each team was used as the unit of analysis. Preliminary analyses revealed that no major assumptions were violated. Though the sample size for testing the study's hypotheses may be considered small, the sample consisted of all the teams that competed in the event. In line with Cohen's (1994) parameters, the effects magnitude is of greater importance than their significance level.

Depicted in Table 1 are the correlations between sources of collective efficacy, preparation effort (PE), prior performance, and collective efficacy (CE). In line with the initial hypothesis (Hypothesis 1), the correlations were positive with low to moderate magnitudes. Initial perceptions of efficacy correlated with sport-specific measures of PE in the range of r = .37 to .61, and general measures of PE in the range of r = .34 to .74. The measures for the sport-specific and general forms of PE were then averaged for each team and correlated with the initial perceptions of collective efficacy. Moderate to strong correlations (r = .51 to .71) were revealed between PE and initial perceptions of efficacy at the p <.01 significance level.

Of the 17 teams that participated, only 10 groups had prior performance in adventure racing as a team. The remaining 7 teams included some racers with individual prior performance in adventure racing but not as a team. Positive and significant (p < .01) correlations ranging from .74 to .88 resulted between prior performance and perceptions of CE. Also, the correlations with *climbing* and *mountain biking* were positive, though not significant.

Perceptions of environmental factors–conditions were expected to negatively correlate with perceptions of CE throughout the race. Pearson correlations were used to test this assertion. Results indicated weak to moderate and in some cases, not different from 0 correlations between the variables at each checkpoint (CP). There was only one significant correlation at the .05 level (r = –.64) yielded at CP2 between CE and a teammate's injury, and another nonsignificant correlation (r = –.53) between the same variables at

Table 1
Correlations Between Preparation Effort Components, Prior Performance, and Initial Collective Efficacy Measures

	Preparation Effort			
Collective Efficacy	Sport-Specific	General	Average	Prior Performance
Running and trekking	.57*	.74**	.71**	.74*
Canoeing	.61**	.52*	.62*	.79**
Mountain biking	.61**	.34	.51*	.49
Climbing	.37	.59*	.52*	.35
Orienteering and navigation	.45	.59*	.56*	.77**

*$p < .05$. **$p < .01$.

Table 2
Correlations Between Environmental Factors–Conditions and Collective Efficacy Scores at Each Check Point

	Collective Efficacy at Check Points		
Environmental Factors–Conditions	1	2	3
Weather conditions	.30	.02	.38
Teammate's injury	−.05	−.64*	−.53
Complexity of the terrain	.19	−.24	−.24
Time of day	−.15	.10	−.04

*$p < .05$.

CP3. The rest of the correlations were very low and nonsignificant ($p < .05$). These correlations are depicted in Table 2.

Four CPs for data collection were used throughout the race (Performance Time; T is represented by T1–T3 or CP1–CP3 and Finish; T4). *M* and *SD* values of CE, performance measures, and Pearson correlations are summarized in Tables 3 and 4. It was hypothesized (Hypothesis 2) that the performance at each CP would be affected by CE measured at the previous CP. The bivariate correlation coefficients support this hypothesis ($r_{CE2,CE1} = .890$, $r_{CE3,CE2} = .811$, and $r_{CE4,CE3} = .905$). Also, it was hypothesized that the measure of CE would be affected by the performance at the current CP, as well as CE measured at the previous CP and performance at the finish line. Bivariate correlation coefficients support this assertion ($r_{r1,CE1} = -.608$, $r_{r2,CE2} = -.605$, $r_{r3,CE3} = -.430$, and $r_{r4,CE4} = -.581$; $r_{CE2,T1} = -.562$, $r_{CE3,T2} = -.709$, and $r_{CE4,T3} = -.450$).

Table 3
Descriptive Statistics for Collective Efficacy and Performance Measures

Statistic	CE1	CE2	CE3	CE4	T1	T2	T3	T4
M	73.71	74.00	66.82	56.13	122.47	326.47	348.53	532.33
SD	16.42	17.25	22.35	31.63	15.33	54.47	63.36	101.01

Note: Collective efficacy is denoted as CE and performance measures as T.

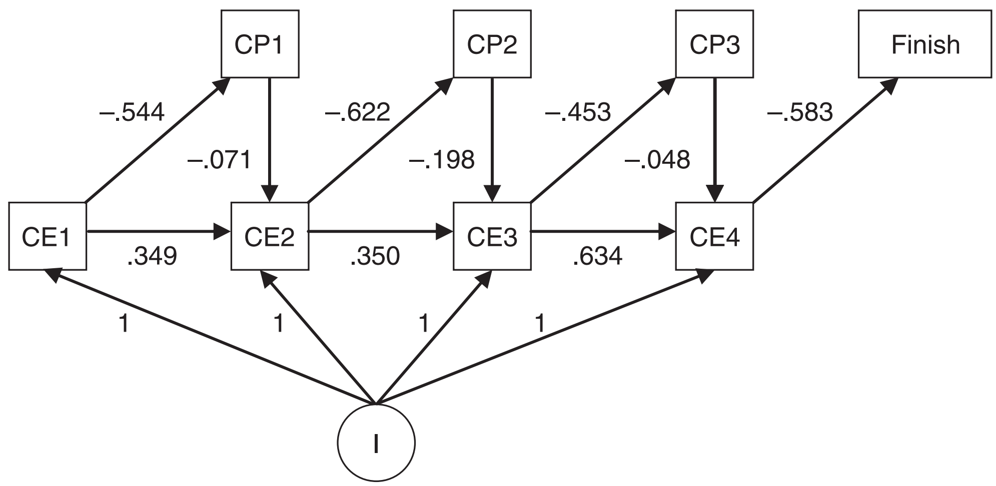
Table 4
Pearson Correlations for Collective Efficacy and Performance Measurers

Variable	CE2	CE3	CE4	T1	T2	T3	T4
CE1	.890	.767	.673	−.608	−.571	−.457	−.521
CE2		.811	.810	−.562	−.605	−.514	−.533
CE3			.905	−.581	−.709	−.430	−.563
CE4				−.440	−.671	−.450	−.581
T1					.717	.518	.640
T2						.528	.800
T3							.570

Note: Collective efficacy is denoted as CE and performance measures as T.

Beyond these bivariate Pearson correlations, the repeated measures nature of collective efficacy measures within the team was taken into account. We used a structural equation modeling framework, resulting in a model similar to a latent growth curve modeling by treating collective efficacy measures as measurement indicators across four time points. However, the model was different from a growth model in that it did not model a change in collective efficacy scores over time. Therefore, it modeled each team with its associated mean collective efficacy measures across four time points. As a result, this modeling was equivalent to a repeated measures model with structural relationships between repeated measures and other covariates. The model and results are summarized in Figure 1. As a result of fitting this model to the data, the model fit indices were obtained as follows: $\chi^2/df = 57.184/20 = 2.86$, CFI = .683, and RMSEA = .352 (90% CI = .247, .461). These fit indices indicate an insufficient model fit. Fit indices from a model with no repeated measure components were $\chi^2/df = 145.137/28 = 5.18$, CFI = .681, and RMSEA = .344 (90% CI = .241, .451).

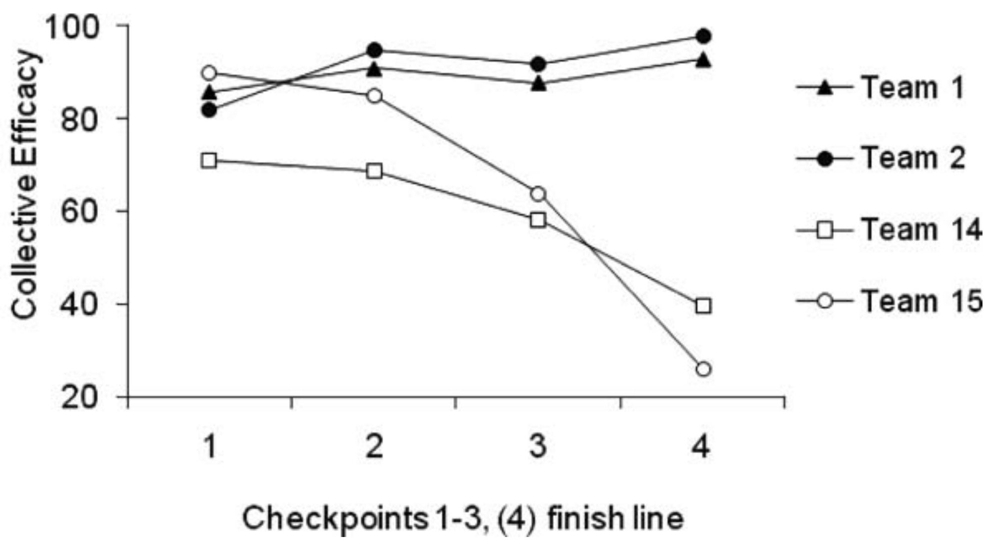
Figure 1
Repeated Measures Structural Model Paths' Coefficients



Note: Correlation coefficients between collective efficacy (CE) and the subsequent performance times at each checkpoint (CP) revealed strong inverse relationships (e.g., $r_{CP1,CE1}$ = –.544), although when factoring in CE with a previous measure of CE and a performance time the relationship weakened (e.g., $r_{CE2,CE1 \cdot CP1}$ = –.071; $r_{CE2,CE1 \cdot T1}$ = .349); however, this was not relevant to the specific test of the stated hypotheses.

Within the repeated measures structural model in Figure 1, CE measures are positively and highly correlated with collective efficacy measured at the previous CP ($r_{CE2,CE1\ T1}$ = –.349, $r_{CE3,CE2\ T2}$ = .350, and $r_{CE4,CE3\ T3}$ = .634). Also, it was revealed that performance was negatively and highly related to the measure of collective efficacy at the previous CP ($r_{T1,CE1}$ = –.544, $r_{T2,CE2}$ = –.622, $r_{T3,CE3}$ = –.453, and $r_{T4,CE4}$ = –.583). In other words, the higher the CE was prior to each CP segment, the faster the times (i.e., better performance). These two findings are consistent with the bivariate Pearson product–moment correlation coefficients and the stated hypothesis (Hypothesis 2). On the other hand, the relationship between CE and performance of a just-completed segment of the CP was slightly different. Bivariate correlation coefficients displayed quite high correlations ($r_{CE2\ T1}$ = –.562, $r_{CE3\ T2}$ = –.709, and $r_{CE4\ T3}$ = –.450). However, once CE was predicted by the previous performance along with the previous CE, these effects decreased ($r_{CE2,T1\ CE1}$ = –.071, $r_{CE3,T2\ CE2}$ = –.198, and $r_{CE4,T3\ CE3}$ = –.048). This indicates that the effect of performance on CE was confounded by the level of CE that the team had prior to the segment.

Figure 2
Line Graph Displaying the Collective Efficacy Scores Taken Throughout the Race for Teams That Finished 1st, 2nd, 14th, and 15th



Also, it indicates that CE was related to performance in an upcoming segment; however, effect of performance of the current segment on CE after the segment was very small: R^2 for CP1, CP2, CP3, and Finish were .296, .438, .205, and .340, respectively. R^2 for CE1, CE2, CE3, and CE4 were .499, .721, .799, and .894, respectively.

To further examine the CE–performance relationship, the CE scores and performance times at each CP were used to demonstrate the differences between the top two teams (1st- and 2nd-place finishes) to that of the bottom two teams (14th- and 15th-place finish). Figure 2 illustrates the initial and continuous measures of CE at CP1–CP3 for the top two teams (1 and 2) as well as for the bottom two teams (14 and 15). A clear trend of the CE–performance relationship was observed over the course of the race. Specifically, as the more successful teams' perceptions of CE increased throughout the race, subsequent performance was improved, and vice versa for the less successful teams.

Discussion

The main objectives of the current study were to examine the influence of the relevant sources of efficacy information on collective efficacy and to explore the relationship between perceptions of collective efficacy and performance in adventure racing teams. Preliminary research examining the relationship between collective efficacy and performance suggests that the confidence an individual places in one's team is likely to affect the overall team performance (Feltz & Lirgg, 2001). Based on Bandura's (1997) suggestions that more research is needed to examine how sources of efficacy information influence levels of perceived collective efficacy, three sources of collective efficacy were examined: prior performance, preparation effort, and environmental factors-conditions.

Consistent with the theoretical concept, the results of the study indicated a moderate to strong positive relationship between perceptions of collective efficacy and subsequent performance at each CP and throughout the race. The findings provide some support for the structure and relationship defined by the theoretical concept. That is, a reciprocal relationship exists between collective efficacy and performance (Myers et al., 2004; Watson et al., 2001).

Sources of collective efficacy information are likely to affect initial perceptions of efficacy as well as perceptions throughout a competition. The current findings revealed a strong positive relationship between preparation effort and initial perceptions of collective efficacy, supporting and extending Gould et al.'s (1989) findings from self-efficacy to collective efficacy. They revealed that coaches of elite athletes rated preparation effort as the best strategy to use as a means to increase perceptions of self-efficacy. In addition, it supports Bandura's assertion that efficacy beliefs can be altered via physical preparation, which is likely to improve physical status (i.e., perceptions of collective efficacy can be enhanced based on the amount of sport-specific and general physical training and conditioning a team undergoes to prepare for a race or event).

Bandura (1997) stated further that enactive mastery experience or prior performance is the most powerful and influential source of efficacy information. He postulated that skills are generated and acquired through experiences, and successful performance experiences raise efficacy beliefs whereas performance failures lower them. In line with this assertion, the results revealed a strong direct relationship between prior performance and initial perceptions of collective efficacy. The magnitudes of the correlations were consistent with Watson et al.'s (2001) study of intercollegiate basketball players, and Carron and Hausenblas's (1998) contention that prior performance is a significant source of efficacy in predicting future performances.

Environmental factors-conditions, such as weather and complexity of the course terrain, were believed to have a negative impact on perceptions of collective efficacy throughout the race (Bandura, 1997, 2000; Cronberg, 1975). On the basis of the findings of Bray and Widmeyer (2000), it was hypothesized that environmental factors–conditions can have significant effects on perceived collective efficacy. This proposition was not supported in this study. Only one significant result was revealed between one environmental factor (teammate injury) and collective efficacy at CP2. Other environmental factors-conditions (weather conditions, complexity of the terrain, and time of day) did not produce any significant results throughout the race. One issue to consider is the participants' ability to interpret the scale items regarding the environmental factors. On the day of the race, the average temperature was recorded at 89°F. Montain, Sawka, and Latzka (1998) stated that exposure to heat stress, either from increased endogenous production or from extreme environmental sources, is the main cause of heat-related fatigue and dysfunction. Regardless of the extreme temperatures and conditions, these matters were not reflected in the environmental scale, which pertained to these specific circumstances. Lastly, equipment issues are always a major part of any adventure race (Paterson, 1999). Several teams experienced equipment problems (e.g., broken oar, flat bicycle tire), which often had a negative effect on performance times. Equipment issues would be considered a physical parameter or barrier to action within the environment; therefore, in future studies, it should be incorporated into any environmental factors-conditions scale for adventure racing.

Bandura (1997) stated that cognitive, motivational, and affective indices are mediating processes that serve as a guide for action in the development of proficiencies. The repeated measures and contrast analysis illustrated the processes and functions of collective efficacy as it relates to performance throughout the competition. Bandura posited a reciprocal relationship between collective efficacy and ensuing performance outcomes (i.e., reciprocal determinism). The analyses revealed that as the top teams' perceptions of collective efficacy increased, their subsequent performance improved; in contrast, as the less successful teams' perceptions of collective efficacy decreased, their successive performance decreased. The results of this analysis support Cannon-Bowers, Tannenbaum, Salas, and Volpe's (1995) assertion that a team that perceives high levels of collective efficacy is likely to expend greater effort and persist longer in the face of adversity. The results also tentatively support Bandura's contention that perceived collective efficacy nurtures certain group aspects such as motivational commitment, resiliency to adversity, and performance accomplishments.

However, these constructs were not directly measured, and future examinations should include these factors.

Although the findings from this study do tentatively support the reciprocal nature of collective efficacy and performance, researchers should consider the bona fide group theory in conjunction with developing techniques and methods to capture multiple data points of collective efficacy throughout a competitive task. Future examinations should also consider perceptions of role ambiguity (Eys, Carron, Beauchamp, & Bray, 2005) and the nature of norms in the teams (Colman & Carron, 2001). This type of research can enhance and further the understanding of how the reciprocal relationship activates certain mediating processes such as cognitive, motivational, and affective states that can contribute to enhanced and sustained levels of performance outcomes and vice versa.

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William A. Edmonds currently is a Program Professor in the Applied Research Center at Nova Southeastern University in North Miami Beach, Florida. He graduated from Florida State University and received his degree in Educational Psychology with a minor in Statistics and Measurement. Dr. Edmonds is a certified biofeedback practitioner with the Biofeedback Certification Institute of America and continues to research, practice, and teach in the fields of biofeedback, education, and sport psychology.

Gershon Tenenbaum, Benjamin S. Bloom Professor of Educational Psychology, a graduate of the University of Chicago, is the Associate Chair of the Department of Educational Psychology and Learning Systems at the Florida State University. He has published extensively in areas of expertise and decision making, psychometrics, and coping with physical effort experiences. Gershon received several distinguished awards for his academic and scientific achievements and is a member of several scientific and professional forums and societies.

Akihito Kamata is an Associate Professor and Department Chair of the Department of Educational Psychology & Learning Systems at Florida State University, where he teaches statistical and psychometric methods and applications to graduate students in behavioral and social sciences. His research interest is quantitative methods in educational and psychological research, mainly focusing on item-level test and scale data analysis methodology through latent variable modeling, multilevel modeling, and item response theory modeling.

Michael B. Johnson is a licensed psychologist and currently an Assistant Professor of Psychology at Georgia Highlands College in Rome, Georgia. He graduated from Florida State University's Combined Program in Counseling Psychology and School Psychology in 2006. Since 2006 he has devoted his professional time to academic work, developing a practice in counseling psychology, settling into his north Georgia home, staying connected with friends and colleagues, and engaging a positive life.